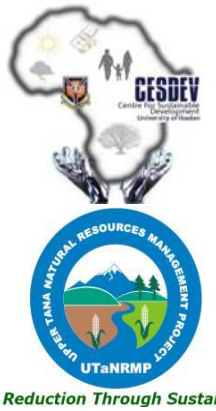

EFFECTIVENESS OF KNOWLEDGE COMMUNICATION AND MANAGEMENT IN FOSTERING RURAL FARMERS' LOCAL INNOVATIVENESS IN EMBU AND KIRINYAGA COUNTIES: A CASE OF UPPER TANA NATURAL RESOURCE MANAGEMENT PROJECT

Final Report

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List of Acronyms and Abbreviations

ASALs - Arid and Semi-Arid Lands
ASDS - Agricultural Sector Development Strategy
CBOs - Community Based Organizations
CFAs - Community Forest Associations
CIGs - Common Interest Groups
COSOP - Country Strategic Opportunities Programme
ECD - Early Childhood Development
ECDE Early Childhood Development Education
FDAs - Focal Development Area
FDACs - Focal Development Area Committees
FGDs - Focus Group Discussions
HDI - Human Development Index
HIV - Human Immunodeficiency Virus
IFAD - International Fund for Agricultural Development
GDP - Gross Domestic Product
GEF - Global Environmental Facility
GoK - Government of Kenya
GPRS - General Packet Radio Service
GPS - Global Positioning System
KA - Knowledge Audit
KII - Key Informant Interview
KM - Knowledge Management
KM&L - Knowledge Management and Learning
MDGs - Millennium Development Goals
MKEPP - Mt. Kenya East Pilot Project
M&E - Monitoring and Evaluation
NRM - Natural Resources Management
PCT - Project Coordinating Team
PRSP - Poverty Reduction Strategy Paper
R&D - Research and Development
SACCOs - Saving and Credit Cooperative Organizations
SCITs - Sub-County Implementation Teams
SCMPs - Sub Catchment Management Plans
SHGs - Self Help Groups
SPSS - Statistical Package for Social Sciences
TNC - The Nature Conservancy
UTaNRMP - Upper Tana Natural Resources Management Project
WRUAs - Water Resource Users Association

EXECUTIVE SUMMARY

This study examined the role of knowledge communication and management in fostering local innovativeness among rural famers, using Upper Tana Natural Resources Management Project (UTaNRMP) as case study. UTaNRMP is an eight year project funded by GoK, IFAD, Spanish Trust Fund and other stakeholders to contribute to reduction of rural poverty in the Upper Tana river catchment. The data for the study was generated across 2 counties (Embu and Kirinyaga) within UTaNRMP catchment to form the study area for primary data collection. Questionnaire, Focus Group Discussion (FGD) and Key Informant Interviews (KII) were extensively utilized on the field to collect data that can generate results for both the objectives of study and hypothetical questions the research sought to answer. The first survey conducted involved 421 respondents comprising of rural farmers who are aware or have benefited from various UTaNRMP's interventions in both counties. The second survey involved the use of two qualitative tools; KII and FGD were conducted with project coordinators and implementers to generate data that can validate findings from the previous survey.

The findings revealed that knowledge management modalities can affect innovation among small farmers in variety of ways; it can especially be done through traditional (cultural and personal) management practices of the rural farmers. A good part of knowledge cannot be simply transferred but needs to be anticipated by processes of experience and learning by doing. Hence, to promote new knowledge among farmers one need to nurture open access to people's extensive tacit knowledge and to enable learning and knowledge exchange between farmers and knowledge experts; which in this case are UTaNRMP implementers popularly known to the rural farmers as agricultural extension officers. Therefore, having gotten the institutional structure for knowledge coordination and smooth running of project, UTaNRMP should harness these potentials with the wealth of tacit knowledge inherent in farmers to promote local innovation by integrating both local and external elements whilst sustaining project intervention through ownership. Despite farmers' superior knowledge and expertise, they are usually not all-knowing thereby lacking the ability to draw appropriate inferences in demanding situations; hence the need for integration of tacit and explicit knowledge for the overall benefit of farmers and UTaNRMP.

The first objective of the study is to establish the effectiveness of knowledge communication in improving rural farmer's adoption of UTaNRMP's intervention. Hence, the first hypothesis which tested the influence of knowledge communication on farmers' adoptability, adaptability and innovation revealed that about 67% of the farmers have good knowledge communication level, while 81.5% have good new technique adoption. Further test to check for influence of knowledge communication on farmers' level of adoption showed that farmers with good knowledge communication level are four times likely to have a good level of adoption of new techniques than those who have poor level of knowledge communication.

The second objective revealed the most common medium of obtaining information among farmers is through co-farmers as stated by 50% of the farmers, while 27% prefer extension workers, others prefer the use of radio at 16% and books at 3%; noting that farmers validated their respective choices to have adequate information by 97%. Thus, hypothesis 2 compared factors associated with creation and invention of new ideas, and it was obtained those farmers who belong to farmer group are twice likely to have abilities for creation and innovation than those who do not. Farmers who interact with extension officers are more likely to have ability for creation and innovation than those who do not. More so, farmers who responded to have used old practices with new ones and farmers who have more experience are more likely to have abilities for creation and innovation. Farmers from Embu county are 40% less likely to have abilities for creation and innovation.

Result from the third hypothesis showed that farmers who are aware of agricultural extension officers are three times likely to have a good level of adoption. Farmers who participated in UTaNRMP training as well as farmers with self-rating high experience are twice more likely to have good level of new technique adaptation. Therefore Hypothesis 3 is in conformity with the third objective of this study which sought to assess the impact of knowledge management strategies in promoting learning and exchange between farmers and knowledge experts.

CHAPTER ONE
INTRODUCTION

1.1 Introduction and Problem statement

While there has been an active movement to promote knowledge management across many fields and organizations, there is no generally accepted definition of the term, nor are there agreed-upon standards for what constitutes a good knowledge management system. However, knowledge management is concerned with ways of exchanging knowledge among those who can develop it and those who can use it. In the time past, knowledge management and learning were neither generated nor communicated through the international and national science and technology institutions but communicated among farmers, linking newer generations with their ancestors (Howes and Chambers 1980). Knowledge according to Hartwich et al (2007), can be understood as both information and skills that are acquired through individual experience and trial and error, within an organization or a learning community, or from outsiders adapting it to local contexts. The communities in Embu and Kirinyaga counties under UTaNRMP access information through awareness creation by the FDACs (Focal Development Area Committees) and the implementing departments, through public meetings such as chief's barazas, and through the media including radio and Internet. However, IFAD's strategy defines knowledge management as the process of "capturing, creating, distilling, sharing and using know-how."

Studies have shown that agricultural extension involves forms of communicative intervention that are aimed at facilitating change processes in dealing with complex problems that face agricultural development today. Scholars have also argued that new solutions and innovations involve new patterns of coordination between people, technical devices and natural phenomena. In recent decades, there has been an increased focus on sustainable intensification in African agriculture. Pretty et al. (2011) analyzed 40 projects in 20 African countries and found that by early 2010, they had provided benefits for 10.39 million farmers and their families on roughly 12.75 million hectares of land. Despite the great potential of agricultural innovations, their uptake by smallholder farmers in Africa seems to be slow (Ndjeunga and Bantilan, 2005) hence the need for knowledge communication at rural farmer's level for local innovation that is recognizable and owned by them. Ajayi et al. (2011) have also shown that fertilizer tree systems; a common practice among rural farmers are inexpensive technologies that significantly raise crop yields, reduce food insecurity and enhance environmental services and resilience of agro-

ecologies in southern Africa. Even though rural change through knowledge communication and innovation often do not involve only farmers, for the purpose of this study farmers will be used as an entry point for understanding some of human predominant practices and responses to proposed changes (interventions) by UTaNRMP in Embu and Kirinyaga counties.

An often considered reason for dilemma in rural projects is obstacles in the communication and management of knowledge. Different empirical studies have shown that knowledge, in fact, cannot be easily generated in research organizations and passed down to the extension services and development projects which diffuse it among farmers (Hartwich et al. 2007). In response, new ways of managing knowledge have emerged across less developed countries, focusing on new dynamics such as participation, collaboration and joint learning between farmers and other agents contributing to the development and diffusion of knowledge.

Most knowledge management programmes have been studied in the corporate sector with underlying motivations on ideas of the knowledge economy, organizational efficiency, structural and cultural change, learning organizations…. (Hovland, 2003). Consequently, recommendations focus on organizational practices such as information technology, communities of practice, expert systems, intranets and other networking tools and communication technologies as well as investment in R&D and the building of partnerships between research institutes and companies (Liebowitz 1999). Hartwich and Monge (2007) opine that, Knowledge management in developing country agriculture, however, has a distinct connotation. For example, rural farmers in Embu or Kirinyaga do not need to look for cutting edge technology. Instead, they need to get access to the often abundantly available knowledge resources that can improve their livelihoods.

UTaNRMP's Knowledge Management officers (both direct and indirect) try to assist farmers to access knowledge through various trainings and empowerment programmes. However, there's unintentional bias to a certain trajectory of development, e.g. "current KM initiatives have not enabled the project to positively reach the entire beneficiary communities" (UTaNRMP KA, 2016). This may be partly as a result of inadequate incentives on the part of the trainers or lack of active participation of targeted beneficiaries. Challenges in accessing knowledge include limited knowledge of the best practice or method to undertake a task; knowing where to locate expertise. Rural farmers however, would not feel comfortble to absorb one type of knowledge promoted by

a certain expert if they've not crossed checked with the other farmers and local authorities as well as consider some market factors. The reason being that; farmers try to reduce risk by contacting multiple sources of information in order to trust in a certain type of technology. In a situation where knowledge sharing is one-sided, active participation will be lacking, thus lack of management or sustainability of the established initiative by UTaNRMP.

As a result, it will be wise in this study to consider blending these dynamics with methods traditionally used for transferring local, indigenous or ancestral knowledge; whilst farmers innovativeness. Suffice to say that in promoting new knowledge initiative or technology among farmers, experts will need to nurture open communication with farmers' extensive knowledge; albeit from their tacit exploration and belief systems, so as to enable learning and knowledge flow.

1.2 Objectives of the study

The main objective of this study is to examine the role of knowledge communication and management in UTaNRMP to determine its effectiveness in fostering local innovativeness among rural farmers. Harnessing local knowledge will improve dissemination and proper implementation of knowledge management; consequently, farmers may promote agricultural development toward overcoming rural poverty.

The specific objectives are:

- To establish the effectiveness of knowledge communication in improving rural farmer's adoption of UTaNRMP's intervention
- To evaluate indigenous knowledge sharing processes and their influence in stimulating local innovation among farmers
- To assess the impact of knowledge management strategies in promoting a culture of learning and exchange between farmers and knowledge management experts.

1.3 Justification for the study

Literatures suggest knowledge management is crucial in determining organizational innovation and performance. Most of these organisations in knowledge management empirics are formal organisations with systematic, structural patterns and settings. These formalities however do not always apply to farmer based organizations constituting majorly of farmers meeting their daily needs with creative but not so complex systems.

Past studies examining knowledge strategy, organizational characteristics and innovation have often examined the influence of each variable on organizational performance independently without much focus on the combined effect of the variables on organizational performance. This study will develop an integrated model to examine the combined effect of knowledge management, organizational characteristics such as communication and innovation of farmers through indigenous knowledge sharing methods to portray a more complete picture of the relationships among the variables. Therefore, it is necessary to assess farmers' innovativeness from improved indigenous knowledge sharing which can enrich their individual productivity; through experiential communication, joint learning, and systemic sharing in order to propose improvements to UTaNRMP's KM&L systems and institutional readiness for continuous learning and implementation of farmers' local innovation using appropriate knowledge management strategy that allows for joint communication. By extension, result from the findings can be communicated to stakeholders to necessitate pro-poor policy reforms and to facilitate policy development process in the agricultural and rural development of Kenya.

1.4 Scope of the study

The study will be delimited to Knowledge Management and Learning in Upper Tana Natural Resource Management Project which covers the six counties of Murang'a, Nyeri, Kirinyaga, Embu, Tharaka-Nithi and Meru. It is important to note here that this study will be conducted in two of these counties which are Embu and Kirinyaga counties; with major focus on the project beneficiaries, specifically on farmers belonging to CIGs and other informal famer groups. The population will be sampled to get a representative sample. The study will also be delimited to three specific study areas. These areas are: Knowledge communication; indigenous knowledge sharing; knowledge management and learning strategies; and how all three independent variables can foster rural farmers' local innovativeness. As the study progresses the relationship between

knowledge communication through sharing and farmers' local innovativeness will be established.

1.5 Outline of the study

The study will be outlined in six chapters, each chapter containing specific information. Chapter one will contain the introduction of the study. It gives a specific background of the study and statement of the problem, objectives of the study; both the purpose and specific objectives of the study, justification for the study, and scope of the study. Chapter two explains the general background of the project under study such as situational analysis of the issues surrounding the project in Kenya and its environment, and finally background information of the project's component under study. Chapter three reviews related literatures based on the study objectives. It further looks at conceptual issues, theoretical issues, empirical issues and methodological issues with focus on how the variables have been analysed in past studies and in describing the current research gaps. Chapter four covers the research methodology, conceptual and analytical framework, hypothetical statements, and further describes the research design; such as target population, sampling procedure, instruments and techniques of data collection, methods of data collection and analysis. Chapter five discusses the results of data analysis, with presentations in tables, charts and figures. The variables considered are knowledge communication and sharing, traditional and scientific knowledge integration, adoption of project interventions, knowledge management, and rural farmers' local innovativeness. Lastly, chapter six covers summary and conclusion of the research findings, recommendations made for policy implication and suggestions for future research.

CHAPTER TWO
BACKGROUND TO THE STUDY

2.1 Economic Background of Kenya

Kenya occupies a total land area of 582,646 km with varied topography. The estimated population is 40.5 million with an annual growth rate of about 2.6% and an average population density of 69 persons per km**.** In 2010 Kenya had a per capita GDP of USD 760. The real GDP growth rate for 2010 was 5.6%, and is forecast to remain at around this level in 2011 and beyond. Inflation is running at over 10% driven by high fuel and food prices and a fiscal deficit of 7-8% of GDP.

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 30% of the population and nearly half its livestock. 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. Kenya has been a multi-party democracy since 1991, it is a representative democracy legislatively and a direct democracy in the election of its president.

2.1.1 Rural Poverty Analysis

Level of Poverty: Nearly half (48%) of the rural population of the country is classified as living below the poverty line or unable to meet their nutritional requirements (UTaNRMP PDR, 2012). The 2005-06 poverty survey (latest available), revealed strong regional disparities in the distribution of poverty. The lowest prevalence of rural poverty was in Central Province (30%), followed by Nyanza (48%), Rift Valley (50%), Eastern (51%), Western (53%), Coast (70%), and North Eastern (74%). National absolute poverty declined from 52% in 1997 to 48% in 2005-06.

About 6.5 million people are considered as hard-core poor, meaning that they are chronically food insecure even if they were to forego all non-food expenditure. Life expectancy at birth has dropped from 59 to 48 years. The enrolment rate in primary schools declined due to the introduction of school fees, although this trend reversed with the introduction of free primary education during 2003.

The rural economy depends mainly on smallholder subsistence agriculture. Most Kenyans live in areas that have medium to high potential for agriculture. However population density in high-potential areas is more than six times the average and constitutes an overwhelming pressure on resources. The Arid and Semi-Arid Lands are home to over 30% of the population, have the highest prevalence of poverty averaging about 65%, and very limited access to basic services. Majority of the rural poor however live in the medium and high potential areas, the target group in the Upper Tana catchment live in such areas. Kenya's poor rural people and that of the project area include:

- smallholder farmers
- herders
- farm labourers
- unskilled and semi-skilled workers
- households headed by women
- people with disabilities
- AIDS orphans

2.1.2 National Poverty Reduction Strategy

The Government's first long-term development plan was outlined in the National Poverty Eradication Plan for 1999-2015, which was designed to address poverty and espoused the MDGs, particularly that of reducing poverty by half by 2015. The Government prepared an Interim Poverty Reduction Strategy Paper for the period 2000-2003, which aimed at improving governance, security, equity and people's participation. After the new government came to power at the end of 2002, an Economic Recovery Strategy for Wealth and Employment Creation was prepared for the period 2003-2007. This changed the thrust of the poverty reduction strategy paper (PRSP), emphasizing economic growth and greater support for the private sector as the

drivers of poverty reduction. It also reiterated the interim PRSP's two additional pillars of poverty reduction: namely, equity and improved targeting in ensuring access of the poor to basic services and better governance, including the strengthening of public safety, law and order.

2.1.3 Kenya Vision 2030

Covering the period 2008-2030 is the country's new development blueprint, replacing the National Poverty Eradication Plan. Its overall objective is to bring about a greater and more sustainable growth of the economy in a more equitable environment, accompanied by increased employment opportunities. Agriculture, livestock and fishing is one of six priority sectors expected to deliver 10% annual growth.

2.1.4 Governance Framework

Governance is recognised as a major constraint to economic growth and poverty reduction. The 2011 corruption perception index of Transparency International ranks Kenya 154 out of 182 countries assessed. UTaNRMP is being designed at a time when a new governance framework is evolving based on the new constitution promulgated in August 2010. This brings with it both opportunities - improved governance and accountability, devolution to the grassroots - and challenges. The adjustment costs of implementation of the new governance system could potentially reduce resources available for development programmes; and there is a legislative challenge as Parliament strives to enact a large number of new laws.

2.1.5 Institutional Framework

The agriculture/rural sector is characterized by a complex institutional setting with no less than ten ministries: the Ministry of Agriculture (MOA); the Ministry of Livestock Development (MOLD); the Ministry of Fisheries Development (MOFD); the Ministry of Forestry and Wildlife (MOFW); the Ministry of Cooperative Development and Marketing (MOCDM); the Ministry of Water and Irrigation (MWI), in which UTaNRMP falls under; the Ministry of State for Planning, National Development and Vision 2030 (MPND & V2030); and the Ministry of Gender, Children and Social Development (MGCSD). Other ministries responsible for critical resources that directly affect the sector are the Ministry of Lands (MOL); the Ministry of Environment and Mineral Resources (MOEMR); and the Ministry of Development of Northern Kenya and other Arid Lands. The sector ministries established the Agricultural Sector Coordination Unit (ASCU)

in 2005 to address the fragmentation of responsibilities between agriculture and rural development-related ministries, development partners and the private sector.

2.2 Upper Tana Natural Resources Management Project Structure

The Upper Tana Natural Resource Management Project (UTaNRMP) covers six 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 national average population density is estimated at 66 people per square kilometer. This is shown in the table below.

Table 2. 1: Population in the Project Area

County	Male Pop	Female Pop	Total Pop	Denstity - KM^2
Murang'a	457,864	484,717	942,581	368
Kirinyaga	260,630	267,424	528,054	357
Nyeri	339,725	353,833	693,558	208
Embu	254,303	261,909	516,212	183
Tharaka Nithi	178,451	186,879	365,330	138
Meru	670,656	685,645	1,356,301	196
Total	**2,161,629**	**2,240,407**	**4,402,036**	**National Average 66**

Source: 2009 Kenya Population and Census Data (KNBS, 2010)

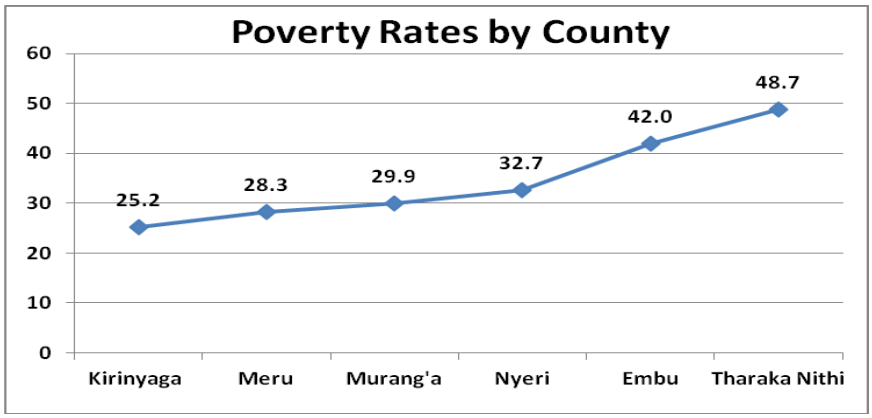
An analysis of population projection shows that, across the counties the population of the labour force (aged 15-59 years) is 2,426,770 which forms the largest and is 55% of the total population. Youthful population (15-34) in the counties accounted for 34% of the entire population in the project area. Those above 60 years were estimated at 8% while children aged below 15 years accounted for 37% of the entire population in the project area. The population projections based on the 2009 census figures shows that the population in the project target area will grow by about 11 percent by 2017. This is significant given that growth in population also implies increased pressure on land.

2.2.1 Economic Activities and Poverty Levels

Embu County depends on agriculture, dairy farming and livestock rearing. Coffee and tea are common in the highlands of the county while miraa (khat), maize, sorghum and green grams are grown on the lower parts of the county, Rice is grown through irrigation on the areas neighbouring Mwea. While the upper areas of the county practice dairy farming, pastoralism is common in the lower areas of the county. The poverty rate in the county is at 42 percent. Kirinyaga depends mainly on irrigated rice and horticulture farming around Mwea on the lower parts of the county and tea, coffee and dairy farming in the highlands of the county. Poverty rates in the county are relatively lower at 25.2 percent. Murang'a County depends mainly on agriculture and dairy farming. The main cash crops are coffee and tea in the highlands and fruit trees such as oranges and mangoes in the low lands. Poverty levels in the county average 29.9 percent. The main economic activity in Nyeri County is agriculture and dairy farming in the highlands, with some quarrying in the lowlands parts of Kieni and tourism around the Aberdare and Mt Kenya forests. The poverty rates are relatively high at 32.7 percent (UTaNRMP BSR, 2014).

The upper slopes of Tharaka Nithi County have better climatic conditions and therefore support tea and coffee farming, whereas the low lying areas are arid and therefore support subsistence farming of cereal crops such as green grams, sorghum and pastoralism. Poverty rates in Tharaka Nithi are at high 48.7 percent and the highest in the project area. Finally Meru County is endowed with high potential arable land which supports, tea, coffee, and banana growing on a commercial basis in the highlands. The low lands feature cereals farming, and miraa (khat) production around Maua. Poverty levels are at 28.3 percent. The figure below shows the poverty levels across the different counties.

Figure 2. 1: Poverty Levels by County



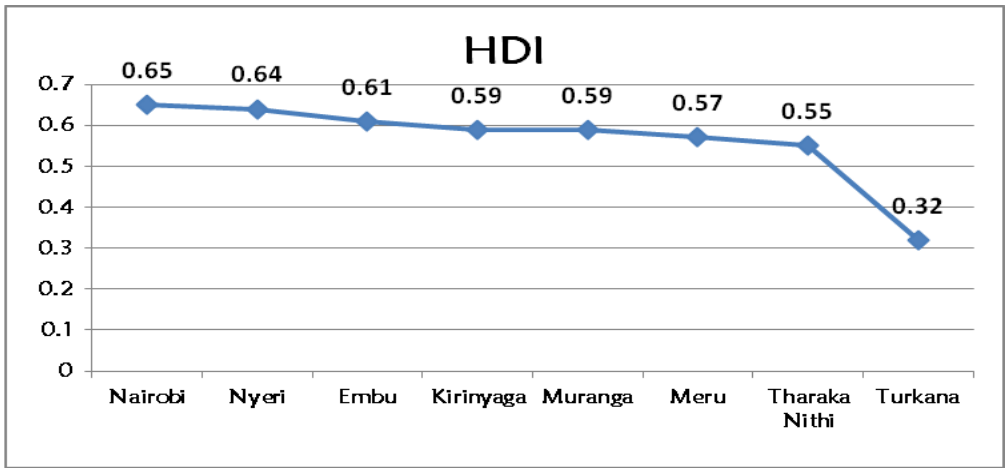
Source: Commission for Revenue Allocation data (December 2011)

Generally, respondents from the baseline survey perceived the poor as people with low living standards, as needy while quite a number described poor people as lazy. Further discussions in the FGDs elaborated that people with low living standards are those that cannot afford three meals in a day, people whose children are malnourished and do not attend school, people without decent shelter, and clothing. When asked how poor people coped with their situation, the most common responses were through casual labour, begging and support from external sources such as relatives, and government. Those in casual labour often exchange their labour for food. The survey findings suggest that, people in all river basins believe that poor people had a role to play in moving out of the situation they faced.

2.2.2 Human Development Index and Life Expectancy

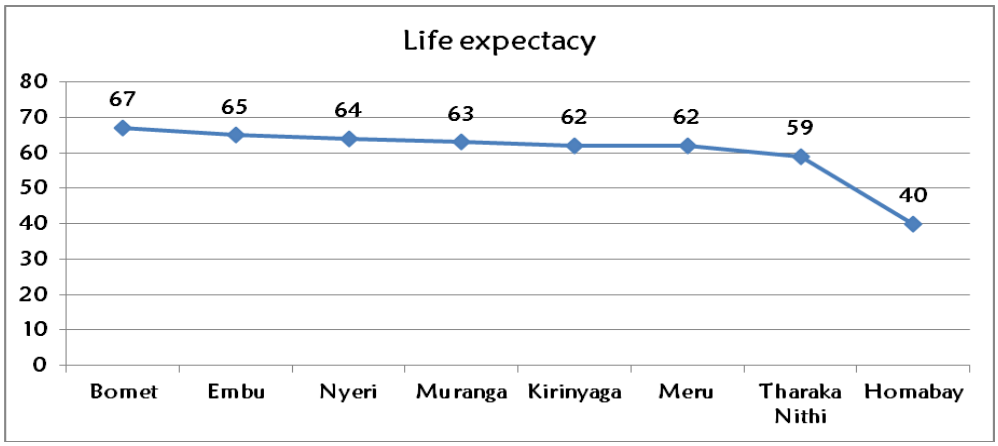
The Human Development Index (HDI) across the six counties ranges from 0.55 in Tharaka Nithi County, to about 0.64 in Nyeri County. This strongly mirrored the national averages considering that Nairobi County had the highest HDI of about 0.65, while Turkana had the lowest HDI of about 0.328. These estimates are shown in the figure below. The average for the country is estimated at about 0.56. Additionally, life expectancy at birth ranged from about 58.7 years in Tharaka Nithi County to 64.6 years in Embu County. Nationally, Bomet led all other counties with a life expectancy at birth of about 66.1 years while Homabay has the least at 39.8 years. This is shown in figure 3.5 below. The life expectancy in the six counties is above the national average estimated at 56.6 years.

Figure 2. 2: Human Development Index (HDI) by County



Source: Kenya Economic Survey 2014

Figure 2.2. 1: Life expectancy at birth by County



Source: Kenya Economic Survey 2014

While specific data on HDI and life expectancy was not collected during the baseline, interviews with stakeholders confirmed the trends in the two indicators. Across the river basins, the above indicators vary, with higher Human Development Indices and longer life expectancy expected in the upper and middle zones which have more favorable climatic conditions for crop production and therefore better food security, compared to populations in the lower zones. So, for example, while Nyeri on average posts a high HDI, river basins on the lower parts of the county have lower indices. This trend cut across all the other counties.

2.2.3 Education Indicators and Literacy Levels

Education is a key development indicator. It is therefore important to review and explore education status and indicators in the counties and across the river basins. The Kenya Economic Survey 2013 shows that net enrolment rates across Early Childhood Development (ECD), primary and secondary assume patterns that are interesting to this project. Enrolment in ECD was below 50 percent for all counties except Nyeri which registered an average of 61.8 percent in 2009. It was least in Embu with an average of 32.8 percent. At primary level, enrolment shoots to an average of 85 percent in Meru and 93.4 percent in Murang'a, before falling again at secondary level to lows of 22.3 percent in Meru and 46.3 percent in Nyeri.

This implies that many children do not go through ECD as well as secondary school, as shown in the table below.

Table 2. 2: Net Enrolment Rate by Level and by County in 2009

County	ECDE			Primary			Secondary		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Murang'a	39.3	39.8	39.5	93.2	93.7	93.4	36.0	42.1	39.0
Nyeri	61.6	61.9	61.8	92.1	93.1	92.6	42.5	50.3	46.3
Kirinyaga	47.8	46.8	47.3	91.3	92.4	91.3	34.0	42.1	38.0
Embu	32.6	33.1	32.8	90.4	92.1	91.3	28.3	37.0	32.6
Tharaka Nithi	33.8	34.2	34.0	87.3	89.1	88.2	23.9	30.6	27.2
Meru	33.5	34.5	34.0	84.1	85.9	85.0	19.1	25.3	22.3
Kenya	41.3	42.3	41.8	90.6	92.3	91.4	22.2	25.9	24.0

Source: Kenya Economic Survey 2014

The national enrolment rates stood at 41.8 percent for ECDE, 91.4 percent for Primary and 24 percent for secondary. The net enrolment rates in 2012 were reported to be 53 percent for ECDE, 95.3 percent for primary level and to 33.1 percent in at secondary level10.

2.2.4 Health Indicators

Health indicators across the counties are salient to the project. Review findings show that other counties except Nyeri had fewer medical personnel than the minimum required. In Nyeri, the doctor population ratio was 1:5, 00014 and 1:7, 61015 while the Nurse to population ratio stood at 1:654 and 1:834 according to the two reports quoted above respectively. This was relatively low in comparison to other counties. However, the county has numerous mission and private

facilities which could contribute to the better ratios. This was confirmed by the County Integrated Development Plan which indicates that in addition to the facilities shown in table 3 below, the county also has 3 mission hospitals, 3 private hospitals, 1 nursing home, 1 hospice, and 228 private clinics.

Table 2. 3: Distribution of Medical Personnel and Facilities by County

County	Pop	Pop/ Doctor	App No of Doctors	Min Required No of Doctors	Pop/ Nurse	Min Required No of Nurses	App No of Nurses	Level 2 Dispensary	Level 3 Health centres	Level 4 District Hosp	Level 5 Provincial Hospitals
Murang'a	942,581	17,000	55	87	1,609	951	586	89	30	9	1
Kirinyaga	528,054	31,000	17	54	1,100	563	480	53	18	5	1
Nyeri	693,558	5,000	139	67	654	740	1,060	69	23	7	1
Embu	516,212	13,000	40	54	1,060	551	487	52	17	5	1
Tharaka Nithi	365,330	21,000	17	32	1,773	389	206	37	12	4	0
Meru	1,356,301	38,000	36	126	1,609	1,447	843	136	45	14	1

Source: Kenya Economic Survey 2014

2.2.5 Other Cross Cutting Issues

The six counties are also faced with other social challenges that are of concern to the project. Interviews with farmers reported that though not many, there were several child headed households in the river basins which needed attention. These could be children whose parents have died or separated and consequently deserted by the parents. The effects of illnesses such as HIV and AIDS have been strongly felt in the counties. Numerous resources have been used by families to manage ill health by family members. HIV/AIDS, Cancer and other terminal illnesses have orphaned many children, and left widows and widowers. The management of these illnesses was reported to be increasingly becoming a major burden to households, some of which are forced to dispose of assets to pay medical bills. In addition the counties also had several widows that have been disinherited following the death of their spouses. Such people lived in vulnerability, either as tenants and squatters.

The increasing youthful population continued to exert pressure on the environment and they were aggressive in taking up opportunities they came across irrespective of their impact on the environment. There is reported increase in number of youth involved in motorcycle business, where they operate without much caution leading to accidents and consequent death and

hospitalisation. Youth were also reported to occupy riparian land where they carry out car wash businesses and therefore affecting the quality and quantity of water flowing downstream.

2.2.6 Actors in the Project Area

UTaNRMP established the other development actors in the project area and nature of community organisations besides WRUAs and CFAs that exist. According to the draft County Integrated Development Plans, cooperative societies, SACCOs, women groups and youth groups were the most common forms of organisations across the six counties. Cooperatives were more in agriculture; SACCOs were more common in trade and housing activities while women groups and youth groups were more geared to supporting member‘s social welfare, though most were also involved in many Income Generating Activities in the agricultural, trading among other sectors. Most women and youth groups were registered as Self Help Groups (SHGs). Non-Governmental Organisations were also present in all counties.

2.3 Background of Upper Tana Natural Resource Management Project

Since 2004 IFAD and GEF have been supporting the Mount Kenya East Pilot Project (MKEPP) which aims at linking sustainable use of natural resources, especially water and forests with enhanced rural livelihoods in five selected river basins of the Upper Tana catchment. The mid-term review of MKEPP in 2009 concluded that performance was satisfactory and recommended the up-scaling of the project to cover all 24 river basins in the entire catchment.

The project rationale is based on the nexus between rural poverty and ecosystem health in a densely populated and environmentally fragile watershed of critical national and global significance. The high prevalence of rural poverty contributes to environmental degradation which in turn reduces sustainable livelihood opportunities; as well as creating negative environmental externalities including forest degradation, human-wildlife conflict, and reduced availability and quality of water to downstream users. Fortunately however, there are a number of opportunities for improving rural livelihoods in ways that are also beneficial for the natural environment.

Essentially the project was created to work with the custodians of natural resources in the Upper Tana providing them with a number of direct and indirect incentives to do things that are good for the environment, good for them, and from which other parties will also derive benefit.

2.3.1 Project Area

The project area is the Upper Tana catchment which covers an area of 17,420 km and includes 24 river basins (five of which are included in MKEPP) that drain into the Tana River. Project interventions is progressively scaled up beginning with further work on the tributaries of the four MKEPP river basins, and 12 of the remaining 19 basins. The area covers six of Kenya's 47 counties, is home to 5.2 million people, provides water for about half the population, and most of the country's hydroelectric power. The area includes the Mt. Kenya and Aberdares national parks and surrounding forest reserves. The area is under heavy and growing population pressure with an average of 300 inhabitants per km.

2.3.2 Target Group

The project targets around 200,000 poor rural households whose livelihoods revolve around the use of the natural resources of the river basin. These include smallholder crop and livestock farmers, agro-pastoralists, fishers, rural traders, and community groups involved in NRM and income generating activities. Special focus is on women and youth as well as other vulnerable groups within the above categories. The project also provide indirect benefits to the non-target groups in the Upper Tana catchment through services and enterprises linked with the project activities, as well as to populations outside the catchment who rely on water and hydroelectricity from the river system.

2.3.3 Project Components

The project is structured along the same lines as MKEPP with four components, each of which will generate its own outcome.

Table 2. 4: Project Components and Target Outcomes

S/No	Component	Outcome
1.	Community Empowerment	Rural communities empowered for sustainable management of natural resources
2.	Sustainable Rural Livelihoods	Natural resource-based rural livelihoods sustainably improved
3.	Sustainable Water and Natural Resource Management	Land, water and forest resources sustainably managed for the benefit of the local people and the wider community
4.	Project Management and Coordination	Project effectively and efficiently managed

Source: UTaNRMP BSR, 2014

2.3.4 Rationale of the Project

The Tana is the most important river basin in Kenya, its flow constituting 27% of the total discharge of the country's rivers. The Upper Tana catchment includes 25% of Kenya's gazette forests and has experienced considerable land degradation and a drastic reduction of surface water availability during the dry season, and poor water quality during the wet season due to high silt loads. The levels of river flow are inadequate for any additional use of surface water for irrigation. The area is densely populated, with large concentrations of poor and very poor people, particularly in the mid-altitude zone. Landholdings are small and diminishing as population grows, crop yields are low and declining due to fertility depletion and erosion, and rural households are poorly linked to markets and services.

Essentially the project will work with the custodians of natural resources in the Upper Tana providing them with a number of direct and indirect incentives to do things that are good for the environment, good for them, and from which other parties will also derive benefit. These incentives will come in a variety of forms, but will rarely if ever, involve direct cash transfers.

2.3.4.1 Alignment with Country Policies

There is a high degree of congruence between GoK policies and IFAD's mandate for rural poverty reduction. GoK and IFAD share a common vision of using agriculture and improved management of natural resources as a vehicle for improving rural livelihoods and incomes. This is reflected in the close alignment between Vision 2030, the ASDS and the current COSOP.

2.3.4.2 Alignment with IFAD Strategies

UTaNRMP is closely aligned with IFAD's strategic framework, for the period 2011-15. The framework reflects IFAD's overarching goal of enabling poor rural people to improve their food security and nutrition, raise their incomes and strengthen their resilience. The framework has five strategic objectives: (i) create a natural resource and economic asset base that is more resilient to climate change, environmental degradation and market transformation; (ii) improve access to services and build resilience in a changing environment; (iii) enable poor rural people and their organisations to manage profitable and sustainable enterprises and take advantage of decent work opportunities; (iv) enable poor rural people to influence policies and institutions that affect their livelihoods; and (v) create enabling institutional and policy environments to support agricultural production and related activities.

2.4 Objectives of Upper Tana Natural Resource Management Project

The goal of the project is to "contribute to reduction of rural poverty in the Upper Tana river catchment". This goal will be 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 objectives are in line with: (i) IFAD's goal of empowering rural women and men to achieve higher incomes and improved food security; (ii) the 2007-12 COSOP objectives of improved delivery of services to the rural poor through institutional capacity building, and improved access to appropriate technologies, markets and rural infrastructure; and (iii) the 2011-25 IFAD Strategic Objectives of ensuring that poor rural women, men, and rural youth have better and sustainable access to natural resources, climate change adaptation and mitigation measures, improved agricultural technologies and services, and opportunities for rural enterprise development and off-farm employment, as well as empowerment of the rural poor through access to markets and participation in policy and programming processes.

Locally, the objectives of UTaNRMP are aligned with: (i) Vision 2030, Kenya's long term development blueprint which aims at creating a "globally competitive and prosperous country with a high quality of life by 2030" and transforming Kenya into "a newly–industrialising, middle–income country providing a high quality of life to all its citizens in a clean and secure environment"; and (ii) the ASDS whose strategic thrusts include increasing productivity and managing key factors of production.

2.5 Project Baseline Information

In 2014, Kamfor Company Limited was contracted by Upper Tana Natural Resources Management Project (UTaNRMP) to carry out a baseline survey in the project area in order to establish the conditions at the start of project implementation. Baseline information/data is important in monitoring and evaluation as it helps to set key benchmarks which will be used to measure whether the project interventions has had measurable outputs, outcomes and impacts. The survey took 12 weeks from March - May 2014.

The objectives of the baseline survey were to:

i. Generate baseline information/data to assist in assessing the project area situation at the beginning of the project
ii. Set bench marks/indicators to inform the M&E function of the project and form a platform for assessing the impact of the project and other project surveys.
iii. Provide comprehensive information for planning and decision-making besides providing benchmarks against which programme interventions will be assessed and will be a reference point when organizing other surveys.

The baseline information/data was collected under six main thematic areas: Socio-Economic; Water Resources; Environmental Conservation; Agricultural/Rural livelihoods, Project Management and Coordination, and Community Empowerment. The baseline survey initially focused on the tributaries of the four river basins covered under Mount Kenya East Pilot Project for Natural Resources Management (MKEPP-NRM, UTaNRMP's predecessor) and the 12 high priority river basins. This was later changed to cover the whole project area, including other 12 river basins.

2.5.1 Survey Approach and Methodology

The approach to the survey focused on responding to the scope of work and activities given in the terms of reference. The consultants' team maintained consultative discussions with the client over the entire period of the assignment.

The survey started with collection of secondary data and preparation of data collection instruments, namely a household questionnaire, Key Informant Interview Guide, Focused Group Discussion Guide, and an Observation Guide. The project areas were then disaggregated along the river basin boundaries used by the Water Resource Users Associations (WRUAs). Sampling of Households was then undertaken using stratified random sampling with an overall sample size of 864 households was taken. Field visits to the river basins were also made to conduct household interviews, focused group discussions, and observations. A total of 42 Focused Group Discussions and 132 Key Informant Interviews were held. Data collected was then analyzed and draft report prepared which was then presented to a stakeholders' validation workshop.

2.5.2 Survey Coverage

The baseline survey initially focused on the tributaries of the five river basins covered under the UTaNRMP's predecessor, the Mount Kenya East Pilot Project (MKEPP) for Natural Resources Management and the 12 high priority river basins. This was later changed to cover the whole project area, including the low priority river basins. The overall area of coverage was thus:

a) MKEPP River Basins (4):

- Ena (Gitimbogo, Thuura, Gangara)
- Rupingazi/Kapingazi (Kiye, Thambana, Nyanjara, Gichangai, Itabua and Kathita)
- Kathita (Ngaciuma, Kinyaritha, Kuuru, Riiji)
- Kithinu/Mutonga (Naka, Nithi, Maara South, Maara North and Thuci)

b) High Priority River Basins

- Maragua, Murubara, Nairobi, Ragati, Rujirweru, Rupingazi, Saba Saba, Thangatha, Thanantu, Thiba, Thika/Sasumua, Thingithu

c) Other River Basins

- Amboni/Muringato, Iraru, Kayahwe, Lower Chania, Mara, Mariara, Mathioya, Nyamindi, Ruguti, Rwamuthambi, Sagana, Ura

2.5.3 Knowledge Management and Learning (Baseline report)

The main purpose of the project Knowledge Management and Learning process is to ensure that knowledge generated within the project is systematically identified, analysed, documented and shared. The knowledge generated will be used to support capacity building and institutional strengthening of stakeholders including community organisations, service providers, farmer organisations and government departments.

The baseline study established that the UTaNRMP is in the process of developing communication strategy for the project. The study further noted that the project Knowledge Management and Learning aspects involves: M&E, Information Management, Communication and feedback, Innovation and experimentation and continuous Learning and adaptation.

Some of the Knowledge Management and Learning activities being implemented by the project are: continuous technical training and capacity building, exchange/study tours, on-farm adaptive trials and demonstration and support for farmer-to-farmer learning, KM processes will ensure

that appropriate lessons learned and good practices from other parts of the region and the world are gathered and disseminated within the project area.

2.5.4 Key Recommendations from the survey

i. SCMPs may need to more prominently highlight socio-economic issues at the community level. A review of most SCMPs shows that most paid more attention to water resource and environmental challenges. Social aspects and challenges that may affect implementation of the plan such as leadership challenges, community organization etc. needs to be analyzed and understood from the onset.

ii. The project will need to devise a mechanism of flagging out people within the river basins that could be facing unique challenges such as single mothers without access to land, people with disability, the elderly and others with special needs. Approaches for social inclusion of this category of people will need to be thought through and income generating activities targeting them designed.

iii. The project will need to make use of the high levels of education reported in the river basins by ensuring supply of relevant information through available forms of media such as print and/ or cell phone.

iv. It will add value for the project to partner closely with other actors such as department for social development, in deliberately designing interventions for the people with special needs. Social inclusion of all farmers is essential in poverty reduction efforts.

v. The number of people reporting that casual labour was a source of income for them was high. Additionally, hired permanent and temporary labour was common across the river basins. It is important to note that those involved in farm labour may not always be the owners of the land, but they could be hired labour. This has implications on many issues such as decisions made in relation to production and target groups for capacity building.

2.6 Upper Tana Catchment Natural Resource Management Project: Logical Framework

a/All indicators to be gender disaggregated b/Organizational Capacity Assessment Tool

Results Hierarchy	Indicators a/	Means of Verification	Assumptions
Goal: Contribute to reduction of rural poverty in the Upper Tana river catchment.	15% reduction of poverty prevalence rate among 205,000 households participating in the project by Year 8 (Baseline 43.1% in 2005) 3% reduction in malnutrition prevalence (weight for age of children under 5) in project area by Year 8 (Baseline 16% in 2009) 5% increase in inventory of household assets among 205,000 participating households by Year 8 (Baseline ?)	Household income and expenditure surveys. RIMS impact survey questionnaire (baseline and final) Demographic and health surveys conducted by Kenya National Bureau of Statistics Annual household asset surveys by M&E	
Development Objectives: Increased sustainable food production and incomes for poor rural households in the project area; and sustainable management of natural resources for provision of environmental services.	15% increase in average real incomes for 205,000 households engaged in sustainable NRM enterprises by Year 8 (Baseline ?). 20% reduction in sediment load in rivers and water reservoirs in Upper Tana Catchment by Year 8 (Baseline 24,000 tonnes/day in rainy season and 2,800 tonnes/day in dry season). 5% increase in base flow in rivers by Year 8 (Baseline ?). 5% increase in ha of forest reserve protected/rehabilitated by Year 8 (Baseline ?).	Baseline and annual follow-up production and income surveys in Project area by M&E and during impact survey in Year 8. Biannual river gauging surveys by WRMA. Periodic sampling and analysis of river water. Remote sensing data to monitor forest conditions.	Potential conflicts between conservation and livelihood pillars of the Project are resolved. Farmers and entrepreneurs in the project area have improved market access.
Outcome 1: Rural communities empowered for sustainable management of natural resources.	Increase in number of community-led initiatives to improve the management of natural resources.	Annual Project reports. Media articles on community-led initiatives.	County conflict resolution mechanism for community investments in NRM
Output 1.1: Communities with increased awareness of sustainable NRM.	Level of awareness on NRM issues within 273 participating communities.	Baseline and annual follow-up surveys on awareness about NRM issues by M&E Media reports on NRM issues	
Output 1.2: Key community organisations with increased capacity to manage natural resources sustainably.	Capacity of 294 community organizations for sustainable NRM planning and implementation	Baseline and annual follow-up organizational capacity assessment tools.	Communities have access to resources to invest in sustainable NRM.
Output 1.3: Community action plans for livelihood improvement and sustainable NRM.	Number of community action plans prepared and implemented (target 240 FDAs and 33 CFAs).	Documented action plans.	Action plans will address the causes of un- sustainable natural resource utilization.
Outcome 2: Natural resource-based rural livelihoods sustainably improved.	Increase in level of income generated and assets acquired by participating households.	Household income and asset surveys: baseline and follow-up by M&E.	Market opportunities for agricultural products will continue to expand.

Table 2.5 continues

Output 2.1: Agricultural packages adapted to agro-ecological and socio-economic contexts.	Number of sustainable agricultural packages tested and demonstrated (target of 240 by Year 8). Quantity of seed produced (target of 200 contract seed growers producing 720 tonnes of seed by Year 8)	Reports on trials, demonstrations and research results.	Tested packages are adopted appropriately by farming communities
Output 2.2: CIGs successfully adopt or improve farm and/or non-farm IGAs	Increasing adoption by CIG members (target 40,000 members and 3,210 matching grants by Year 8).	Project reports on CIG income-generating activities by M&E. Farmer field school records.	Continued access to financial services and inputs, including through PROFIT.
Outcome 3: Land, water and forest resources sustainably managed for the benefit of local people and the wider community.	Reduction in level and severity of land degradation, improved water flows, water quality and forest condition.	Baseline and follow-up measurements of these key environmental parameters through biannual river gauging surveys by WRMA, periodic sampling and analysis of river water, and remote sensing data to monitor forest conditions.	Potential conflicts related to resource utilisation will be resolved.
Output 3.1: Sustainably managed water resources.	Access to safe water (target 60,000 households by Year 8). Area under irrigated using water-efficient methods (target 2,000 ha by Year 8). Levels of chemical and microbial pollution in waterways (Baseline ?). Number of functional WRUAs (target of 24, Baseline is 17 WRUAs formed by MKEPP and NRMP).	Household surveys (baseline and follow-up). Records kept by Irrigation Water User Associations. Bathymetric surveys in reservoirs. Water quality monitoring surveys.	There is adequate community capacity to maintain the water investments for continued sustainability
Output 3.2: Sustainably managed forest and agricultural ecosystems.	Area of forests rehabilitated and/or protected (target of 1,300 ha by Year 8) Number of human-wildlife conflicts reported (target of 60 km of wildlife fence by Year 8). % decrease in rates of farm soil loss by Year 8 Disbursement and use of 1,450 matching grants for SWC initiatives by Year 8.	Reports on activities undertaken by CFAs. Soil loss measurements at representative sites covering the main farming systems. Reports on matching grants for SWC activities	CFAs effective in controlling illegal uses of forest resources. SWC matching grants activities continue after the matching grants.
Outcome 4: Project effectively and efficiently managed.	Project activities fully integrated in mainstream GoK systems and institutions with functional management, monitoring and reporting.	NIMES M&E reports	Constitutional arrangements conducive to project implementation.
Output 4.1: Fully functional governance, management, monitoring and reporting systems.	Project implemented on schedule with performance ratings of satisfactory or better. Increasing measures of institutional capacity.	Supervision and implementation support mission reports, and audit reports. Formal institutional capacity assessments (eg OCAT b/)	It will be possible to recruit and retain suitably qualified project staff.
Output 4.2: Knowledge about NRM effectively managed and disseminated to stakeholders.	Increasing dissemination and use by stakeholders of knowledge generated by project. Regional knowledge centres effectively networked.	Number of information materials produced and distributed project-wide as monitored by M&E. Reports of regional KM. Surveys on awareness of sustainable NRM.	Other partners will cooperate with knowledge management systems.

Table 2. 5: Logical Framework for UTaNRMP Source: UTaNRMP Project Design Report (2012)

2.7 Knowledge Management and Learning: Background and UTaNRMP Orientation

2.7.1 Brief Background

Several definitions and conceptions of KM exist (Alavi et al., 2001; Coombs et al., 1998; Davenport, 1998; Nonaka et al., 1995; Probst et al., 1999). These different approaches to KM concentrate on the creation, diffusion, storage and application of either existing or new knowledge. Wiig (1997) puts his emphasis on the management of existing knowledge and states that the purpose of KM is "to maximize the enterprise's knowledge-related effectiveness and returns from its knowledge assets and to renew them constantly." Davenport et al. (1998) stress that KM consists of making knowledge visible and developing a knowledge-intensive culture. Several studies identify acquisition, identification, development, diffusion, usage and repository of knowledge as core KM processes (Probst et al., 1999; Alavi et al., 2001). Swan et al. (1999) argue that knowledge exploration and exploitation are the core objectives of KM.

In the early 1960s, Drucker was the first to coin the term knowledge worker (Drucker, 1964). Senge (1990) focused on the "learning organization" as one that can learn from past experiences stored in corporate memory systems. Barton-Leonard (1995) documented the case of Chapparal Steel as a knowledge management success story. Nonaka and Takeuchi (1995) studied how knowledge is produced, used, and diffused within organizations and how such knowledge contributed to the diffusion of innovation. A number of people, perceiving the value of measuring intellectual assets, recognized the growing importance of organizational knowledge as a competitive asset (Sveiby, 1996; Norton and Kaplan, 1996; APQC, 1996; Edvinsson and Malone, 1997). A cross-industry benchmarking study was led by APQC's president Carla O'Dell and completed in 1996.

Knowledge management (KM) was initially defined as the process of applying a systematic approach to the capture, structure, management, and dissemination of knowledge throughout an organization in order to work faster, reuse best practices, and reduce costly rework from project to project (Nonaka and Takeuchi, 1995; Pasternack and Viscio, 1998; Pfeiffer and Sutton, 1999; Ruggles and Holtshouse, 1999). Management theorists who have contributed significantly to the evolution of KM include Peter Drucker, Peter Senge, Ikujiro Nonaka, Hirotaka Takeuchi, and Thomas Stewart. Scholars still lack a consensus on knowledge management–related terms, even though these terms do appear to be complex enough to merit the concept analysis approach.

Some of the reasons for this lack of consensus lie in the fact that a word such as “knowledge” is necessarily subjective, not to mention value laden in interpretation.

Many knowledge management (KM) efforts have been largely concerned with capturing, codifying, and sharing the knowledge held by people in organizations. Although there is no prerequisite as to what constitutes a good definition of KM, there is widespread agreement as to the goals of an organization that undertakes KM. Nickols (2000) summarizes these goals as follows: “the basic aim of knowledge management is to leverage knowledge to the organization’s advantage.”

Knowledge management as proposed by IFAD and adopted by UTaNRMP, is a continuous improvement process involving all members of project teams, who learn, try out new ways of doing things, reflect, share their wisdom, and then change and adapt their projects to become more effective and successful (UTaNRMP KA, 2016). Hence this definition implies that KM is more than just managing information and document repositories, knowledge management and learning are approach to improve project performance and results. KM&L integrates a number of functions and activities into a coherent and flexible project management system geared to performance enhancement. Five interconnected functions form the foundation of the KM&L system, they are: learning and adaptation; monitoring and evaluation; internal and external communication; innovation and experimentation; information management.

2.7.2 Knowledge Management and Learning in UTaNRMP

Knowledge management is implemented in UTaNRMP as one of the two sub-components of Project Management and Coordination. The other sub-component being Project Management; encompasses Coordination, Planning, and financial management (disbursements, procurements and audits). However, this study area going by its title: Effectiveness of knowledge communication and management in fostering rural farmers’ local innovativeness, will be limited but not entirely restricted to the Knowledge Management and Learning (KM&L) sub-component.

Knowledge Management and Learning falls under component 4, which is Project Management and Coordination, the component is designed to ensure that the project is effectively and efficiently managed. The objective of the component is to enhance management in the

implementation and coordination of activities to ensure the project achieves its objectives. The KM&L system also encompass information management, M&E, innovation, learning and adaptation, and communication at various levels. It therefore supports capacity building for systematic knowledge management and learning among the implementing agencies and in stakeholder institutions. The principal activities being undertaken include: knowledge management, learning and communication strategy; knowledge harvesting, storage and processing; knowledge sharing and learning partnerships. Some of these elements are present in the national systems and in previous projects by the government of Kenya, but require better coordination, particularly the flow of information and knowledge sharing in the extension system.

UTaNRMP developed KM&L to encompass five key pillars namely: Monitoring and Evaluation; Information Management; Communication; Innovation and Experimentation and Learning and Adaptation. In fulfilling the requirements of this component, the project embarked on the process of developing a Knowledge Management and Learning Strategy for the project. The process had two main components that included conducting a knowledge management audit and developing a knowledge management strategy.

CHAPTER THREE
LITERATURE REVIEW

3.1 Introduction

The literature review includes review of related studies done by other scholars on the role of knowledge communication and management in fostering rural farmers' local innovativeness, with a focus on local and foreign trends. It discusses and examines the conceptual application of knowledge management from inception; it also establishes theoretical perspective of the study and linkages between the study variables. The chapter includes a conceptual framework, an operational analytical framework designed for operationalization of the study objectives, and hypotheses. This will also include literatures on the processes of knowledge management, knowledge sharing, indigenous knowledge learning and practice system, and communication for local innovation. Other areas covered are: organizational knowledge management for agricultural innovation, integrating local knowledge between coordinating team; specifically the knowledge actors and the rural farmers, farmers' engagements with community groups such as FDACs and CIGs. This chapter generally contains review of conceptual issues, review of theoretical issues, review of empirical issues, and review of methodological issues.

3.2 Conceptual Issues

Researchers have not reached consensus on the distinctions, if any, between knowledge and information. For example, Nonaka (1994) considers information to be just “a flow of messages” whereas knowledge is based on information and justified by one's belief. Other researchers believe that all information is considered knowledge but knowledge is more than just information, i.e., knowledge includes information and know-how (Kogut and Zander, 1992; Zander and Kogut, 1995). Management information systems' researchers tend to use “knowledge” to suggest that there is value and uniqueness in examining KMS compared to the traditional information systems (Alavi and Leidner, 2001).

Many researchers use the terms knowledge and information interchangeably, emphasizing that there is not much practical utility in distinguishing knowledge from information in knowledge sharing research (Bartol and Srivastava, 2002; Huber, 1991; Makhija and Ganesh, 1997). We adopt this perspective by considering knowledge as information processed by individuals including ideas, facts, expertise, and judgments relevant for individual, team, and organizational performance (Alavi and Leidner, 2001; Bartol and Srivastava, 2002).

Knowledge Management definitions are typically drawn both from the knowledge management literature and, internally, from their own organization. The use of concept definition through concept and semantic mapping techniques can help participants rapidly reach a consensus on a “formulaic” definition of knowledge management. That is, one that focuses less on the actual text or words used and more on which key concepts need to be present, what comprises a necessary and sufficient set of concepts, are rules of thumb to use in discerning what constitutes an illustrative example of knowledge management. Ruggles and Holtshouse (1999) identified the following key attributes of knowledge management; they are generating new knowledge, accessing valuable knowledge from outside sources….

Although the phrase “knowledge management” entered popular usage in the late 1980s (e.g., conferences in KM began appearing, books on KM were published, and the term began to be seen in business-oriented journals), KM has been around for many decades. Librarians, philosophers, teachers, and writers have long been making use of many of the same techniques. However, it could also be argued that knowledge management has been around far longer than the actual term has been in use. Denning (2000) relates how from “time immemorial, the elder,

the traditional healer and the midwife in the village have been the living repositories of distilled experience in the life of the community". It is important to account for the differences in managing tacit and explicit knowledge since these types of knowledge capture, creation, transferal, and sharing occur via different methods (Bloodgood and Chilton, 2012). Masa'deh, Obeidat, Al-Dmour, and Tarhini (2015) stated one opportunity of managing knowledge is through the capture of tacit knowledge for use by an organizational practice.

3.2.1 Knowledge Communication

Knowledge communication is described by Eppler (2006) as the deliberate activity of interactively conveying and co-constructing insights, assessments, experiences, or skills through verbal and non-verbal means. Knowledge communication has taken place when an insight, experience or skill has been successfully reconstructed by an individual because of the communicative actions of another. Knowledge communication thus designates the successful transfer of know-how (e.g., how to accomplish a task), know-why (e.g., the cause-effect relationships of a complex phenomenon), know what (e.g., the results of a test), and know-who (e.g., the experiences with others) through face-to-face (co-located) or media-based (virtual) interactions. This type of knowledge communication can take place synchronously or asynchronously. The term 'knowledge dialogue' is used for the first type of knowledge communication (synchronous), stressing the interactive and collaborative style of knowledge exchange in this communication mode (Nonaka et al., 2000).

Knowledge communication does not only differ in terms of what is communicated (knowledge) in context rather than isolated information, but also how one communicates. The transfer of information can often be successful without additional effort beyond an ordinary, everyday communication style. Communicating expertise-based, complex insights, by contrast, calls for didactic tricks and at times sophisticated indirect speech acts and visualization means that help the other side to become actively involved in the communication and engage in a collaborative, goal-directed sense making process – a prerequisite for the construction of new knowledge (Weick, 1995). The process of knowledge communication hence requires more reciprocal interaction between decision makers and experts because both sides only have a fragmented understanding of an issue and consequently can only gain a complete comprehension by iteratively aligning their mental models. All of this means that when we communicate

knowledge, we are still communicating information and emotions, but we also create a specific type of context so that this information can be used to re-construct insights, create new perspectives, or acquire new skills.

This (interpersonal) communication perspective on knowledge transfer has already been emphasized by other researchers who explicitly label this view as 'knowledge communication' (Scarbrough, 1995; Antonelli, 2000; Harada, 2003; Reiserer et al., 2002) and by several practitioners such as (Watson, 2004). Nevertheless, these authors have often treated knowledge communication as a kind of black box that is described only in broad terms and general traits, like the major communication goals or steps. Transformation of tacit-to-explicit knowledge according to Okoroafor, (2014) occurs through training or through experience. Specifically, tacit knowledge may be harder to attain than explicit, making the transfer and utilization of knowledge more critical to understand throughout the organization (Teo and Bhattacherjee, 2014). Building knowledge transfers into strategic planning as well as project planning and execution is a method of support goal planning and communication. By examining the communication problems which often impede knowledge transfer in detail, the study look into this black box and propose pragmatic ways of improving knowledge communication, especially among knowledge management experts and farmers alike.

3.2.2 Knowledge sharing

Cummings, (2004); Pulakos, Dorsey, and Borman, (2003) define knowledge sharing as the provision of task information and know-how to help others and to collaborate with others to solve problems, develop new ideas, or implement policies or procedures. Knowledge sharing can occur via written correspondence or face-to-face communications through networking with other experts, thus knowledge sharing differs from knowledge transfer and knowledge exchange. Knowledge transfer involves both the sharing of knowledge by the knowledge source and the acquisition and application of knowledge by the recipient. "Knowledge transfer" typically has been used to describe the movement of knowledge between different units, divisions, or organizations rather than individuals (Szulanski, Cappetta, and Jensen, 2004). Although "knowledge exchange" has been used interchangeably with "knowledge sharing", Cabrera, Collins, and Salgado, (2006), are of the opinion that knowledge exchange includes both knowledge sharing (employees providing knowledge to others) and knowledge seeking

(employees searching for knowledge from others). This study seek to adopt the term “knowledge sharing” when discussing studies that measured knowledge transfer using scales that assessed both knowledge sharing and learning. The problem with local knowledge sharing however is its lack of coordinated approach which is generally left to individual initiatives, creativity as well as collective procedures to drive innovation.

In a mixed-methods study, Zhang et al. (2014) found cultural values had a direct effect on knowledge sharing with cultural values interactively affecting the motivation of the workforce knowledge sharing. Suppiah and Sandhu (2011) explored clan, adhocracy, market, and hierarchy organizational culture and found clan culture positive influenced tacit knowledge sharing while market and hierarchy cultures did not. Suppiah and Sandhu (2011) eliminated adhocracy due to statistical insignificance during initial testing of the model used in their research. Organizational culture links knowledge management processes and firm performance through the trust between those in the employee workforce (Nold, 2012). Donate and Guadamillas (2011) hypothesized that the greater of a knowledge-centered culture, the higher the level of influence of knowledge and the exploitation practices on innovation results. Lack of culture of knowledge sharing may also restrict creative growth within an organization (Donate and Guadamillas, 2011). Leadership (internal and external) should ensure farmers feel empowered to share knowledge and innovative practices as part of the organizational culture. Hence empowerment according to Fernandez and Moldogaziev (2013), allows employees to make corrective actions without requiring micromanagement, which frees their co-workers and supervisors for other organizational requirements.

3.2.3 Integrating local knowledge

Knowledge can also be compared on local and traditional grounds. Olsson and Folke (2001) suggest a local fishing association in a Swedish community displayed management practices that enabled the protection of crayfish beyond the local population to the ecosystem, an example of local ecological knowledge. In contrast, traditional ecological knowledge implies a historical and cultural context to knowledge generation and dissemination. For example, the Turkwel Riverine Forest in Kenya has been managed for many years by an indigenous system known as ekwar which refers to a parcel of riverine forests whereby the owner and family has exclusive rights to

collect building materials, firewood and edible fruits. Outsiders require permission from the ekwar owner to graze their livestock in the area (Stave et al. 2007).

Matata et al. (2010) identified the factors which drive the adoption of improved fallows among smallholder farmers in western Tanzania. The results suggest that significant explanatory variables include receiving information on improved farming, and the main obstacles listed were lack of awareness or poor knowledge of improved fallows. In contrast, a recent study on the adoption of traditional gum Arabic agroforestry systems in western Sudan investigated which factors influence the decision to adopt this technology (Gibreel, 2013). Their results show that farmers with less commercialization, access to credit, less fragmented land, more education, located away from the markets and with more years of experience in farming, are more likely to adopt the traditional gum Arabic agroforestry system. In a study focusing on the East African region, Wambugu et al. (2011) looked at the adoption process of fodder shrub innovations in Kenya, Tanzania, Uganda and Rwanda. The study identified several key elements for scaling up the adoption of fodder innovations, including: the inherent attributes of fodder shrub technologies and the landscape; collective action; a pluralistic extension approach; involvement of large non-governmental organization promoters; dissemination facilitators; farmer-to-farmer dissemination; other technologies preferred by the farmers; and an enabling political environment.

Researchers have usually compared knowledge types along different continua. This includes those that represent the extent to which knowledge is: locally specific or generalised across regions; formalised; expresses expertise; articulated in ways accessible to others; and is embedded in traditional cultural rules and norms derived from longstanding association and feedback with ecological processes (Raymond et al., 2010). There are clear benefits of incorporating traditional knowledge alongside conventional scientific knowledge when assessing current understanding to guide decision-making (Tengö et al. 2013). This study will examine how diverse tacit knowledge that is inherent in farmers can be harnessed to foster local innovative practices toward agricultural development by integrating both local and external elements. This is because, despite farmers' wide-range knowledge and expertise, they are usually not all knowing and may at times lack the ability to draw appropriate inferences in demanding situations.

3.2.4 Communication for Local Innovation

Knowledge and perceptions that include both local, external or scientific elements at the level of a community or society, is often part of a shared knowledge base that Giddens (1976) calls 'mutual knowledge'. Mutual knowledge is not always explicit, but in many instances remains implicit or taken-for-granted (Schutz and Luckmann, 1974; Giddens, 1976). Nevertheless, such 'tacit' knowledge (Nonaka and Takeuchi, 1995) can play an important role in shaping farmers' practices. Consequently, farmers can harmonize their ideas to increase their overall performance and productivity. While knowledge communication is required for innovation, so are strong teams that understand the functionality of knowledge management to support local innovation (Von Krogh et al. 2012). Innovation is a method to ensure a customer receives more value for their contracts and exchanging tacit knowledge helps in the development of innovation (Arnett and Wittman, 2014). Sankowska (2013) determined that while trust facilitated knowledge transfer, knowledge creation facilitated organizational innovation. Farmers' knowledge and beliefs can originate from various sources, for example, from traditional or own experiences and experimentation, from experiences elsewhere (modern) as passed on, for example, by communication workers, traders or migrants, or from formal agricultural research. In some cases, the precise origin of this fast becoming inherent knowledge can no longer be established.

The role of extension and training is crucial in the development of knowledge, perceptions and attitudes about agricultural innovations, as a result, knowledge management officers are often referred to by the rural farmers as agricultural extension workers. As agricultural production systems can vary considerably in nature and complexity in different settings, it is important to take these differences into account in tailoring extension interventions (Bernet et al. 2001). There has been a growing emphasis on farmer-led extension, in which farmers are the principal agents of change in their community and help disseminate the new technology to other farmers (Franzel et al. 2001, 2004, Kiptot et al. 2006). This was initiated by the 'farmer first' approach, which stressed the importance of local knowledge and farmer innovation to complement the traditional transfer of technology approaches to agricultural research and extension (Chambers et al. 1989). Although the approach has faced considerable criticism, the idea to link agricultural research to farmers' knowledge has been generally accepted (De Wolf, 2010). Nevertheless, a factor that has often been neglected in adoption studies is the extent to which farmers themselves are involved in the development of and experimentation with the new technology.

Often, a new technology is considered to be a 'finished product' and farmers are assumed to either adopt or not adopt the technology. However, farmers experiment with different adaptations of the technology, which tends to be neglected by scientific research institutions (De Wolf, 2010). When farmers are able to adapt the new technology themselves and apply it in their local context, the potential of successful and sustained adoption will increase (Mekoya et al. 2008). Communication for local innovation can take place in many forms; nevertheless this study adopts communication for local innovation to mean the transfer of knowledge resulting to productive outcome such as adoption/adaptation to new intervention, application of new technology to local processes and having a positive value for their beneficiaries who transcribe it into their own context for sustainability.

3.2.5 Organizational Innovation

Innovation is viewed as one of the fundamental organizational activities, which apply to the case of farmer group. Innovation is defined as a new idea, method or process of introducing something new (Sarros, Cooper, and Santora, 2008). Thus organizational innovation refers to the conception, development and introduction of new products, services and processes, or new ways of organization. Organizational innovation in terms of development of new products and processes is an important source of sustainable competitive advantage and superior performance (Eshlaghy and Maatofia, 2011; Sarros et al., 2008).

Innovation constitutes an indispensable component of corporate activities in that it enables a firm to apply new productive manufacturing processes, to respond to changing customer needs, attain positive reputation in customers' perceptions and, as a result, gain sustainable competitive advantage and superior performance (Eshlaghy and Maatofia, 2011). Eshlaghy and Maatofia (2011) argue that through the development of organizational capabilities and aligning them to the dynamic environment, innovation strengthens an organization's competitive advantage and enhances performance. Studies by Darroch and McNaughton (2003), and Lopez-Nicolas and Merono-Cerdan (2011) suggest that through stocks of knowledge, a firm is able to invent new products and processes which give it competitive advantage. These authors collectively imply that organizational innovation is important in understanding the relationship between knowledge sharing and performance. However, the influence of innovation on the relationship has been given scanty attention in past research work.

3.3 Theoretical Issues

3.3.1 Organizational Knowledge Transfer

The increasing importance of organizational learning for creating competitive advantage has triggered the study of and consequences of organizational knowledge transfer at intra- and inter-organizational levels. Organizational knowledge transfer refers to the process through which organizational actors – teams, units, or organizations– exchange, receive and are influenced by the experience and knowledge of others. Since organizational knowledge transfer requires the integration of differentiated knowledge, it manifests itself through changes in the knowledge bases or performance of recipients (Argote et al. 2000).

In addition to studies focusing explicitly on knowledge transfer (Mowery et al., 1996; Tsai, 2001), studies have labeled knowledge transfer processes in alternative but related ways. For example, studies by knowledge scholars across different fields have also considered knowledge sharing (Tsai, 2002), knowledge flows (Schulz, 2001), and knowledge acquisition (Darr et al., 1995; Lyles and Salk, 1996) which can be used interchangeable when discussing knowledge transfer. Contextual conditions may moderate the relationships between knowledge transfer and its consequences; knowledge sharing is however employed in this study to mean knowledge exchange generally in order to establish connectedness between farmers and 'knowledge experts' by eliminating any form of distance as to who should be in possession of knowledge (giver) and who should need knowledge (receiver). In the context of this study, knowledge sharing occurs when the need for knowledge is identified and applied accordingly regardless of the source of intervention whether traditional (from farmer's perspective) or modern (from knowledge expert). Previous research, for instance, argued that transferring knowledge across different firms is more complicated than transferring knowledge between units within the same organization (Inkpen and Tsang, 2005).

Local people often hold knowledge that is vital to the cultivation and use of locally adapted crop varieties. This information is rarely collected by scientific studies and is not held by seed banks (van Oudenhoven and Haider, 2012). This research will examine how organizational knowledge sharing and consequences are distinctively related to knowledge transfer between project implementers and beneficiaries. For an organization like farmers' group to attain or maintain successful performance, the use of dynamic capabilities is tied to knowledge creation and the

practices within the organization (Alegre, Sengupta, and Lapeidra, 2013). Successful performance through knowledge transfer requires understanding of the use of organizational knowledge management at both individual and team levels.

3.3.2 Knowledge Management for Agricultural Innovation

Knowledge management is often applied distinctively to conditions on the basis of explicit knowledge or tacit knowledge; which can be personal or traditional knowledge embedded in experience. Basu (2014) defined knowledge management to include several areas such as education and sharing of best practices as well as employee training and development and communication media. Traditional corporate and development theory generally focus on developing and diffusing explicit knowledge. Innovation on the other hand is creating value through more effective processes, products, or pricing to create a competitive advantage for an organization (Hinterhuber and Liozu, 2014). Alegre and Chiva (2013) defined innovation performance as three different dimensions involving product and process effectiveness and innovation efficiency. Knowledge management programmes have been studied in the corporate sector with regard to information and explicit data management. The underlying motivations of such programmes therefore relate to ideas of the knowledge economy, organizational efficiency, structural and cultural change, learning organizations, and financial profit (Hovland, 2003).

First-generation knowledge management, both in the corporate sector as in agricultural development, has emphasized a top-down and technological perspective where the main goal was getting the right technological information to the right people at the right time. Röling and van de Fliert (1994) found that most investments in agricultural research and extension were based on the assumption that agricultural science generates technology which extension experts transfer to users, ignoring local knowledge creation and sharing, as well as the relevance of articulating demands by farmers and promoting their self-confidence and empowerment.

During the last decades this approach has been repeatedly put in question (Russel and Ison, 2000; Leeuwis, 2004) and more balanced approaches have become common where the focus is not only on the supply side but also on satisfying the demand for the production of new knowledge. Sveiby and Simons (2002) have shown that for the corporate business sector, relevant knowledge is created collectively, in groups, through mechanisms of networking and communication. For the agricultural sector Röling (1996) and Sumberg et al. (2003) have argued that for knowledge

to be absorbed by the community of users, it needs to get applied, reworked, adjusted and improved. Today's second-generation knowledge management emphasizes collaboration in the management of knowledge.

However, second-generation knowledge management is not to be achieved by simple means. Thompson and Scoones (1994) argue that knowledge management cannot be improved by simple measures, such as by transferring power from the outside to the inside, from researchers to farmers, but only through complex social processes that do not necessarily follow systemic patterns. According to these authors, knowledge creation requires knowledge management practices capable of involving multiple agents, consistent with recent approaches to innovation based on the ideas of auto-organization of entrepreneurs (Miles et al. 1997), social R&D networks (Sorenson et al. 2006) and complex adaptive systems (Kauffman, 1995). In a complex adaptive system, individuals and organizations act and survive by adapting and learning to organize themselves into communities, providing the necessary ground for the creation and improvement of knowledge. Agents in such a system are free to act and learn independently or collectively. In other words, their collective behaviour is complex, not managed from above but emergent from the structure of the network of interactions in which they are embedded.

Crespi and Zuniga (2012) found through a study of the relationship between innovation and productivity that knowledge was important in innovation with strong associations between innovation and productivity. Hogan and Coote (2014) found evidence supporting innovative behaviors and firm performance when examining the organizational culture of some law principals. Hence creativity and innovation can help farmers adapt to different initiatives and technology which increases their level of participation within the system as well as their acceptability of project intervention.

3.4 Methodological Issues

3.4.1 Knowledge Strategy, Organizational Characteristics and Innovation

As suggested by contingency theorists, different constructs related to organizations need to be aligned to achieve desired organizational outcomes. Thus for knowledge strategy to be successful, there is need to achieve a match or fit between knowledge strategy and organizational characteristics to support innovative efforts critical to enhance organizational competiveness and performance. Knowledge exploration and exploitation draw on different structures, processes and resources generating significantly different performance outcomes over time (He and Wong, 2004). Innovation which brings about superior organizational performance is an outcome of KM and various antecedent organizational factors or determinants, namely structure, leadership and culture (Liao, 2007; Sarros et al., 2008). Strategic leadership of organizations help define and shape work contexts that contribute to organizational innovation; and there is evidence that leadership style is an important determinant of innovation (Jung, Chow, and Wu, 2003; Sarros et al., 2008).

Past studies examining knowledge strategy, organizational characteristics and innovation have examined the influence of each variable on organizational performance singly. These studies have not focused on the combined effect of the variables on organizational performance. In a study examining the effects of strategic KM strategies on innovation and performance of Spanish firms, Lopez-Nicolas and Merono-Cerdan (2011) found that strategic KM strategy impacts on organizational performance directly and indirectly through an increase on innovation capability. The study by Lopez-Nicolas and Merono-Cerdan (2011) made a contribution in understanding the role of innovation in the relationship between strategic KM and organizational performance however; the study conceptualized strategic KM in terms of codification and personalization of knowledge. The study did not examine knowledge strategy in terms of knowledge exploration and exploitation and its effect on organizational performance. This study will develop an integrated model to examine the combined effect of knowledge management, organizational characteristics such as communication and innovation of farmers through indigenous knowledge sharing methods to portray a more complete picture of the relationships among the variables.

3.5 Summary of Empirical Issues

Table 3.5. 1: Summary of Empirical Issues (Adopted from Kimwomi, 2015)

Study	Research Focus and Methodology	Key Findings	Knowledge Gaps	Focus of Current Study
Siren et al. (2012)	Role of strategic learning as mediating variable between exploration and exploitation and profit performance of Finish software firms. Used survey data of 206 Finish software firms; and structural equation modelling.	Exploration and exploitation do not directly affect profit performance, and that strategic learning mediates the relationship.	Studied Finish Software firms. Did not examine the influence of moderating variables and intervening variables such as organizational innovation; used financial measures of performance.	Study UTaNRMP a nonprofit organisation in Kenya. Examine the moderating variable of acceptability and adaptability of non-governmental communicative interventions.
Uotila et al. (2009)	Relationship between firm exploration and exploitation, and financial performance of manufacturing firms in Finland. Used longitudinal panel data from 279 firms between the year 1989 to 2004; and GMM regression models.	Curvilinear relationship between exploitation and financial performance that depends on industry environment.	Studied manufacturing firms in Finland. Did not examine influence of other moderating variables such as organizational characteristics and intervening variables. Only considered financial measures of performance.	Establish the extent to which effective knowledge communication and proper management can improve rural farmers' adaptation to UTaNRMP intervention in Embu and Kirinyaga counties.
Bierly & Daly (2007)	Effect of knowledge strategy and competitive environment on performance of small manufacturing firms in USA. Used survey data from small firms; and hierarchical regression analysis.	Positive relationship between knowledge exploration and firm performance; concave relationship between exploitation and performance. R^2 of 0.08; competitive intensity moderates the relationship.	Study focused on small manufacturing firms in USA. Did not examine the influence of other moderating variables such as organizational characteristics and mediating variables such as organizational innovation.	Evaluate indigenous knowledge sharing activities and its influence in stimulating local innovation among farmer beneficiaries in Embu county.
Venkatraman et al. (2007)	Impact of joint pursuit of exploration and exploitation on sales growth of USA software firms. Used data from 1,005 US software firms. Used cross-sectional time series and generalized estimating equations approach.	Did not find empirical support for direct relationship.	Studied USA software firms. Did not consider influence of moderating and intervening variables. Only considered sales growth as a measure of performance.	Assess the effectiveness of knowledge management and learning strategies within UTaNRMP, and its impact in promoting a culture of learning and exchange between farmers and experts.

CHAPTER FOUR
METHODOLOGY

4.1 Conceptual Framework

Knowledge Management activities require a conceptual framework to operate within; otherwise the activities will not be coordinated and may not produce the expected KM benefits. Several authors have proposed and developed conceptual and coherent models of Knowledge Management KM, depending mostly on a thorough investigation of various models presented in novel classification of KM processes. Complex adaptive systems (ICAS) are particularly well suited to model KM as they view the organization much like a living entity concerned with independent existence and survival. Beer, as well as Bennet and Bennet, have applied this approach to describe the cohesiveness, complexity, and selective pressures that operate on intelligent complex adaptive systems (Dalkir, 2005). The ICAS model is represented in Figure 4.1.

ICAS Model, (Source: Dalkir, 2005)

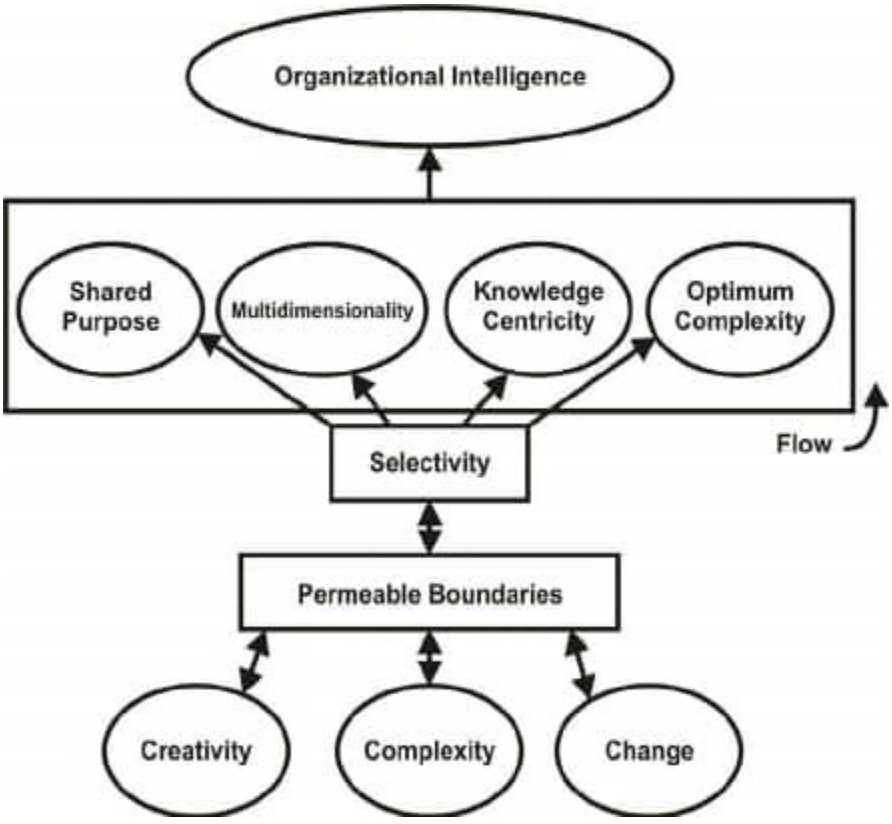


Figure 4. 1: Conceptual framework for knowledge management processes

The key processes in the ICAS KM model can be summarized as: understanding, creating new ideas, solving problems, making decisions, and taking actions to achieve desired results. Hence, Intelligent Complex Adaptive System (ICAS) model is composed of living subsystems that combine, interact, and coevolve to provide the capabilities of an advanced, intelligent technological and sociological adaptive enterprise. Since only people can make decisions and take actions, this model emphasizes individual knowledge embodiment and his or her knowledge assets (competency, capacity, learning) which are leveraged through multiple networks such as community of practice. Bennet and Bennet (2004) describe a complex adaptive system approach to KM; they believe strongly that the traditional bureaucracies or popular matrix and flat organizations are not sufficient to provide the cohesiveness, complexity, and selective pressures that ensure the survival of an organization. A different model is proposed, one in which the organization is viewed as a system that is in symbiotic relationship with its environment.

Complex adaptive systems are organizations that are composed of a large number of self-organizing components, each of which seeks to maximize its own specific goals but which also operates according to the rules and context of relationships with the other components and the external world. Knowledge becomes the most valuable of these resources because it is critical in taking effective action in a variety of situations. In such instance, knowledge is often used to distinguish information management (predictable reactions to known and anticipated situations) and knowledge management (use of existing or new reactions to unanticipated situations).

4.2 Analytical Framework

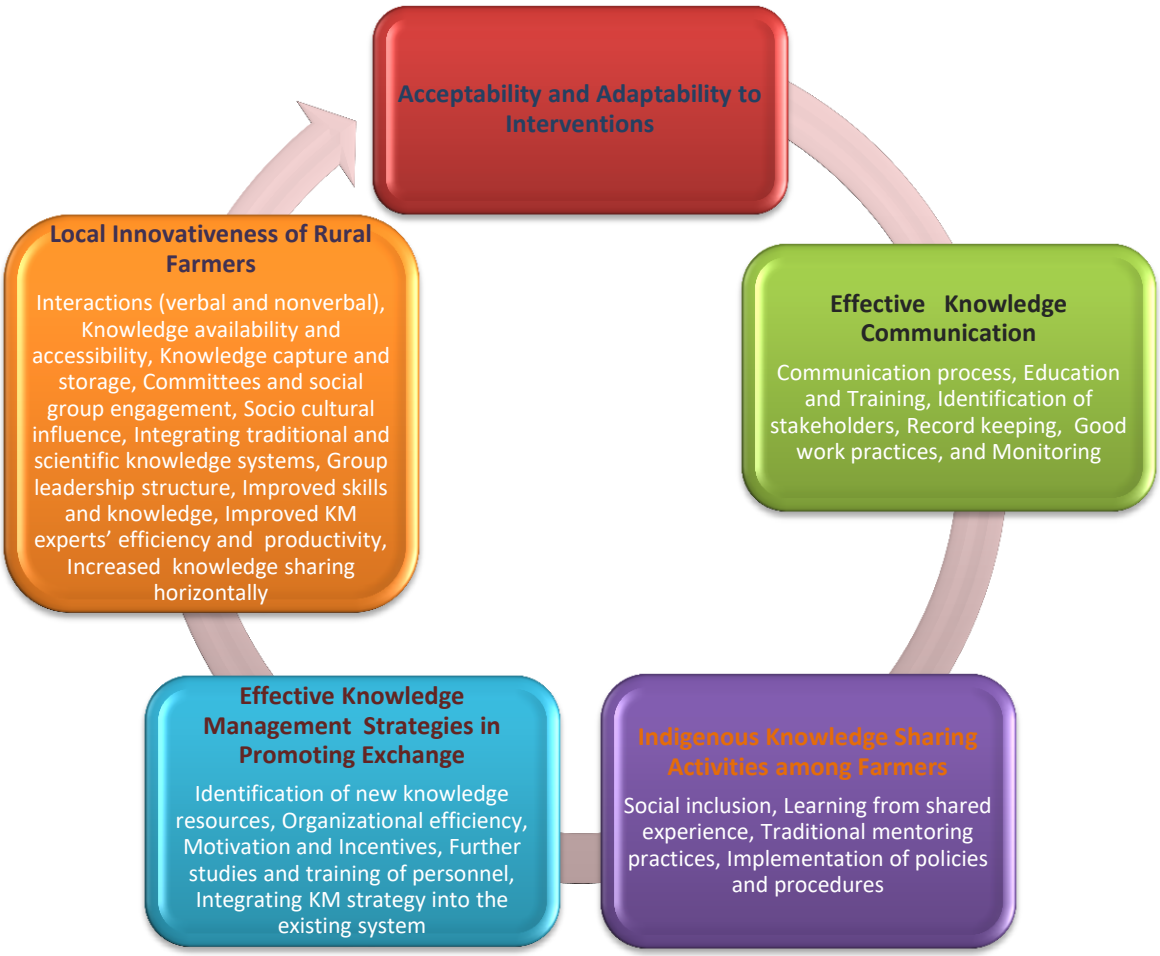


Figure 4. 2: Operational Model for Knowledge Communication and Innovation Assessment of Farmers

4.3 Statement of Hypothesis

The analytical framework indicates that effective knowledge communication and management through indigenous knowledge sharing activities among farmers can foster their local innovativeness and learning cohesion with experts. In summary, this study sought to test the following hypotheses:

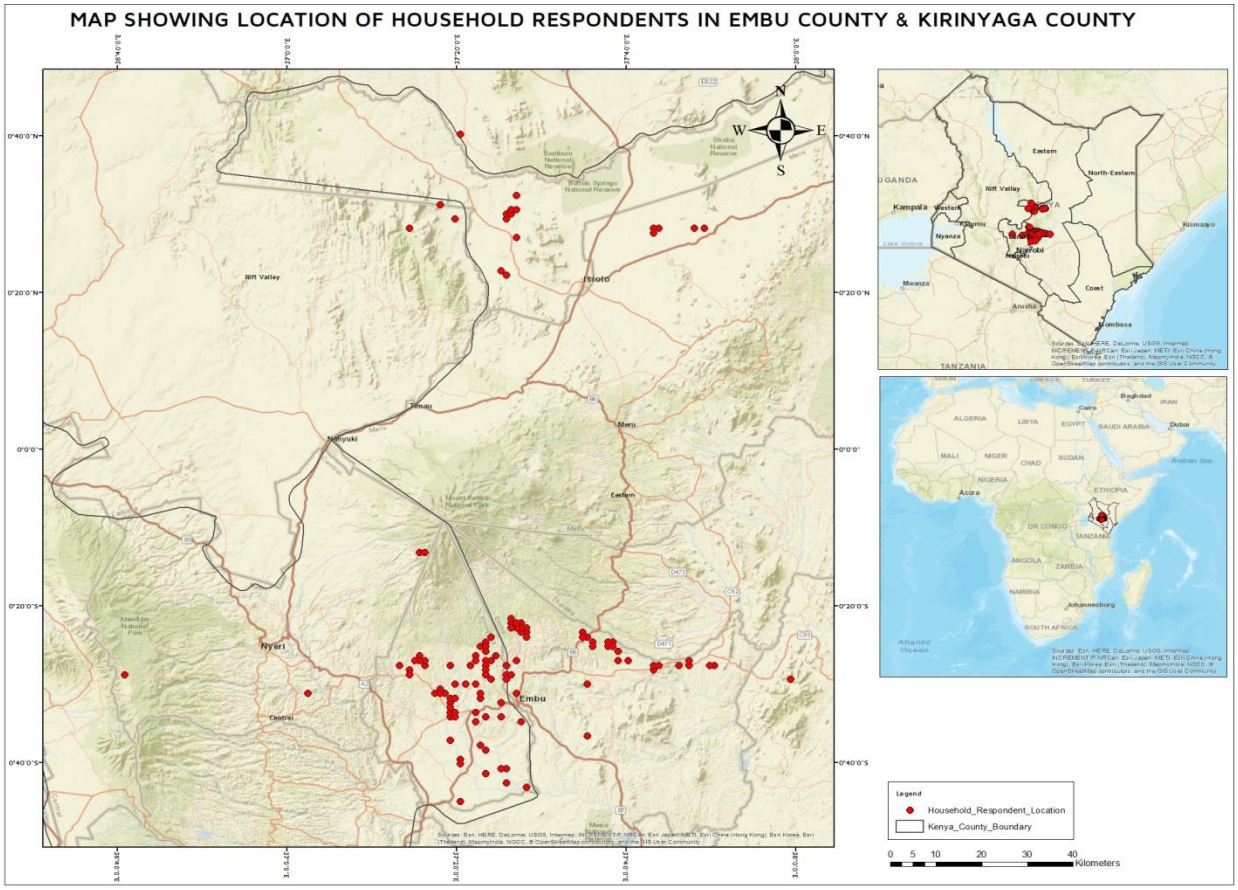
H1: Knowledge communication does not significantly influence farmers' adaptability, adoptability and innovation

H2: There is no significant creation and invention of new ideas among the farmers

H3: There is no significant adaptation and adoption of new interventions among the farmers

4.4 Study Area

Figure 4. 3: Map of Africa and Kenya showing Location of Respondents



Source: Field Survey, 2018

The Upper Tana River Basin covers approximately 17,000 km^2 and includes 24 river basins and the tributaries of five river basins under MKEPP that drain into the Tana River. The River basin is home to 5.3 million people (TNC, 2015). The basin covers Mount Kenya and the Aberdare highlands with elevations ranging from 4,500 m at Mount Kenya to about 400 m above sea level in the east of the catchment. There are two rainy seasons and rainfall is relatively high with average annual rainfall of about 2,000 mm at higher altitudes (Hunink et al. 2013). The water this area provides is of critical importance to the Kenyan economy. It fuels one of Kenya's most important agricultural areas, provides half of the country's hydropower output, supplies 95% of Nairobi's water and is home to national parks and reserves which are important areas of biodiversity (TNC, 2015). The wettest season is experienced between March and July while the hottest comes between January and mid- March. The land is largely arable and is well watered

by a number of rivers and streams. Agriculture is the main driver of the economy in this county with over 70% of the residents being small scale farmers.

Upper Tana catchment consists of 25% of Kenya's gazetted forests; the area covers six counties namely: **Murang'a, Nyeri, Kirinyaga, Embu, Meru and Tharaka Nithi.** The area also includes the Mt. Kenya and Aberdares National Parks and surrounding Forest Reserves. The project targets to benefit 205,000 poor rural households (1,025,000 people) in the project area. However, for the purpose of this study, two counties namely: **Embu and Kirinyaga** were selected randomly from the six aforementioned counties to serve as project area for this study. The river basins in these counties include:

Embu: Rupingazi, Mutonga/Thuci, Thura, Rwanjoga, Gangara, Itimbogo, Itabua/Rupingazi.
Kirinyaga: Kirwara, Kiwe, Rwamuthabmi, Thiba, Nyamindi, Mugaka

The following river basins have been purposively selected and proportionally distributed for the study based on; the level of UTaNRMP activities carried out in the river basins and the time line for survey.

Table 4. 1: Distribution of Study Area

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

Source: Field Survey, 2018

4.4.1 Selection Criteria for Study Area

The largest and most important basin in Kenya is Tana river basin, with its catchment covering approximately 17% of Kenya's land mass, the flow of the Tana river basin constitutes 27% of the total mean discharge measured along rivers in the country's major drainage basins. The basin has both the largest existing generated hydro-power and the greatest remaining hydro-power potential and presently accounts for approximately 61% of the total power supply in the country. The catchment provides water for about half the country's population, and most of the country's hydroelectric power. The area which includes the Mount Kenya, Aberdares National parks and

surrounding forest reserves is under heavy and growing population pressure with an average of about 250 inhabitants per km.

Consequently, the Tana area became an important catchment to national economic growth and development. The Government of Kenya (GoK) and IFAD financed the Mount Kenya East Pilot Project (MKEPP), which has linked sustainable use of natural resources, especially water and forests, with enhancement of rural livelihoods. At the request of the Government, IFAD and GoK designed a new project UTaNRMP to cover more capacity; from the initial 4 river basins coverage to 24 river basins. Embu and Kirinyaga counties are two of the 47 counties in which the project is highly operational, with its headquarter in Embu and are therefore very progressive in the achievement of UTaNRMP's objectivity. Hence Knowledge Management and Learning activities are being implemented by the project for continuous technical, training/capacity building, exchange/study tours, on-farm trials/demonstrations and support for farmer-to-farmer learning. The survey will test and identify these KM processes in the 4 river basins within the two randomly selected project areas (Embu and Kirinyaga), and their influence in farmers' innovative activities; who are majorly semi-subsistent.

4.5 Data Requirement and Sources

Multi-stage sampling techniques were employed in the selection and distribution of survey instruments. Qualitative survey method which are Key Informant Interviews and Focus Group Discussions, as well as quantitative survey instrument (structured questionnaire) were adopted in collecting a total of 421 (135 in Embu and 286 in Kirinyaga) data for quantitative analysis, and a total of 13 data (1 KII & 12 FGDs) for qualitative analysis. The type of data collected included demographics, communication, training/mentoring, knowledge capture and storage, indigenous knowledge sharing, and innovation. These sets of data contain specific and in-depth information on the role of knowledge management in UTaNRMP and levels of farmers' interaction with project interventions.

Suffice to say that both primary and secondary data were employed by this survey. Primary data as used in this survey involved the use of individual respondent Questionnaire, KII and FGDs. While secondary data involved: UTaNRMP baseline survey, KM&L Audit, documented KM systems and strategy, academic journals, IFAD journals, UTaNRMP reports, published researches, manuals, newsletters, picture and video documentaries, and observations.

4.5.1 Sampling Design/Technique

The target sample of respondents was 421 farmers made up of males and females of different age groups all engaged in one or more farming activity. These respondents were administered questionnaire in the 4 river basins (Thiba, Thuci, Nyamindi and Rupingazi) of the study area, within Upper Tana Natural Resources Management Project catchment. Random and purposive sampling were employed in selecting participants for Focused Group Discussions (FGD) and Key Informant Interview (KII) based on their relevance to the objectives of study and respondents' job description within the study area.

4.5.2 Determination of Sample size

The representative sample for respondent interview was determined scientifically. The sample size was arrived at using the following formula to calculate the sample size.

$$n = \frac{Z^2 P (1-P)}{d^2}$$

Where:

n= the sample size

Z= Z statistics for level of confidence

P= expected prevalence or proportion

d= precision

$$n = \frac{(1.96)^2 (0.05) (0.05)}{0.5^2}$$

n= 384

For non-response 10% of n will be add to n = (38+384) = 422

Adjusted Sample Size = 421

4.5.3 Distribution of Sample size

Embu and Kirinyaga counties were stratified along 4 river basins to form the study area constituting the first stratum. Each river basin (first tier stratum) was then divided into three sub-strata representing the upper, middle and lower sections of the river basins. The second stratum comprises of 36 FDAs in the 4 river basins. The survey adopted UTaNRMP Baseline survey (2014), considering that the upper and lower zones of the river basins are normally less densely

populated than the middle zones of the river basin. Hence, the sample size of each river basin was divided in ratio 1:2:1 for the upper, middle and lower sections respectively.

Table 4. 2: Distribution of Sample Size by Study Area

S/No	County	River Basins	Length (Km)	Total Size	Total No. of FDAs	Proportionate Sample size	Adjusted Sample size
1.	**Embu** 516,212 183 sq km	Thuci	78	152	5	55	75
2.		Rupingazi		354	4	44	60
1.	**Kirinyaga** 537,054 357 sq km	Thiba	78	715	17	176	176
2.		Nyamindi	78	453	10	110	110
Total					**36**	**385**	**421**

Source: Field Survey, 2018

4.5.4 Preparation of Instrument and description of the Questionnaire

Before commencing actual data collection, the river basins were delineated into upper, middle and lower sections with assistance from 2 County Project Coordinators (CPCs) representing Embu and Kirinyaga, and Focal Development Area Committees (FDACs) executives using the available maps in the project area. The middle point of each location was identified and then from this middle point, the first farmer to be interviewed was selected randomly by visiting their homes. Thereafter, selection of individual house for interview was done systematically, with enumerators heading towards opposite corners of each starting point and visiting each 3rd house on their route.

Within the households, interviews were conducted with only one respondent regardless of the household size but usually with an adult or any other farmer present; both male and female. This is because the survey instrument is individual and not household based; farmers' homes were intentionally chosen to capture their maximum attention and willingness to be interviewed while in the comfort of their homes unlike meeting them on the farm. In cases where respondents from the systematically selected houses for the survey were not present or were unwilling to

participate, replacement was done by selecting the immediate next house (towards the river flow) that had previously not been selected. It is worthy to note that the respondents in most cases are semi-subsistence farmers.

4.5.5 Administration of Research Instrument

The field data collection was carried out over a period of five weeks. During the first week, a pre-testing of all data collection instruments was carried out purposively in 1 river basin out of the 4 under study. The pilot testing involved a sample of 6 farmers for individual interviews and 1 FGD with Rupingazi FDAC executives. After the pilot test, data instruments were reviewed for errors and consistency and finally administered in Embu county for one week and then in Kirinyaga county for two weeks. The final phase of data collection was done in the fifth week with FGDs and KII participants in both counties.

4.5.6 Validity and Reliability of Research Instrument

Questionnaires employed for quantitative analysis of the study formed the basis of primary data collection. They were administered after pre-testing at Rupingazi river basin and found very reliable; through enumerators who were trained on the objectives of the survey and how interviews were to be conducted. In term of comparability, some information from the baseline survey were retained but restructured to meet current objectives. Although questionnaire is susceptible to respondents' subjectivity, it is however capable of capturing relevant information based on their individual opinions which allows for data analysis using Statistical packages to test for validity and reliability.

Appropriate mobile application software was used to ensure errors were eliminated as mobile devises were GPRS enabled and allowed for tracking and accuracy of GPS coordinates.

4.6 Data Collection

Three survey instruments were adopted by this study for primary data collection, they were guided by: individual structured questionnaire (for quantitative survey), Discussion guide (for FGD), and Checklist (for KII) respectively.

Questionnaire: 421 questionnaires were distributed across **2** river basins in Embu, **2** river basins in Kirinyaga, and a total of **36** FDAs (Focal Development Areas) for individual survey. All **421** questionnaires administered were recovered from the field survey.

Key Informant Interview: KII was carried out with **1** KM&L officer, being the project's direct knowledge management expert and the only KM officer employed by UTaNRMP.

Focused Group Discussion: FGDs were conducted with **7** SCITs (Sub County Implementation Teams) and **5** FDACs (Focal Development Area Committees) in Embu and Kirinyaga counties, making a total of **12** FGDs. Each participant team was made up of 8-12 members in no significant order.

Embu county: a total of **4** SCITs and **3** FDACs participated in the discussions;

SCITs – Embu East, Embu North, Mbeere North, and Mbeere South

FDACs – Kathambu, Kyeni/Kiangagwa, and Njeruri

Kirinyaga county: a total of **3** SCITs and **2** FDACs participated in the discussions;

SCITs – Kirinyaga Central, Kirinyaga East and Kirinyaga West

FDACs – Kirunda/Kathare and Ndui-ni

4.7 Method of Data Analysis

Data Collected was analyzed using Descriptive and Inferential Statistics on SPSS 25, and Microsoft Excel 2010. Before data analysis, quantitative data collected from the field survey was filtered and then coded for running statistical analyses while qualitative data was interpreted as content analysis using quotations in addressing significant issues discussed.

4.7.1 Data Analysis

Quantitative data from all the interviews conducted was transcribed and analyzed according to the study objectives and hypothetical statements, whilst running binary logistics to determine level of significance among variables; Chi test of independence to check for association between variables; and using descriptive statistic that explain the average degree of knowledge communication across the diverse group of farmers interviewed according to a set of independent and dependent variables. Where necessary qualitative survey such as, KII and FGDs were used to reinforce findings from questionnaire. For qualitative analysis, interview guide was slightly altered on the field to attain desired information occurring from data collection processes. Further editing was done in the course of data input carried out by the researcher.

4.7.2 Data Presentation

Data is presented in the form of frequency distribution, percentages, charts, binary models and cross tabulations.

CHAPTER FIVE
RESULT PRESENTATION AND DISCUSSION

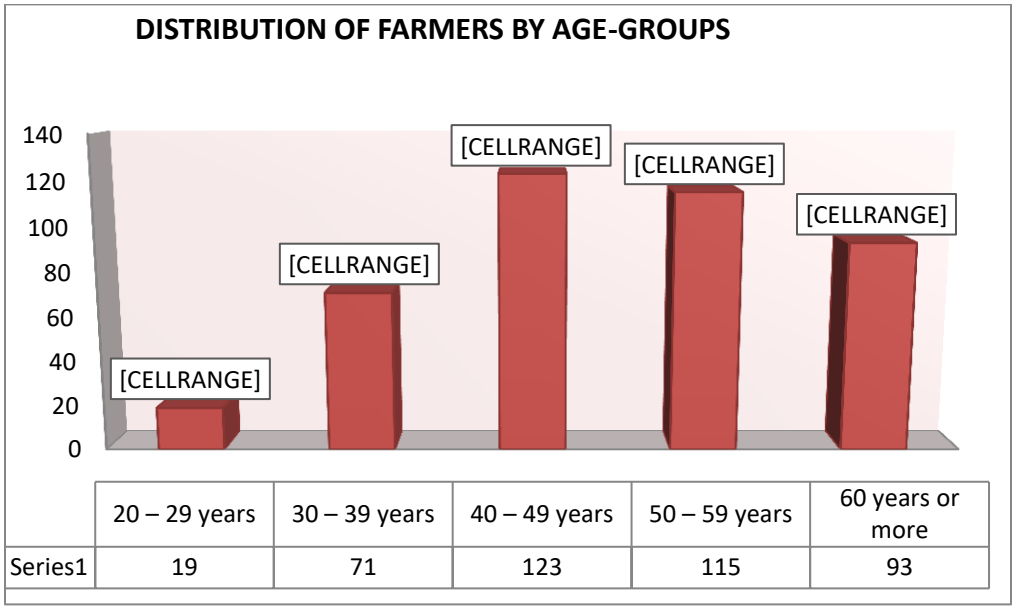
5.1 Socio-Demography

This section shows socio-demography and background of farmers who participated in the survey. The results revealed information on respondents' age, county, gender, level of education, and types of farming engagement.

Table 5.1. 1: Descriptive Statistics on Age

	Min.	Max.	Mean	Std. Dev.
Age (yrs)	20	95	49.14	12.17

Figure 5.1. 1: Age Distribution of Respondents

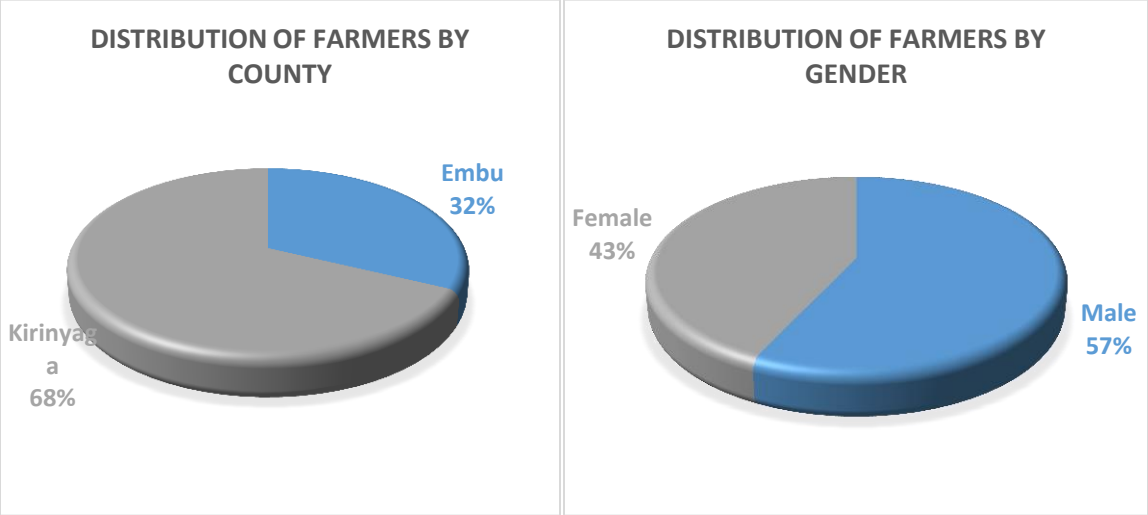


Source: Field Survey 2018

The descriptive statistics on respondents' age shows the least and highest observed age among the farmers is 20 years and 95 years respectively, with overall average age of 49 years, and a standard deviation of 12 years. Respondents' age group show only 4.5% are 20 - 29 years, 17% of the farmers are 30 - 39 years, 29% are between 40 - 49 years, 27% are 50 - 59 years, and over 22% are reported to be 60 years or more. With majority of the farmers in their middle age, their level of knowledge repository can be considered high since knowledge is garnered from level of

experiences which is closely associated with age. It also goes to say that majority (77.5%) of the farmers are still within their productive age, though it is quite alarming and poses a challenge to have such large population of passive youths ages 20-39 at (21.5%), with those in their middle and old ages taking the lead at (78.5%) productivity; noting the fact that agriculture is the major occupation of the respondents.

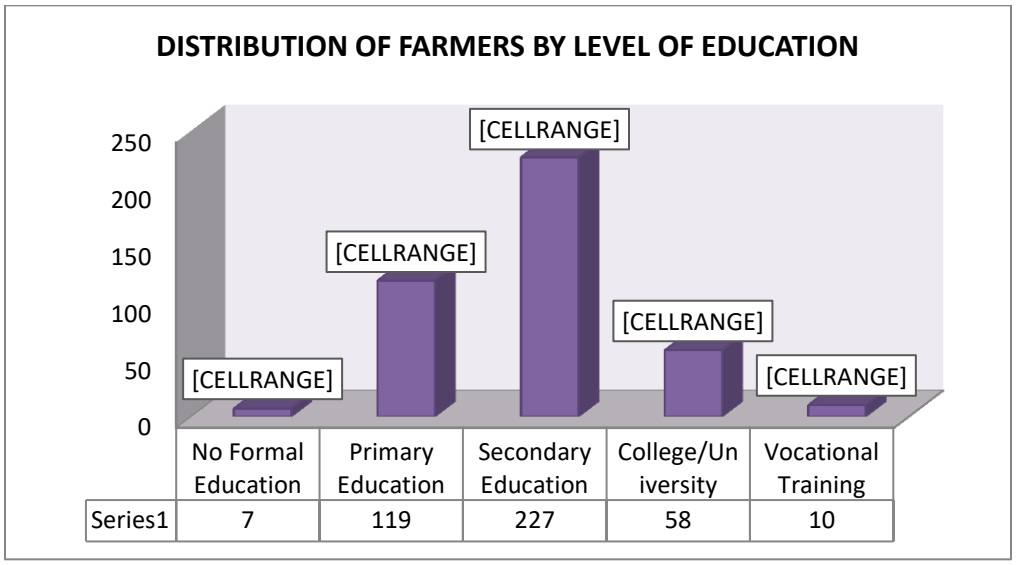
Figure 5.1. 2 and Figure 5.1. 3*:* Socio-Demographic Categories by County and Gender Respectively



Source: Field Survey 2018

The distribution of respondents according to their location/county show that most (68%) of the farmers interviewed are from Kirinyaga county; while 32% are from Embu county. This is because Kirinyaga county has 27 FDAs where Embu has 9; FDAs are formed on the basis of UTaNRMP coverage and level of interventions. Suffice to say that Kirinyaga has more beneficiaries than Embu. At such rate; Kirinyaga county will have less dependent and vulnerable farmers at the end of UTaNRMP in 2020. Respondents' gender shows that most of the interviewed farmers are 57% male and 43% female. By implication, high participation of women in farming results to a better chance of increased productivity, more income at household level, improved livelihood and consequently reduced inequality; since women can work and fend for themselves.

Figure 5.1. 4: Distribution of Farmers by Level of Education



Source: Field Survey 2018

The distribution of farmers according to their level of education showed that not more than 2% of respondents had no formal education, up to 28% had primary education, 54% were reported to have had secondary education, about 14% responded to have attended a college/university, lastly, 2% have had vocational training. Contrary to the popular belief of attributing farming to illiteracy and poverty in Africa, the population of educated farmers in the survey implies there's better attitude and enlightenment toward farming in Embu and Kirinyaga spurring from their incredible level of formal education at 88%. Such will enable rural farmers to diversify, develop and implement modern technologies, gain market access, and invariably practice a more sustainable and climate smart agriculture.

Table 5.1. 2: Types of Farming Practices and Proportion of Farmers engaged in each

	Frequency	Percentage
Crop	30	7.1
Livestock	69	16.4
Horticulture	43	10.2
Mixed	279	66.3
Total	**421**	**100.0**

Table 5.1.2 above shows that most farmers, 66% practice mixed-farming. Mix farming is usually practiced by the farmers as a means of sustenance while growing cash crops (such as coffee and tea in Embu and rice in Kirinyaga) for income, assorted vegetables, fruits and legumes are readily available in their kitchen gardens as well as eggs and dairy products for personal consumption. It is also a common practice to combine both crop and livestock farming as manure from animal is used to improve farm yields whilst making animal feed from crop remnant.

5.2 Data Analysis by Objective

5.2.1 Knowledge Communication and Farmers' Adoption of new Interventions

Enquiry was made to find out farmers' level of knowledge communication and its influence in their adoption of UTaNRMP interventions, responses obtained can be seen on Table 5.2.1.1 through Table 5.2.1.5. Method of knowledge sharing among farmers shows 49% engage in knowledge sharing through experience, about 35% consented to demonstration and putting ideas into practice, 16% prefer the use of books and manuals containing details on their areas of interest. Not more than 7% share knowledge through the use of models which are vivid representation of ideas and are learned by observation; denoting farmers' preference for participation and illustration since almost all the preferred methods have participatory characteristics.

Table 5.2.1. 1: Characteristics of Knowledge Communication and Level of Farmers Engagement

Characteristics		Frequency	Percentage
Method of Knowledge Sharing	Experience	205	48.7
	Books and Manual	69	16.4
	Demonstration	146	34.7
	Models	30	7.1
Awareness on Upper Tana Project	Heard of Upper Tana	409	97.1
	Not heard of Upper Tana	12	2.9

Involvement with Upper Tana Project	Beneficiary of specific Project (Dairy Cow/Goat, Poultry Irrigation, Well etc.)	38	9.1
	Fund Beneficiary	237	56.3
	Group Membership	16	3.8
	Training	90	21.4

Likewise 97% of the farmers within the survey area are reportedly aware of UTaNRMP meaning the project has huge popularity among the farmers. In the same vein 56% of those who are aware of Upper Tana are directly involved through interventions such as funding of projects with matching grants, while 21% indicated to have benefitted from Upper Tana trainings (usually on community development and natural resources management). Others indicated they benefitted from: Energy saving jiko (cooking device); Dairy cow/goat and poultry through rural empowerment programs in their various farmer groups. One of Upper Tana project's criteria is for beneficiaries to belong to a CIG comprising of various Self Help Groups (SHG) before gaining access to funds, so as to ensure accountability of project implementation.

Table 5.2.1. 2: Awareness of Knowledge Officers, Level of Interaction and Group Membership of Farmers

Characteristics		**Frequency**	**Percentage**
Awareness of Agricultural Extension Officers	Yes	395	93.8
	No	26	6.2
Awareness of Extension Officer from Upper Tana	Yes	381	90.5
	No	40	9.5
Interaction with Extension Officer	No interaction	80	19.0
	Not often	93	22.1
	Often	187	44.4
	Very often	61	14.5
Level of Satisfaction of Responses from	Not satisfactory	14	4.1

Extension Officers	Satisfactory	229	67.2
	Very satisfactory	98	23.3
Member of Farmers' Group	Member	410	97.4
	Non-member	11	2.6
Communication Methods	Activity plan	76	18.1
	Minute agenda	124	29.7
	Phone messages	157	37.6
	Notice board	22	5.3
	Words	38	9.1

Depicting that connectedness of farmers will increase their level of adoption. In other words, connectedness variables provide insights on how interactive communication influences the uptake of intervention. Hence one of the variables employed to test farmers' adoption of UTaNRMP, is their level of interaction with project implementation officers otherwise known to the farmers as agricultural extension officer. 94% of the farmers have good knowledge of an agricultural extension officer, of which 90.5% are reportedly from Upper Tana. However, most of these officers are not direct staff of UTaNRMP, but are seconded by GoK for project coordination and implementation at various levels (county, sub county and community), each with a distinct jurisdiction and specialization. Having just 19% introverted farmers out of the 94% who reportedly know extension officers, interaction level of 81% with the officers is a positive and progressive attitude toward adoption; it results in stakeholder recognition which enables farmers to channel their inquests to a more appropriate source. Interactions between farmers and agricultural extension officers are often based on questions concerning:

- Access to fund/fund management
- Group development
- New technology/innovation
- Value addition

- Improved farming techniques
- Improved livestock management etc.

Coincidentally, these also form the basis for the nature of ideas the farmers share in their various groups. Paralleling it with high level of importance, those who have interacted with Upper Tana extension officers show that majority perceive information shared as satisfactory, amounting to 67%; while 23% perceive the information to be very satisfactory; however 4% reportedly were not satisfied with the level of information gotten from the extension officers.

In order to establish communication, it is worthy to note that group membership played a key role by providing an environment for active participation and exchange between farmers. As much as 97% of the farmers interviewed belong to a farmer group/association in their respective locations. Among those who belong to a group, enquiry was made on their methods of communicating information within the group, 38% prefer the use of phone messages; 30% responded to using minute agenda, 18% chose activity plan, 9% communicate through word of mouth; in order words having a one on one conversation, while 5% will rather get information from notice boards. Hence communication is done on verbal and nonverbal basis and interestingly with the use of mobile technology, advancing their level of adoption.

Table 5.2.1. 3: Training and Monitoring by UTaNRMP

Characteristics		Frequency	Percentage
Participation in Upper Tana Project/Training	Participated	362	86.0
	Not Participated	59	14.0
Reasons for Non-Participation	Lack of access to training	18	30.5
	Poor awareness/information	34	57.6
	Lack of interest/Unavailability	7	11.9
Rating of Current Farming/Rearing Method	Below average	53	12.6
	Average	341	81.0
	Above average	27	6.4

Visitation of Upper Tana Officers after Project Completion	1 – 2 months	100	23.8
	3 – 4 months	145	34.4
	5 – 6 months	99	23.5
	Do not visit at all	77	18.3

In terms of project intervention, 86% of the farmers interviewed stated they had at one point participated in Upper Tana training/program, while 14% had not participated. Furthermore, among those who had not participated in Upper Tana training prior to the study, shows that majority of them (about 58%) was due to lack of awareness and information about the training. 30% also gave reasons concerning lack of access to training, while 12% stated they had no interest or were not available as at the time of training.

Variable such as rating of current farming/rearing method (after project intervention) shows 81% consider themselves to be average farmers with only 13% below average, which brings us to inquire on the nature of interventions carried out in these farmers' locations with a variable asking; new methods learnt through Upper Tana? Though not present on the table, several responses were generated, they include: fishery, animal husbandry; poultry/livestock management, animal feed production, vaccination, irrigation systems, farm record and book keeping, dairy/milk/honey production, accountability/fund management, and management of natural resources.

Closely associated with project implementation is monitoring, some variables were used to check for monitoring among which is visitation of Upper Tana officers to project locations after project completion. 18% of farmers stated they (Upper Tana officers) usually do not visit after completion of projects while 82% indicated they visit within stipulated periods of 1-6 months after project completion. Monitoring as one of the five pillars of KM in UTaNRMP is established on several bases among which is proposing methodical reporting on project activities by implementing partners based on the agreed project indicators at impact, outcome and output levels; hence monitoring can be achieved on this level of 82% involvement of officers with project implementation.

Table 5.2.1. 4: Characteristics for Checking Farmers' Knowledge Capture and Storage

Characteristics		Frequency	Percentage
Note-taking During Training	Don't take notes	60	14.3
	Sometimes take notes	137	32.5
	Take note all the time	224	53.2
Most Useful Documentation	Notes on lesson learned	139	33.0
	Listening	133	31.6
	Training manuals	78	18.5
	Good work practices	67	15.9
	Others	4	1.0
Training Encouragement	Encourage others	402	95.5
	Do not encourage others	19	4.5
Frequency of Knowledge Usage	Not at all	2	0.6
	Not frequently	23	6.4
	Frequently	281	77.6
	Very frequently	56	15.5

Establishing the effectiveness of knowledge communication in improving rural farmers' adoption would not be complete without variables that can test for knowledge capture and storage of which are: documentation during training, level of knowledge usage, and encouraging other farmer's participation. Result shows that 78% of the farmers use knowledge gained from training on frequent basis while 15% others use it more frequently than the rest, only about 6% do not make use of the knowledge frequently. Equally, up to 86% of those farmers who

previously participated in Upper Tana training reportedly took notes during training while 14% do not take notes but are rather interested in other methods of documentation such as; listening at 32% coming in close preference to note taking at 33%, training manuals and good work practices are other preferred choices of farmers. On the other hand, considering their level of knowledge repository after training; farmers are motivated to indulge others positively, 95% consented to have encouraged other farmers (outside of their group) to participate in all forms of training available.

The essence of knowledge capture and storage is to ensure that learning is impactful with traceable record that can be unlearned and relearned with changing times. UTaNRMP's acting KM officers (in this case, county and sub-county implementation officers) "need to learn, adapt, and understand the value of knowledge" to enable increased KM practices and storage since they interact with farmers directly. An officer suggested that these implementation officers can start by "documenting for knowledge management where necessary without seeming like an additional work".

Both Embu and Kirinyaga farmers have demonstrated high level of adoption of UTaNRMP's intervention which is largely influenced by knowledge communication processes (group activities, interaction with officers and training participation) existing within or around them and sustained through practices such as record keeping and TOT approach. Subsequently, concern should be shifted to non-beneficiaries since beneficiaries seem to be doing well, in order to achieve wider coverage and inclusiveness of willing participant who are eager to embrace intervention having come in contact with project beneficiaries. Consequently the rigorous job of educating, convincing and begging for participation from farmers (beneficiaries and non-beneficiaries) is reduced with shift in consciousness arising from project's outcome unlike in the early phase of project interventions.

Table 5.2.1. 5: Characteristics showing Level of Impacts and Outcome of Post-training on Farmers

Characteristics		Frequency	Percentage
Impacts of New Methods Learnt	Beneficial	356	84.6
	Not beneficial	65	15.4
Post-Training Positive Changes	Improved livelihood & financial Capacity	129	36.2
	Improved Productivity (Dairy, Farm yield, Poultry yield, etc.)	95	26.7
	Increase in food supply	6	1.7
	Good leadership in farmer groups	5	1.4
Willingness to Participate in More Training	Yes	400	95.0
	Not likely	10	2.4
	No	11	2.6
Impact of Experienced Farmers in the group	Teaching the less experienced farmers	410	97.4
	Do not teach less experienced farmers	11	2.6

Among those farmers who availed themselves the opportunity to participate and benefit from Upper Tana interventions, 85% reportedly have had various levels of positive impact ranging from farm benefits, improved productivity and livelihood, to strengthening of group cohesion. By implication the level of poverty in the homes of beneficiaries who recorded positive impacts will be reduced by a matching percentage. Furthermore, experiencing these benefits influences their willingness for future participation thereby increasing the sustainability prospects of UTaNRMP interventions in these areas. 95% of the trainees would be willing to participate in more training, with the remaining 5% either likely or not likely to participate in more training. Such high rate of willing participants will not only encourage project ownership but comes with multiplying effects such TOT; eventually trained farmers will become trainers of trainees (TOT) having garnered more knowledge and exposure resulting in expansion of project outcomes.

5.2.2 Indigenous Knowledge Sharing Processes and Local Innovation

To find out the level and pattern of indigenous knowledge sharing among the farmers under study, variables such as preferred medium of information, traditional practices, participation in group activities were analyzed with results shown on Table 5.2.2.1 through Table 5.2.2.3. It is worthy to note that indigenous knowledge communication is considered on the basis of social inclusion, traditional mentoring practices, and implementation of policies and procedures.

The most common medium of obtaining information among the farmers is through other farmers, as stated by 50% of the farmers. Half of the population's reliance on getting information from the same source translates to high level of traditional mentoring practice which can be validated by their response as to whether their choice is well informed. Farmers' perception to their choice of information show that 97% believe the chosen source has sufficient information they need, while only 3% reported not having enough information from their choices. However not all the farmers are conventional; as 27% of them prefer to engage extension workers, 16% obtain information through radio, and not less than 3% obtain information from books. The concern here is not comparing both medium of information but to establish that rural farmers due to their location and other social factors may likely connect and relate more to traditional practice. Hence, no matter the level of intervention in these areas, there will always be an element of orthodox practice blended into the new systems which form the basis of local innovation (that is, integrating indigenous knowledge with modern knowledge for better result). Thus farmers themselves are involved in the development of and experimentation with new technologies learnt by harmonizing their ideas to increase their overall performance and productivity.

Table 5.2.2. 1: Social Inclusion and Farmers' Mentoring Practices

Characteristics		Frequency	Percentage
Members of a Farmers' Group	Members	410	97.4
	Non-members	11	2.6
Medium of Obtaining Information	From other farmers	212	50.4
	Extension workers	112	26.6
	Radio	67	15.9

	Elders	14	3.3
	Books	14	3.3
	Parents	2	0.5
Perception to Choice of Information	Has enough information	409	97.1
	Not enough information	12	2.9

The study also sought to find out from the farmers their most preferred traditional farming practice, that is if any. 85 percent of the farmers surprisingly including the nonconventional ones showed interest in traditional method of farming. Responses observed have it that about 17% mostly prefer mixed farming/cropping, 14% prefer digging (manually), 23.8% majority but occurring at less frequency are categorized as other practices. Other traditional farming practices mentioned include: broadcasting, animal grazing, vegetable and fruit gardening, arable farming, seed bulking, fallowing, manual milking and storage (use of earthen pot for cooling and preservation), plucking and weeding.

Table 5.2.2. 2: Characteristic showing Sustained Traditional Farming methods by Farmers

Characteristics		Frequency	Percentage
Best Traditional Farming Practice	Crop Rotation	37	8.8
	Mixed Farming/Cropping	71	16.9
	Mulching	32	7.4
	Digging	57	13.5
	Ploughing	12	2.9
	Organic Farming	16	3.8
	Shifting Cultivation	6	1.4

	Manure Application Usage	12	2.9
	Other Practices	100	23.8
	None	63	15.0

Furthermore, the farmers demonstrated a great tendency to explore more knowledge (modern technology) as a result of motivation sprouting from their use of indigenous knowledge. A question was asked on if their traditional farming method motivate their learning new things and the result shows that up to 86% are motivated by their engagements in traditional farming practices. Surprisingly still, 1% of the farmers who consented to be motivated by traditional farming practices had earlier not indicated any interest in traditional farming, it further proves that rural farmers and traditional farming methods are inseparable but can coexist with new methods given the right intervention. This is because such practices are long standing traditions that are product of series of experiences with ecological systems and several evolutions directly having cultural ties and belief system such as superstition, and are found to have been very helpful over time.

A farmer insisted that superior technologies have long existed in their traditional practices before modern technologies, he said and I paraphrase “before the coming of milk coolers, farmers used to store their fresh milk in earthen pots which are covered and placed in strategic corners of the house to retain ground moisture which serves as coolant for the substance and can stay fresh so long as the temperature remains cold”. In this case when introducing farmers to modern technology, recognition should first be given to their already existing systems by finding a common ground where both systems can co-operate.

Table 5.2.2. 3: Policy Procedures and Implementation in Farmer Groups

Characteristics		Frequency	Percentage
Motivation from Traditional Practices	Motivated	363	86.2
	Not Motivated	58	13.8
Meeting Attendance with Other Farmers	Attended meetings	413	98.1
	Did not attend meetings	8	1.9
Joint Participation in Discussion and Sharing of Ideas	Everyone participated	385	91.4
	Not Everyone Participated	36	8.6
Existence of Group by-Law	Presence of rules and Regulations	417	99.0
	No rules and regulations	4	1.0
Method of Enforcing by-Laws	Penalty fine	279	66.9
	Query	42	10.1
	Suspension	96	23.0
Tendency towards Local Innovation	Would do things differently	175	41.6
	Would practice old and new methods together	188	44.7
	Would not do things differently	58	13.7

It was earlier established that up to 97% of the farmers interviewed belonged to farmer groups in their localities which makes it possible for active participation in their respective groups, thus social inclusion is achieved on that basis. However 98% of those farmers belonging to group perpetually attend group meetings giving them the platform to learn from shared experiences, up to 91% stated that every member of their farmer groups engage in discussion and exchange of

ideas, about 99% indicated having rules and regulations in their various groups. Measures for implementation of policies and procedures are equally present in these groups regardless of their nature and sizes. The commonest law enforcement strategy in farmer groups is payment of penalty fine (on a lighter note) by the offender, as stated by 67% farmers. There are harsh punishments where farmer are either suspended or queried.

Since local innovation according to this study is any form of innovation involving a specific population who engage in the use of traditional knowledge resulting from contact with modern intervention, the survey establish that the farmers' response on their tendencies towards local innovation is based on their willingness to combined both old (traditional) and new (modern) methods revealed at 45% level of acceptance to do them side by side. At the same time, 42% of the farmers would abandon their old practices for new ones if introduced, while 14% others will continue to practice conventional farming. Conclusively, indigenous knowledge sharing methods evaluated on the basis of their influence in stimulating local innovation among farmers have a significant trend of 86% in the positive attitude of farmers; meaning that UTaNRMP interventions are not adopted wholly by farmers but are adopted majorly to meet particular demands whilst generating positive and a more progressive result.

5.2.3 Impact of Knowledge Management Strategies in Promoting Learning Culture and Exchange (through Adaptation, Adoption and Creation)

To ascertain farmers' level of knowledge management and learning strategies towards adaptation, adoption and creation of new ideas, some enquiries were made to determine farmers' flexibility towards adaptation to new methods which revealed that 91% of the farmers are willing to do things differently from the conventional ways. Although, about 3% stated they were not likely to do things differently, and 6% are somewhat opposed to change as they would not consider doing things differently from what they are used to. Further investigation shows that the most commonly suggested new methods among the farmers is the use of modern farm technology, as stated by 17% of those who participated in the study; hence the recognition of new knowledge resources for improved productivity. Going further, 11% of the farmers suggested improved livestock or dairy farming, classified as others are: improved farming techniques such as conservation agriculture, use of irrigation system, use of biogas for domestic cooking, artificial insemination, afforestation, etc.

Table 5.2.3. 1: Characteristics showing Farmers' Open-mindedness to New Intervention

Characteristics		Frequency	Percentage
Flexibility to Adoption of New Methods	Would do things differently	383	91.0
	Not likely to do differently	12	2.9
	Would not do things differently	26	6.2
New Methods Suggested	Improved Livestock/Dairy Farming	47	11.2
	Horticulture	15	3.6
	Use of Irrigation System	14	3.3
	Use of Modern Farm Technology	73	17.3
	Improved Farming Technique	47	11.2
	Others (Use of Biogas, Artificial Insemination, Afforestation, Animal husbandry, Greenhouse, Farm inputs)	18	4.3
Replacement of Old Methods	Completely replaced	153	60.1
	Partly replaced	94	22.3
	Not replaced	74	17.6
Areas of Knowledge Usage	Farming	277	65.8
	Natural Resource Management	81	19.2
	Social Group	43	10.2
	Household	20	4.8

To assess effectiveness in the areas of knowledge management, farmers were questioned on the aspects where knowledge acquired (through Upper Tana projects and group engagements) are utilized: 66% indicated using their acquired knowledge on farming activities such as apiculture; some reported to have utilized knowledge learned to tame bees, hang beehives, collect mature

honey and to use foreign materials as honeycombs. Other areas of knowledge application include: planting on wet and dry lands, early cultivation and harvesting through weather forecasting, land improvement for increased productivity, use of farm inputs, planting fodders, making silage for feeding livestock, and availability of food through all seasons with the use of irrigation system. 19% of the farmers use knowledge gained for natural resource management such as protection of water catchment, land preservation, afforestation (both on personal basis and UTaNRMP school greening initiative), and soil control. In social groups, KM have been utilized in the areas of group development through access to funds/loans, matching grant, writing of proposals, market entry, investment strategies (table banking and merry go round) and keeping of group record. 5% of farmers also indicated household development through improved livelihood from personal savings, keeping of farm record, value addition (resulting in high sales) and healthy practices (such as vaccination and construction of livestock sheds).

Table 5.2.3. 2: Level of Knowledge Adaptation and Innovation from Project Intervention

Characteristics		Frequency	Percentage
Discussion of New Ideas	Not Frequently	292	69.4
	Very Frequently	129	30.6
New Ideas Shared	Access to fund/fund management	32	7.6
	Group Development	45	10.7
	New Technology/Innovation	33	7.8
	Value addition	12	2.9
	Improved planting techniques	155	36.8
	Improved Livestock Management	39	9.3
Development from Discussed Ideas	New development emerges	303	72.0
	No new development	118	28.0
Visitation to Other Farmers' Group	Visited other farmers' group	164	39.0

	Did not visit other farmers' group	257	61.0
Current Level of Better Decision Making	No difference	13	3.1
	Below average	8	1.9
	Average	266	63.2
	Above average	134	31.8

In paralleling the established KM resources among farmers with their level of adaptation and innovation, result revealed that not lesser than 31% discuss new ideas very frequently in their group while 69% reportedly discuss new ideas but not on regular basis. Further probe showed these ideas do not end at just discussion but are development driven, up to 72% of the farmers reported new development emerging from the discussion of new ideas within their respective groups; only 28% of them did not record any form of development. 39% of the farmers consented to have visited other farmer groups (knowledge tour), where new methods are learned and re-created by participating farmers. Knowledge tours are organized by UTaNRMP, some of these tours are usually on the areas of interventions adopted (already in existence) by farmers in other locations who have recorded a great deal of success. The outcome has helped farmers in the areas of benchmarking, innovation and general improvement where ideas learned are implemented locally to match their dispositions.

In terms of adaptation and adoption, the majority of farmers amounting to 82% have either completely or partly replaced their old methods while almost 18% are indifferent. 63% of the farmers generally rated their current ability (after series of knowledge acquisition) to make better decision as average, 32% are now above average level of decision making, while the remaining 5% have either not made improvement or are below average in their levels of decision making.

The overall essence of KM is to have organizational efficiency for development and consequently innovation, which has been demonstrated by the farmers at different levels and stages resulting from a culture of learning exchange between farmers (beneficiaries) and

knowledge experts (Upper Tana extension officers). Effectiveness of KM practices in UTaNRMP interventions are measured "mostly by use of non-qualitative methods like quantitative case studies and success case method that bring out the cause-and-effect linkages" as extracted from KII. The interview further revealed that knowledge sharing can be increased horizontally "through communities of practice, knowledge tours to experience what peers are doing at their local areas, and regular formal and informal interactions" which are quite in line with the findings of this objective.

5.3 Hypothesis 1: Knowledge communication does not significantly influence farmers' adaptability, adoptability and innovation

Knowledge Communication Index: Awareness of Upper Tana Project; Knowledge of Agricultural Extension Officer; Knowledge of Extension Officer from Upper Tana; Frequency of Interaction with Extension Officer; Level of Satisfaction with Responses from Extension Officer; Visitation of Extension Officers after Project Completion

Adoptability, Adaptability and Innovation Index: Adoption of new things on exposure; Replacement of old practices with new ones; Usage of knowledge gained; Areas of usage of knowledge gained; Discussion of new Ideas; New development resulting from discussion; Visitation to Other farmer groups; Ability to make better decisions; Innovation and creation of new ideas

The descriptive statistics (Table 5.3.1), on knowledge communication index shows out of the overall scale of 12-score the least and highest observed score is 0 and 12 respectively, with an average score of approximately 8 and standard deviation of 3. Out of an overall scale of 15-score, the least and highest observed score was 1 and 15 respectively; with an average score of approximately 11, and standard deviation of 3.

Table 5.3. 1: Descriptive Statistics on Composite Scoring

	Total Score	Min.	Max.	Mean	Std. Dev.
Knowledge Communication Index	**12**	0	12	7.8	2.7
Adaptation, Adoption and Innovation Index	**15**	1	15	11.3	2.5

Following the composite scoring, the farmers' level was classified as "poor" and "good", as seen on Table 5.3.2. It was obtained that about 67% of the farmers have good knowledge communication level, while 81.5% have good new technique adoption & innovation level.

Table 5.3. 2: Classification of Farmers' Knowledge Commucication and Adoption Level

Characteristic	Frequency	Percentage
Poor Knowledge Communication (0 – 7)	139	33.0
Good Knowledge Communication (8 – 12)	282	67.0
Poor Adoption & Innovation Level (0 – 9)	82	19.5
Good Adoption & Innovation Level (10 – 15)	339	81.5

Table 5.3. 3: Crosstab showing chi-square test of independence for Knowledge Communication and Socio-demographics

	Poor Knowledge Communication	**Good Knowledge Communication**	**χ^2- value**	**P-value**
Gender				
Male	71	169	2.98	0.09
Female	68	113		
Educational Attainment				
Non-formal	2	5	8.13	0.09
Primary	36	83		
Secondary	71	156		
College/University	23	35		
Vocational	7	3		
Type of Farming				
Crop	17	13	19.59	0.00
Livestock	29	40		
Horticulture	20	23		
Mixed	73	206		
Age-Group				
20 – 29 years	7	12	3.03	0.55
30 – 39 years	29	42		
40 – 49 years	36	87		
50 – 59 years	36	79		

60 years & above	31	62		

Chi-square test of independence was used to check for association between specific socio-demographic variables and categories of knowledge communication, and obtained that types of farming practiced by the farmers have statistically significant association with the level of knowledge communication at 1% level of significance. Gender and educational attainment were also statistically significant at 10% level of significance.

Thus, conclusion can be made using a significance level of 10% that level of knowledge communication among the farmers was dependent on gender of farmer, type of farming practiced, and educational attainment of farmer.

Table 5.3. 4: Crosstab showing chi-square test of independence for Adoption Level and Socio-demographics

	Poor Adoption Level	**Good Adoption Level**	**χ^2- value**	**P-value**
Gender				
Male	44	196	0.47	0.50
Female	38	143		
Educational Attainment				
Non-formal	1	6	10.86	0.03
Primary	26	93		
Secondary	45	182		
College/University	5	53		
Vocational	5	5		
Type of Farming				
Crop	10	20	4.73	0.19
Livestock	13	56		
Horticulture	10	33		
Mixed	49	230		
Age-Group				
20 – 29 years	4	15	1.55	0.82
30 – 39 years	15	56		
40 – 49 years	20	103		
50 – 59 years	22	93		
60 years & above	21	72		

The Chi-square test of independence checked for association between major socio-demographic variables and categories of adoption which shows that only educational attainment was statistically significant, at 5% level of significance. Conclusion can be made using a significance level of 10%, that level of adoption of new techniques among the farmers was dependent on their educational attainment.

Table 5.3. 5: Binary Logistic model of Influence of Knowledge Communication on Farmers' Adaptability, Adoptability and Innovation

Variable	Odds-Ratio	Confidence Interval
Knowledge Communication	4.39	2.64 – 7.28

The binary logistic model was used to check for influence of knowledge communication on farmers' level of adoptability and innovation. It was obtained that there is a significant odds ratio of 4.39 from the model. Thus, concluding that farmers with good knowledge communication level are four times likely to have a good level of adoption of new techniques and innovation than those who have poor level of knowledge communication.

Table 5.3. 6: Model Classification of Farmers' Adoption and Innovation Levels

	Predicted Adoption Level			
		Poor	**Good**	
Observed Adoption Level	**Poor**	0	82	0
	Good	0	339	100.0
				80.5

The model classification as seen on Table 5.3.4 above revealed that the derived model was adequate to classify up to 80% of the farmers correctly under their respective adoption and innovation levels, based on their observed level of knowledge communication.

5.4 Hypothesis 2: There is no significant creation and invention of new ideas among the farmers

Table 5.4. 1: Binary Logistic model showing Factors Associated with Farmers' Creation and Innovation Level

Variable	Odds-Ratio	Coefficient	Confidence Interval	Std. Error	Sig. Value
Interaction with extension officers	1.3	0.26	1.03 – 1.65	0.16	0.030
Membership of farmers' group	2.4	0.88	0.51 – 9.88	1.70	0.289
Participation in Training	2.0	0.69	0.81 – 4.92	0.92	0.135
Integration of old practices with new	1.2	0.18	0.79 – 1.72	0.23	0.444
Farmers' Category (Ref: Less Experienced)	1.14	0.13	0.71 – 1.82	0.27	0.581
Visitation of other farmers' group	1.8	0.59	1.16 – 2.78	0.40	0.009
County (Ref: Embu)	0.4	−0.92	0.27 – 0.73	0.11	0.001

To determine the factors that potentially have associations with farmers' creation and innovation level, the binary logistic was employed and the odds-ratio were determined from several univariate models; variables that are individually significantly associated with the farmers' creation and innovation abilities were included in the multi-variate models. The odds-ratio of the multi-variate model and significant value can be seen on Table 5.4.1 above.

It was obtained those farmers who interact with extension officers are more likely to have ability for creation and innovation than those who do not interact with extension officers. Farmers who belong to farmer groups are twice likely to have abilities for creation and innovation than those who do not belong to any farmer groups. Farmers who participated in UTaNRMP training twice more likely have abilities for creation and innovation than those who have not participated in UTaNRMP training.

More so, farmers who responded to have used old practices with new ones are more likely than those who responded to have not changed their old practices. Farmers who had more experience level are more likely to have abilities for creation and innovation than those with less experience level. Farmers who indicated they had visited other farmer groups are almost twice likely to have

abilities for creation and innovation. Farmers from Embu county are 40% less likely to have abilities for creation and innovation.

5.5 Hypothesis 3: There is no significant adaptation and adoption of new interventions among the farmers

Table 5.5. 1: Binary Logistic showing Factors Associated with Adaptation and Adoption of New Techniques

Variable	Odds-Ratio	Coefficient	Confidence Interval	Std. Error	Sig. Value
Awareness of Agricultural extension officer	3.1	1.13	0.69 – 14.03	2.39	0.141
Participation in Training	96.9	4.57	12.02 – 782.18	103.29	0.000
Farmers' Category (Ref: Less Experienced)	2.0	0.69	1.23 – 3.31	0.51	0.005
County (Ref: Embu)	1.65	0.50	0.99 – 2.72	0.42	0.051

To determine the factors that potentially have associations with the farmers' adoption and adaptation to new techniques, the binary logistic was employed and the odds-ratio were determined from several univariate models; the variables that are individually significantly associated with farmers' level of adaptation to new techniques were included in the multi-variate model. The odds-ratio of the multi-variate model can be seen on Table 5.5.1 above.

It was obtained that farmers who have awareness of agricultural extension officers are three times likely to have a good level of adoption than those who are not aware of agricultural extension officers. Farmers who participated in UTaNRMP training were observed to be ninety-six times likely to have a good level of new technique adaptation. It was obtained farmers with self-rating high experience levels are twice more likely to have good level of new technique adaptation. Also, it was obtained that farmers from Emby county are almost twice likely to have a good new technique adoption level than those from Kiriyanga.

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 Summary and Conclusion

This research established that knowledge management has different levels of adoption for overall development and project success by distinguishing 3 major factors: Communication; Integration; and Innovation. Effective communication and the exchange of knowledge contribute to personal and organizational development. Consequently farmers' innovativeness from agricultural practices in Embu and Kirinyaga counties will improve many rural and urban livelihood through increase in food productivity, financial stability, equality and lastly contributing to national agricultural and economic development.

The first objective resolved that knowledge communication is multifaceted and can be adapted to different scenarios whether learned or shared traditionally/personally, formally, or both ways. Hence, knowledge communication can improve farmers' adoption of new technology through the existing knowledge sharing network such as group membership and participation in UTaNRMP's trainings, which is directly influenced by their awareness of UTaNRMP and openness to new interventions. Farmers' level of adoption of existing projects so far shows that among 86% farmers who benefited from various UTaNRMP interventions, 85% have had several positive impacts in their livelihoods, economic, and social status of which 78% use the knowledge gained on frequent basis and 15% others use it even more frequently.

The second objective which examined indigenous knowledge sharing processes and their influence in stimulating local innovation among farmers established that farmers' response on their tendencies towards local innovation is based on their willingness to combined both traditional and modern methods showing 45% level of acceptance of farmers to do them side by side. At the same time, 86% farmers are motivated to learn/adopt new methods/technology from their engagement in traditional farming practices. Thus, UTaNRMP interventions are not entirely adopted by farmers but are adopted to meet particular demands which can generate a more progressive result and subsequently leading to farmers' local innovation from their experimentation with technologies and open-mindedness.

The third objective asserts that in terms of adaptation and adoption, the majority of farmers amounting to 82% have completely or partly replaced their old methods while 18% are

indifferent. 63% of the farmers have equally rated their current ability to make better decision as average and 32% are currently above average while the remaining 5% have either not made improvement or are below average. Concluding that the overall essence of KM is having organizational efficiency for development and consequently leading to innovation which has been demonstrated by the farmers at different levels. Knowledge exchange can therefore be increased through communities of practice; such as informal meetings between farmers and knowledge experts, and embarking on knowledge tours.

Overall, the study concludes that successful knowledge communication and management involves active participation of different agents and actors at different levels to influence agricultural innovation. To this end, UTaNRMP has been effective in promoting rural agricultural development in Embu and Kirinyaga counties with effective knowledge communication processes. UTaNRMP's institutional arrangement is embedded in both common and complex KM approaches; some of its project's implementation strategies are formed and utilized on available KM resources within the system. Hence both farmers and UTaNRMP can leverage on the existing structures to promote local innovation through effective knowledge communication and integration of processes and systems identifiable to farmers resulting in maximum participation and ownership.

6.2 Recommendations and Policy Implications of the Study

Recommendations will be made on the basis of barriers discovered to be directly responsible for the limitation of effective knowledge communication for local innovation in the course of this study. As such this research is not for academic purpose only but also to inform policy making, hence, the deliberate use of simple grammar systematically employed in structuring the survey instruments and in the discussion of results such that stakeholders; farmers and policy makers alike can read and comprehend every message in the study. Having revealed by the study that farmers' innovation is increased by good knowledge communication level and effective management, thus:

- Farmers should be encouraged at various levels and empowered with infrastructures, resources that can strengthen their capacity to learn and invent.

- Dominance in sharing explicit over tacit knowledge by knowledge expert should be replaced with experiential exchange that requires hands-on learning, observation, dialogue and interactive problem solving.
- Farmers' involvement in active planning and execution of project should be given maximum consideration; in the context of existing technology and perceptions.
- Most of the farmers under study recorded great success and productivity from having group membership. Formal and informal sharing networks already exist in most groups, and often it is a matter of building and expanding on those existing networks.
- Projects that promote traditional technology transfer and do not tap into the capacities of farmers to welcome modern initiative should be harnessed for maximum outcome.
- Once up and running, effective knowledge-sharing practices have the potential of accelerating farmers' individual and collective innovative thinking, which can translate into acceptability, adaptability and sustainability of new ideas or processes for their collective good.
- Farmers with adequate qualification should be introduced to professional training and mentorship capable of increasing their confidence in the knowledge and technologies they promote.

The list of recommendations presented herein offer a structured starting point to officers carrying out knowledge communication as well as knowledge management; when carrying out an intervention/assessment should look out for current knowledge-based potentials within farmer groups.

6.3 Limitations of the Study and Suggestions for Future Research

Since the role of knowledge management is interpreted at organizational level by KM officers or experts, some active participants may be unaware of their roles in the organizational knowledge management procedures by possibly assuming little knowledge management or innovation activity as this could support providing unknown or false answers. It would be a good idea to approach these unassuming actors with very clear and explicit terms without losing essence, hence, the challenge of substituting a more accurate and significant jargon with simpler vocabulary; as in the case of the farmers under study. Language barrier wasn't much of challenge

in the survey as this was met with the use of trained local interpreters who facilitated the process where needed.

Conducting a case study would not only support the timeliness of responses, but would add personal interaction to provide personal perceptions and allow for follow-up questions to this survey (Houghton, Casey, Shaw and Murphy, 2013). In addition to conducting this study, it would also benefit the organization by contributing to the existing body of knowledge within the institution with valid and scientific facts. Future research can explore information provided herein to mediate challenges of effective knowledge communication and knowledge management structure generally. It would also be an opportunity to consider weather forecast in carrying out similar survey in the future; raining season is the peak of farm activities as farmers are mostly on the field during such season, making it challenging to get or sustain their attention during interview. Another option would be to conduct a longitudinal study over a longer timeframe to generate more in-depth qualitative data needed for historical facts. Since this study only assessed the role of knowledge communication and management in fostering local innovativeness among rural farmers within Upper Tana Natural Resources Management Project catchment, it would be good for further research to get samples from farmers outside the project area to compare this study and discover more avenues for research inclusiveness.

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Appendix

Photo gallery depicting field experience