STRENGTHERNING MAIZE DOLICHOS LAB INTERCROPS ENTERPRISE TO MITIGATE THE EFFECTS OF CLIMATE CHANGE FOR ECONOMIC DEVELOPMENT: A CASE OF UCHIRA VILLAGE COMMUNITY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS FOR THE DEGREEE OF MASTER IN COMMUNITY ECONOMIC DEVELOPMENT IN THE OPEN UNIVERSITY OF TANZANIA

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CERTIFICATION

I, the undersigned, certify that I have read and hereby recommend for acceptance by the Open University of Tanzania a dissertation titled: “Strengthening Maize Dolichos Lab Lab Intercrop Enterprise to Mitigate the Effects of Climate Change for Economic Development in Uchira Village Community” Tanzania in partial fulfillment of the requirement for the Degree of Master in Community Economic Development (MCED).

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Dr. Deus D. Ngaruko

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Date

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DECLARATION

I, Peter Edward Xavery do declare that, the work presented in this dissertation is my original work. It has not been presented and will not be presented to any other university for similar or any other degree award.

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Signature

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Date

DEDICATION

This dissertation is dedicated to my brilliant and outrageously loving and supportive wife, Sindi Kasambala Xavery and my beloved children Lucy, Laurent, Sean, Gianni and Ethan for their patience and understanding when I was sometimes physically away from them for the whole period of my studies. To my always encouraging, ever faithful parents, the late Xavery and Lucia.

ABSTRACT

This study was carried in four villages of Kirua South Ward of Moshi Rural District, Kilimanjaro region- Tanzania. The overall aim of the study was collecting information and data with regards to climate change and variability. Both secondary and primary were used. Primary data were obtained using structured questionnaires and key informant interviews. In total 80 respondents were randomly selected for interviews whereby 20 extra knowledgeable farmers were purposefully sampled for a key informant interviews. Findings showed that local people perceived climate change and variability in their communities. The changes have affected crops and livestock in a number of ways resulting in reduced productivity, which in turn has subjected small scale farmers to income poverty. In order to improve the income level of small scale farmers in the study area, the study proposed and implementation of a CED project in Uchira village as a pilot project, which included the use of drought tolerant maize varieties together with Dolichos lablab and good agricultural management practices in order to improve agricultural outputs in an area so as to reduce effect of climate change and variability. The results indicate that members who participated in the project realized Net benefits of Tanzanian Shillings (Tshs.) 846,500/= with Benefit Cost Ratio(BCR) of 2.02 in year 2013 while before the project returns to invest was not that much attractive for the previous year 2012 with Net benefit of Tshs. 237,500/= and BCR of 1.26. The success of this project will be a catalyst for other farmers, agricultural sector expert, and other stakeholders to extrapolate to a wider population in the Kirua South ward eventually improve the income level of farmers and the nation as a whole.

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LIST OF ABBREVIATIONS

CED	-	Community Economic Development
CNA	-	Community Needs Assessment
EAC	-	East African Community
IIED	-	International Institute for Environment and Development
SARI	-	Selian Agricultural Research Institute
WHO	-	World Health Organisation

CHAPTER ONE

1.0 PARTICIPATORY COMMUNITY NEEDS ASSESSMENT

1.1 Introduction

According to Deressa (2006) agriculture is the most important sector in Sub-Saharan Africa (SSA) and it is set to be hit the hardest by climate change. It is confirmed by Füssel and Klein (2006) that a number of studies which have been conducted found out that climate change has negative impact on agriculture. To this effect these scholars call upon nations to neutralize the potential adverse effects of climate change in order to protect welfare of vulnerable segment of the society. Adaptation seems to be the most efficient and friendly way for farmers to reduce the negative impacts of climate change. This can be done by the smallholder farmers themselves taking adaptation actions in response to climate change or by governments implementing policies aimed at promoting appropriate and effective adaptation measures.

Tanzania recognizes that agriculture is the backbone of the economy. This is in line with Anderson et al.(2005) who argued that agriculture remains the largest sector in the economy and hence its performance has a significant effect on output and corresponding income and poverty levels. Tanzanian agriculture is the major source of food, and accounts for about 45 percent of GDP, 60 percent of merchandise exports, 75 percent of rural household incomes and 80 percent of the population's source of employment. Furthermore, agriculture stimulates economic growth indirectly through larger consumption linkages with the rest of the economy than

other sectors. Higher and sustained agricultural growth is needed to meet Tanzania's National Strategy for Growth and Reduction of Poverty (NSGRP, also called MKUKUTA in Kiswahili) and Millennium Development Goals of halving poverty and food insecurity by the year 2015. However, the agricultural sector is facing a serious challenge posed by climate change, which can become a crucial limiting factor for agricultural growth in the medium to long term. So far, the issue of climate change in relation to agriculture has not been given sufficient attention in the country as a whole and Kirua South Ward in particular. This being the case the researcher was interested to collaborate with the targeted community to establish the activity that will bring economic development and mitigate the impact of climate change in agriculture**.**

In carrying out this activity, the researcher deliberately decided to work with the community of small scale farmers in four villages, Kirua South Ward. These were chosen because of their common income generating activity which can promote socio-economic development, if at all the community need assessment will be done accordingly. Further to that following the visits to the study area before the actual assessment was discussions with Kirua South Ward official, village officials and other stakeholders within the ward, it came to our attention that this is the group that lives in abject poverty despite the availability of abundant resources such as land which the villagers have.

In order to alleviate poverty among the small scale farmers in the study area, the researcher took an initiative to collaborate with key development partners such as

CBOs (Community Based Organization), Local Government Authority' officials, Government Institutions, the beneficiaries and various professionals in a participatory manner from the initial stage of identifying problems, finding solution and plans for implementation.

The Needs Assessment was participatory whereby community development practitioners and the targeted community identified the community felt needs and possible interventions which could address those needs promptly. In carrying out the needs assessment exercise, the researcher applied various methods to gather data from the community, such as Focus Group Discussions (FGD), interviews, questionnaires, records review and previous research reports. The data and information gathered enabled the researcher to prepare the community profile as well as a summary of community challenges and existing opportunities that can be utilized to solve identified problem.

1.2 Community Profile

This study was conducted in Kirua South ward, which is about 25 km East from Moshi town in Kilimanjaro region. The study area is in South of Moshi rural district on the southern slopes of Mount Kilimanjaro. The most significant physical feature in the area is the snow-capped Mount Kilimanjaro, which is the highest in Africa. The area, like the other districts in Chagga land, is a land-scarce area. This ward is in between two rivers. River Nanga is on the western side and river Mue on the eastern side of the study area. The study area is a transect of about 10 km wide and 17 km long, stretching from the lowlands at about 800m altitude up to about 1200 m

altitude. Kirua South ward is covered by natural trees with some scattered gullies in the lowland area.

Low land areas annual crops are cultivated, which includes maize, beans sunflower and groundnuts. The intermediate harbours the Chagga home garden which includes coffee banana belts together with fodder trees for livestock. Trees are used to provide shade for coffee, as live fences, for fodder and mulch, for bee forage, and for timber and firewood. Kirua South ward has 2 mono modal rains i.e. short rains starting from late October to late December which is not that much useful though some crops by about 20 % are tried such as maize especially early maturing varieties. The other season is the long rains which start from late February/early March to May which is the main season for all crops found in the ward.

This ward was purposefully selected as it represents the parts of the slopes of the mountain with an exceptionally varied ecosystem which range from drier areas in lowlands to bit moderate rainfall in medium altitudes of the Mount Kilimanjaro. Further to that this study areas was selected because only small-scale farming and no big farm estates in between.

Major crops cultivated in the area includes maize, beans, sunflower, cow peas and vegetables/fruits found in all villages except the low land which lacks natural irrigation furrows. Kirua south is one of the main dairy cattle keepers in Moshi District whereas improved dairy cattle's are found. Other livestock types found are local cattle, goats, chicken/ducks and pigs.

1.1.2 Socio Economic Activities

Kirua South Ward inhabitants are actively engaged in agriculture as a major economic activity. Livestock is second to agriculture in providing food and income to the people of this ward. Over years this area is experiencing decline in both crops and livestock production due to the effects of climate change and variability among other factors. This situation is made worse by rampart tree cutting, water sources destruction and poor agricultural practices. However, environment and tree planting campaign are underway throughout the ward by different organizations including Village Care Initiative which is the host organization for the CED researcher.

Over the years this area has been experiencing decreasing in coffee production by small holder farmers which has led to low household income. However, efforts are being made by different agricultural programs for reviving coffee production.

1.1.3 Social Economic Infrastructure

The ward has a total 4 Day Care Centers where as 2 belong to Faith Based Organization (FBO) and the other belong to the Non-Governmental Organization. There are 10 primary schools out of them 7 are government owned and school 3 private schools. Other institutions include one Cooperative union and 2 registered SACCOS. NGOs, CBOs and FBOs also play a significant role in promoting livestock, agricultural sector and service delivery in this area. These include Village Care Initiative, CEDE (Community Economic Development Empowerment), KEDA (Kilimanjaro Environmental Development Association) and EWAT (Environment Science from Sokoine University of Agriculture) and Micro finance institutions.

1.1.4 Social Services

This ward has all rivers and springs originating from Mt. Kilimanjaro. These are the major sources of water gravity system in the ward. Unfortunately most of the sources have been destroyed. This has lead to low volume of water in rivers and springs and therefore, the problem of water for use in by the community members in this ward is big. The road network linking the ward and its neighbors is relatively good. The ward is easily accessible through the tarmac road on high way from Arusha –Dar Es Salaam and feeder roads which are passable throughout the year. The ward is connected to National electricity Grid.

Many parts of the ward are served by a land line (TTCL), mobile phone services including AIRTEL, TIGO, and VODACOM. Radio services include FM Stereo and Sauti ya Injili. E-mail and internet services are provided by private entrepreneurs especially is sub-towns.

1.2 Community Needs Assessment

Community needs assessment was conducted in order to collect information and data with regards to climate change and variability, establish its impacts and adaptation strategies within agricultural sector in Kirua South Ward. This was done in order to identify a workable intervention that can greatly contribute to the improvement of economic status of small-holder farmers in Kirua South Ward communities.

Participatory approach was used purposely in the identification of the real needs of the community and thereafter and devising appropriate intervention to address the

needs. The assessment was done based on the appropriate use of research design, research methods in order to obtain relevant data. The said assessment will help to plan strategies and interventions which would bring a desirable change.

The findings of this survey are expected to be useful to policy makers and other stakeholders who are responsible for agricultural development and climate change. Further to that the findings will provide knowledge and awareness to small scale farmers and other stakeholders who are linked to agriculture, food security and poverty alleviation programs. The findings could also be used by environmental Civil Society Organizations to implement different agenda to reverse any undesired trend in the management of the environment in the ward and region at large.

1.2.2 Objectives of Community Needs Assessment

1.2.2.1 General Objective

This study aimed at collecting information and data with regards to climate change and variability, establish its impacts and adaptation strategies within agricultural sector in Kirua South Ward. On the other hand this survey assisted community members to acquire skills and knowledge in good agricultural management practices in order to use available opportunities in this ward to improve their livelihood.

1.2.2.2 Research Objective

To identify a workable intervention that can greatly contribute to the improvement of economic status of small-holder farmers in Kirua South Ward communities.

1.2.2.3 Specific Objectives

i) To describe the demographic characteristics of the study area.

ii) To examine the economic activities undertaken by community members.

iii) To assess the knowledge of small scale farmers on climate change and its impact.

iv) To assess the direct and indirect socio-economic effects of climate change on small scale farmers in the selected villages.

v) To assess the level of participation and practicability of climate change and variability and adaptation/copping strategies employed by smallholder farmers in the study area.

vi) To identify and suggest a CED project in order to improve community economic development.

1.2.2 Research Questions

i) What are the demographic characteristics of the study area?

ii) What are the economic activities undertaken by community members?

iii) How do communities in Kirua South Ward understand climate change, its causes and effects?

iv) What socio-economic effects do small farmers face due to climate change?

v) What adaptation and mitigation measures do small farmers use to cope with climate changes?

vi) What is the level of participation and practicability of climate change and variability adaptation strategies employed by smallholder farmers in the study area?

vii) What can be done in order to enhance sustainable economic development of

your community?

1.2.3 Community Needs Assessment Research Methodology

This part outlines clearly the research methods used to collect and analyze data for the Community Needs Assessment.

1.2.2.4 Research Design and Sampling Procedure and Size

This study used triangulation design as a strategy for increasing the validity of research findings. The researcher chose this design because it combines the advantages of both the qualitative and the quantitative approach. Further to that this design was chosen because this study wanted to deepen the understanding of the target community regarding climate change and its impacts on small scale farmers and establish an economic project in the study area.

The researcher conducted key informants interviews with small scale farmers, ward and villager leaders, extension agents and experts from various organizations. Pretested questionnaire instrument was also administered in order to capture demographic information of the community members as well as capturing some important information such as economic status of the members of the communities.

1.2.2.5 Sampling Techniques

The sampling frame was constructed from a list of two agro-ecological zones in Kirua South ward in Moshi district. The sample was stratified according to the two zones (Low Rainfall Zone and Intermediate Rainfall Zone) where there are high

climate variability i.e. severe droughts. This was meant to get climate variability existing within the two zones. Based on this stratification, a two-stage stratified random sampling procedure was used to select a sample of 80 households (Table 1). The sample was constituted by randomly selecting one ward from the district which has both lowland and intermediate zones. To obtain a sample proportional to size, four villages from this ward were randomly selected. A list of farmers was constructed for selected villages. Simple random sampling procedure (i.e. each individual has an equal chance of been chosen) was used to select farmers from each of the four villages.

About 20 extra knowledgeable farmers were purposefully sampled for a key informant interviews. About 5 elders aging 50 years and above were involved in the key informant interview for each selected village. There was a bias towards more elderly people for the reason that such people have a wealth of information on knowledge on climate changes and variability since they have lived long in this area. Participants for the key informant interview were selected based on their age, gender, primary activity and knowledge of the community and climatic variability changes.

To ensure that women were well represented in the discussion, they were purposively included. A check list that included issues on knowledge on climate, and associated coping strategies, guided the interviews. Cost of production for maize and dolichos lablab intercrop enterprise was administered to assess benefits accrued by using these drought tolerant technologies. Net benefits and Cost Benefit Ratio was computed to

assess return to investment on the use of these technologies. Sensitivity analysis was performed to incorporate uncertainty into economic evaluation. To assess the stability of net benefits accrued from the new improved technologies the prices and yields were reduced and increased by 10 % and 20 % respectively and new net benefits computed.

Table 1.1: Sample Composition at Kirua South Ward

Agro Ecological Zone	Villages	Questionnaire Interview	Key Informant Survey
Intermediate	1.Uparo 2. Yamu	20 x 2 =40	10
L owland	1.Uchira 2.Mabungo	20 x 2 =40	10
Total		80	20

Source: Field Data, (2013)

In Table 1 above present a small randomly selected sample of small scale farmers and livestock keepers and this may limit the generalization of the study findings. Notwithstanding the fact that the number respondents interviewed is small, the sample was selected scientifically, hence they may represent the true population of small scale subsistence farmers in Kirua South Ward. In addition, interviews with government officials, Research Institutions, NGOs and other stakeholders were held to supplement the farmers' views.

1.2.2.6 Data collection methods

Various methods, including quantitative and qualitative primary data collection tools were used for this study. These are further elaborated here below:

1.2.2.6.1 Pre-field Consultation

The researcher conducted pre-field consultation with various stakeholders including relevant departments in the central and local government in the first month of research which included District Agricultural Officer, Kirua South Ward officials, Uchira village leaders, opinion leaders and ward Agricultural Extension agent done in April, 2012. The purpose of this consultation was to facilitate researcher's insertion in the study area. This was done because the CED researcher found it necessary to get familiar with the communities concerned in the study area in order to facilitate future work of collecting data.

1.2.2.6.2 Primary Data

Primary data was collected by using a number of methods including questionnaires, interviews and observation. These are further discussed here below.

1.2.2.6.3 Questionnaire

By using this method, data collected from respondents is recorded in a permanent medium for analysis and future reference. Data were collected using an enumerator-administered structured questionnaire for quantitative data. This set of questionnaires aimed at assessing/capturing farmers' knowledge on climatic change and variability and adaptation strategies implemented in the study area in order to reduce community vulnerability to climate change impacts. Further to that the questionnaire was designed to capture data on parameters such as sex, age, and education level experience in farming of the respondents.

Before starting the actual primary data collection, the questionnaire was pre-tested,

enabling the modification of some of the questions. Experienced enumerators consisting of agronomists and socio-scientist were used to administer the questionnaire.

1.2.2.6.4 Key Informants Interviews

As for qualitative survey a key informant interview was conducted to 20 knowledgeable respondents from middle aged and above. This was meant to get information on climate variability and copping strategies from experienced respondents from the villages. The interviews were structured, that is to say the researcher prepared guiding questions in order to facilitate the discussions.

During the interviews the respondents were expected to answer different questions. Interviews were flexible in the sense that the mode of questioning could be changed if the situation so demanded and the respondents had the opportunity to ask for further clarifications and/or information.

1.2.2.6.5 Focus Group Discussion

Focus group discussion was conducted with 10 small scale farmers, 2 Village Care Initiative, staff, CED researcher an extension agent. This was done purposely in order to get first hand information and test the validity of the information filled in the questionnaires. The second group discussion was with CBO leaders and representative of small scale farmers from Uchira village to sell the idea about the project and determining their commitment, ability to run the project and finally to get their opinion that would help during the project planning process.

1.2.2.6.6 Secondary data

Secondary data was obtained from a review and analysis of relevant literature from various records, both published and unpublished materials, including records from government statistical units, local institutions and policy documents regarding climate change and variability. Secondary data was used to guide, inform and enrich the final analysis and discussion of the data collected during the study. The researcher is, however, aware that he has not exhausted information about climate change and variability in the study area.The researcher used all these research instruments in order to collect data from different sources. This is because the researcher believes that in order to get reliable data it is important to crosscheck information by using different instruments and/or triangulation.

1.2.3 Data Analysis Methods

This research employed both qualitative and quantitative analysis. Data analysis included editing, screening, computer data entry and verification. After which quantitative data processing was carried out by Statistics. The data collected has been processed using the Statistical Package for Social Sciences (SPSS) and analyzed according to the study objectives. Descriptive statistics and frequencies were also used in analyzing quantitative information collected during in-depth interviews from the structured questionnaire. Cross tabulations was used to compare groups. Microsoft Exel prepare charts and graphics.

1.3 Community Needs Assessment Findings

The findings from the CNA survey Kirua South Ward are presented below based on

the method and type of data collection. Through the questionnaire the researcher managed to get information on and general views on various issues regarding economic development of target area and farmers' knowledge on climatic change and variability and adaptation strategies implemented in the study area in order to reduce community vulnerability to climate change impacts. Other information captured by the questionnaire included parameters such as sex, age, and education level experience in farming of the respondents.

Focus Group discussions generated additional information with various stakeholders which gave the researcher an opportunity to get additional information which helped to enlarge the researcher's knowledge. The findings from the questionnaire show farmers' knowledge on climatic change and variability and adaptation strategies implemented in the study area in order to reduce community vulnerability to climate change impacts. And parameters such as sex, age, and education level experience in farming of the respondents. Thereafter, follows the general overviews on economic activities. Qualitative data collection involved 20 interviewees who provided information through Focus Group Discussion and key informants.

1.3.1 Findings on Demographic Characteristics of the Respondents

Demographic characteristics shown in table 2 can assist in understanding the basic dynamics of family structure, household composition and human resources in the study area. The mean age of household's heads in the in the study area was 53.2 years (49.2 years in low land and 57.2 years in intermediate zones). In the case of Northern Tanzania, early generation of farmers settled on the fertile slopes of Mt.

Kilimanjaro and Meru, whereas later generations (the young) occupied the less fertile lowlands and marginal rainfall areas as was the case in Kirua South Ward community.

Table 1.2: Demographic Characteristics Of Sample Households

Agro ecological zones	Low Land N=40	Intermediate N=40	All N=80
Mean age of household head in years	49.2	57.2	53.2
Average number of years respondent lived in the village	33.2	35.2	34.2
Respondents' farming experience in years	24.0	26.2	25.1
Family size	5.9	4.4	5.0
Education level of Household head in years	6.5	8.9	7.7
Marital status			
Married	87.5	80.0	83.8
Single	10	7.5	8.8
Widow/widower	2.5	12.5	7.5

Source: Field Data, (2013)

Residence status of the respondent's interviewed in the area was also assessed. This was important in determining communities coping strategies to the impact of climate change and climate variability in the respective areas. Mean farmers' farming experience was 25.1 years implying that on the average they started farming carrier in their early eighties. About 87.5% of households in the low land and 80% in the intermediate zones are married while 10% percent are in the low land and 7.5% in the intermediate zones are single. There is no significant difference in marital status between zones p=0.229.

A high proportion of farmers in intermediate zone have attained above primary education (8.9 years) while in lowland zone it's slightly lower. As expected, more households in the intermediate zone had higher education due presence of more schools in the area.

1.3.2 Findings on Socio Economic Activities Practiced in Kirua South Ward

Table 3 shows data on socio economic characteristics and the available labor force. The study area is relatively fertile with normally good crop production and significant livestock holdings especially in lowland zone. Respondents' occupation status for the two zones of ward does not differ much. The study observed that, most of the respondents practice both subsistence farming and traditional livestock keeping dominated by free range systems in low land zone (table 3). Further to that, the study showed households gained the majority of their income through crop and livestock sales.

Table 1.3: Economic Activities and Available Labor in Percentage

Income source	**Lowland N = 39**	**Intermediate N = 40**	**All N = 79**
Crop production	39.5	52.6	46.1
Both crop production and livestock keeping	50	47.4	48.7
Livestock keeping	5.3	0	2.6
Small businesses	5.3	0	2.6
Labor participation(mean)			
Full time	2.2	2.1	2.16
Not full time	2.0	2.3	2.2
Family size	5.9	4.4	5.1
Total workforce*	4.2	4.3	4.25

* Total workforce = Full time labor + Part time labor

Source: Field Data, (2013)

Both crop production and livestock keeping are most important economic activities which contribute to 50 and 47.4 percent in lowland and intermediate zones respectively of the total household income.

Crop production alone was mentioned as their main occupation by 52.6 and 39.5 percent in intermediate and lowland zones respectively. The primary crops in this area are maize, beans, and pigeon pea in that order. In the intermediate zone most livestock keepers practice zero grazing while in lowland, extensive rearing is more popular. Livestock species kept in the area include cattle, goats and sheep, in order of their importance. Since most of these household heads were farmers, majority of them reside on the farm.

Available labor force was slightly lower in the lowland zone (4.2 persons) as compared with an overall available labor of (4.25) persons. This is due available alternative activities like charcoal burning and local brew making. In the intermediate zone with mean education level of (9.2), some members of the family are engaged in the non farming employment activities in urban centers. Most respondents use own labor in their farm. Own labor is the major source of labor the study area.

1.3.3 Findings on Challenges Facing Small Scale Farmers in South Kirua Ward in Crops Production

The survey findings show that one of the barriers experienced by farmers in the study area was drought as a result of climate change as reported by 81.7 and 72.3 percent

of respondents in lowland and intermediate zone respectively (Table 4). Both zones have been hit by drought for four consecutive years.

Table 1.4: Constraints in Crop Production

Constraint	Lowland N=30	Intermediate zone N=30	All N=60
Drought/climate change	81.7	72.3	76.9
High input prices	6.9	20.0	13.6
Lack of capital	6.9	6.7	6.8
Crop pests and diseases	3.5	0	1.7
Livestock diseases	1	1	1

Source: Field Data, (2013)

A cause likely to be of concern is poor climatic conditions as mentioned above. As reported by farmers during key informant interview *"We are no longer sure when to start preparing the land for planting or when to start planting. The weather is no longer predictable as it used to be some 30 years ago*," laments a farmer from Mabungo village. Such reports on frequencies of drought and climate changes are likely to affect crop production negatively by increasing the number of people at risk from hunger and increased levels of displacement and migration.

High input prices were cited to be another constraint to production especially in the intermediate zone (20 percent). This is because of high costs of coffee pesticides which require high spraying regimes against coffee berry diseases and leaf miners infestation.

Lack of capital was another constraint as mentioned by 6.8 percent of farmers on the average. Small-scale farmers lack collateral, which is a prerequisite to credit access.

Credits are urgently needed not only for investments but more for procuring the means of crop production i.e. inputs as most small scale farmers have no financial reserves and therefore often depend on crop sales for financing their production process.

Pests and diseases 3.4 percent incidences results to loss in quantity and quality of yields for various crops especially in the lowland zone due to high temperatures which favors pest multiplications. Sometimes diseases managements is hardly practices by small-scale farmers therefore losses are considerably high.

The livestock survey result suggests that diseases are a major bottleneck for livestock production (Table 4). High prevalence of diseases, such as East Coast Fever, Heart water, Anaplasmosis, Babesiosis, Trypanosomiasis and Helminthiasis are the most important diseases in the study area.. As narrated by Mr. John Leoni Temba a farmer (key informant) from intermediate zone, 'trypanosomiasis was not present back in 1950s, but now the tsetse flies have moved to these places due to high temperatures as a result of global warming.' Animal diseases do lower production levels, present a hazard to human health, render the use of otherwise suitable areas impractical for livestock keeping and prevent access to potential export markets.

These diseases not only affect the development of the livestock industry, but also keep out livestock products from the more profitable markets. Further, results from key informant survey indicated that inadequate seasonal and poorly developed water resources are result of consecutive droughts especially in the lowland zone. Poorly

distributed or inadequate watering points lead to poor livestock distribution, overgrazing and range degradation especially in low zone areas of Kirua South.

1.3.4 Findings on Knowledge/Awareness /Perceptions on Climate

Contrary to popular perception, indigenous or local communities have intimate knowledge of their environment (the soils, water, forest, flora, fauna, etc), and most of their decisions and actions are informed by this knowledge-base.

Table 1.5: Knowledge/Awareness on Climate Variability

	Strongly agree	Agree	Neither agree/ disagreed	Disagree	Strongly disagree
Climate is changing N=80	63.3	23.3	11.7		1.7
Climate change is a result of human behavior N=70	68.3	11.7	13.3	5.0	1.7
Climate change is naturally occurring N=60	6.7	28.3	3.3	18.3	43.3
Personally can Help limit change N=57	68.4	28.1		1.8	1.8

Source: Field Data, (2013)

Out of the sampled respondents 63.3 percent were aware of the changing climate as most farmers are experiencing harsh climatic conditions which affected their everyday life. Farmers have been struggling to adjust to changing weather patterns. Also 68 percent strongly agrees that climate change is a result of human behavior. About 43 percent of farmers believe that climate change is occurring naturally implying that some farmers are not aware of the causes of climate change. On the other hand, 68.4 percent have a hope that they can personally help limit the change.

Majority of the respondents in the interview were in agreement on the need to take up measures individually and collectively to address the problem of water shortage with majority of them indicating that planting of trees should be the first priority.

1.3.5 Findings on the Community Participation In Climate Change And Variability Mitigating Activities

Respondents were asked if they have participated in any climate change mitigation activity.

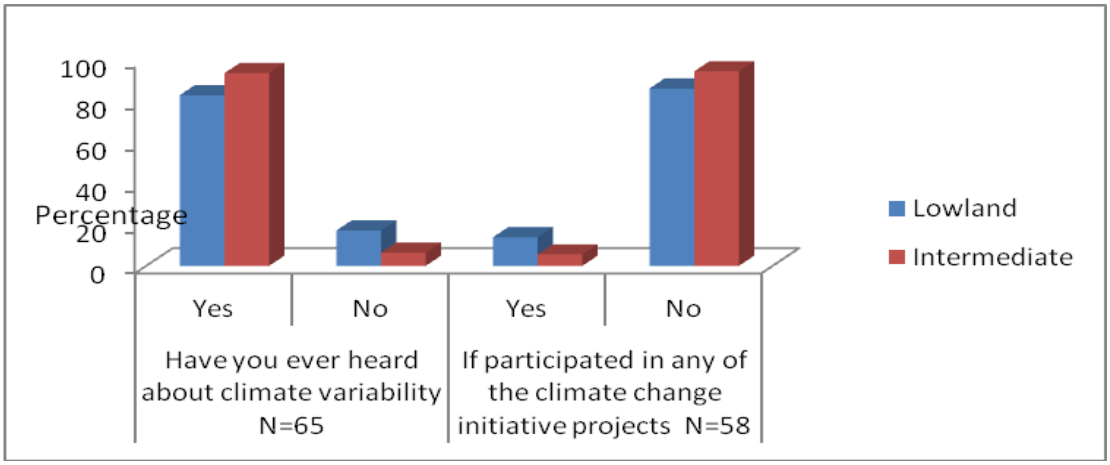

Figure 1.1: Participation in Climate Change Activities

Source: Field Data, (2013)

Majority of the farmers expressed that they have heard about climatic variability 93.5 and 82.9 percent in intermediate and lowland zone respectively and they were already been affected by the unusual events of climate change.

Of the respondents, only 5.6 and 13.9 percent in intermediate and lowland zones respectively noted that they had participated in activities mitigating climate variability. Among the activities includes increased planting distances of some crops in response to perceived seasonal changes in moisture availability during the last 5

years. Others had introduced short-maturing varieties of maize in an attempt to respond to declining rainfall at the end of the growing season. The following respondent demonstrates how his farming practices have changed in direct response to the rainfall decreased he has experienced*: "I think it is a better strategy to start cropping because the rains come late. You can use this rain and then there is often a drought" commented* a farmer Jofrey Mshana from Uchira village.

1.3.6 Findings on Potential Socio-economic Effects do Small Farmers Face Due To Climate Change

This study shows that among the potential socio-economic effect of climate change includes crop loss 88.6 and 59.4 percent as reported by farmers in lowland and intermediate zones respectively (Figure 7). There is a significant difference (p=0.040) in crop loss between the two zone. As expected crop loss in lowland zone is higher as compared with the intermediate zone where the Chagga gardens are still maintained. '*Chagga garden'* is a mixture of crops i.e. coffee, bananas, yams and beans and trees for shades and fodder.

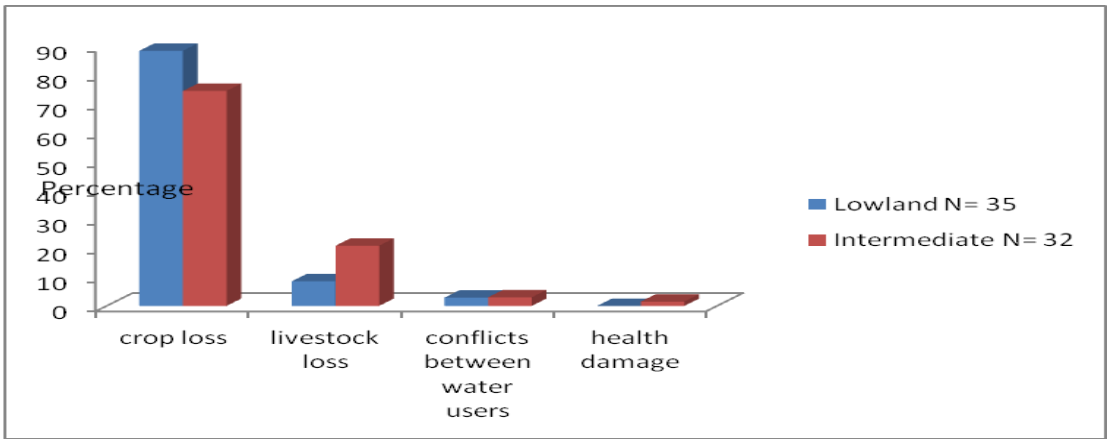

Figure 1.2: Potential Impacts of Climate Change

Source: Field Data, (2013)

Human activity in destruction of the environment including hills leads to decreased rains and resulted to less vegetation in the area. Some crops and or trees which can no longer be planted includes: banana, coffee, cassava, '*mpingo'*, castor oil and '*kimaroro*' to mention but a few. These have disappeared in lowland zone in the study area. Results from the key informant shows that there are losses both on crop livestock and wild animals.

As for livestock, in 1960s they kept improved breeds but now some farmers in the intermediate zone keep cross breeds and some are going back to keep indigenous cattle which eat less and drink less water. Livestock productivity is lower than it used to be back in 1960s. Also there is loss of some species of wild animals such as antelope, hyenas, snakes etc.

1.3.7 Findings on the Copping Strategies/Measures Taken on Climate Variability

As indicated in the study area, the use of drought tolerant varieties was 69.4 and 30.6 percent in lowland and intermediate zones respectively Figure 9). There is a significant difference between the two zones (p=0.069) as in the intermediate they plant hybrids which requires more rains than what is available in the lowlands. But adopting better short 'temperature-adapted' varieties could completely mitigate the climate change effects that result from global warming.

In this study, reforestation was mentioned by 61.5 percent of respondents in intermediate zone as a way of reducing effects of climate variability in the study

area. Indigenous and other local peoples are vital and active parts of many ecosystems and may help to enhance the resilience of these ecosystems. In addition, they interpret and react to climate change impacts in creative ways, drawing on traditional knowledge as well as new technologies to find solutions, which may help society at large to cope with the impending changes by planting trees and cover the soil and modify the micro climate.

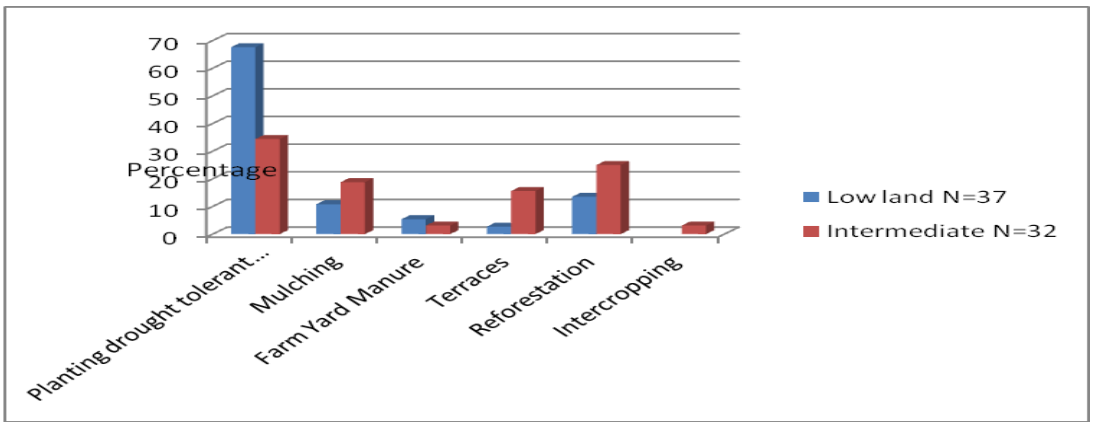

Figure 1. 3: Farmers' Copping Strategies On Climate Variability

Source: Field Data, (2013)

Mulching as mentioned by 60 and 40 percent in the intermediate and lowland zones respectively is another strategy adopted by farmers in the study area. It provides cover to open land and between plants and trees. The soil is covered with cutted pasture, leaves, etc. Mulching not only reduces evaporation, but also lowers erosion resulting from the activities of water and wind. In addition, the mulching layer prevents siltation of the soil. By covering the soil, roots are kept cool, the humidity loss of the soil is decreased and pest plants are impeded in growing. Furthermore, the gradually composted mulching layer is transformed into humus, which results in organic fertilization.

Terracing as reported by 15.6 percent of respondent in the intermediate zone is another measure which can improve the groundwater level and therefore foster the expansion or protection of rain-fed agriculture. One of these techniques is the terracing of slopes that reduces the steepness and thus leads to accelerated infiltration of precipitation water. Some farmers in the study area construct terraces against steep hillsides and building of hedges and natural barriers to protect against landslides. It helps managing the risks of natural hazards and improves the management of natural resources.

Farmyard manure though mentioned by few respondents strives to build humus in the soil in order to improve soil fertility and conserve moisture. Humus formation increases soil stability and water retention capacity and thus reduces the soil's susceptibility to erosion. Humus provides more favorable conditions for soil organisms and stimulates soil biota. Increased humus content is also an indicator of increased sequestration of atmospheric carbon dioxide in the soil hence reducing effects of climate variability. Using farmyard manure helps to fertilize the soil through increased soil organic matter and nutrients. Careful soil cultivation also leads to organic matter being stored in the upper soil layer.

Intercropping is another copping strategy that reduces the risks from natural disasters such as diseases and pests and natural calamities as different crops have different susceptibilities to such stresses. The new varieties do well under drought-stress but respond to better conditions. This increases the capability of farmers to cope with natural risks.

1.3.8 Findings on Adaptation Measures Planned and Implemented in Kirua South Ward

Farmers were asked which adaptation measures/activities are planned and implemented and those ones which are relevant but not yet planned in their areas.

Table: 1.6 List of Adaptation Measures Implemented, Planned, Effective and Not Relevant

Adaptation measure	**Implemented**	**Planned**	**Relevant (*but not planned)***	**Not relevant**
Restriction of water uses N=41	70.7	14.6	7.3	7.3
Land planning measure N=69	36.2	42.0	20.3	1.4
Improving forecasting N=58	46.6	25.9	24.1	3.4
Use of drought tolerant varieties N=61	41. 0	39.3	18	1.6
Use of crop diversification measures N=52	50.0	30.8	19.2	
Use of improved farming technologies N=65	33.8	47.7	18.5	
Water conserving technologies N=56	37.5	42.9	19.6	

Source: Field Data, (2013)

Amongst the most important adaptation measures implemented by farmers in the study area includes restriction of water use as reported by almost 70.7 percent of the respondent in the study area. Improving forecast was implemented by 46.6 percent of farmers in the area. It was also observed that this measure was equally effective but not implemented as reported by 24.1 percent implying that this has some potential. i.e. listening to weather forecast in radios etc. Results from the key informant survey indicate that they also have their traditional ways of predicting rains. Observing red

ants serving foods underground then they know that onset rains is ready. When focusing on indigenous knowledge base, these can contribute significantly to climate mitigation strategies, their resourcefulness and active responses to climatic variation. Further findings from the key informant include indicators based on the plants physiological responses. This includes flowering intensity of certain trees such as the Mangoes ((*Mangifera indica*), and certain *Accacia spp*. locally known as "Miiba" from October to December, immature dropping of fruits by certain tree species, shedding of leaves of the sycamore fig (*Ficus sycomorus*) and dropping of water from the leaves of *Albizia schimperiana* before the onset of the rains. These have been used as indicators of the type of the rains expected. This knowledge is important because climate models can provide the bigger picture of climate change and provide estimates for the likely results of different future scenarios of human development. However, they are not very good at providing information about changes at the local level.

Landscape planning measure as implemented by 36.2 percent of respondents generally lacks a basic awareness of climate change as well as the understanding and the motivation to address climate change. As further findings from the key informant indicate, most local/community members are currently unaware of or unconcerned in incorporating climate change when planning their development programs. They fail to understand their responsibility to address the potential impacts of climate variability in their spheres of planning. Of course, the relatively low percentage indicates that there is still much room to improve local land use planning action in climate change mitigation and adaptation.

1.3.9 Findings on Examining the Possibility of Establishing the Sustainable Economic Development Project in One of the Villages of This Ward

Key informant representatives interviewed indicated that small scale farmers in Kirua South Ward have been struggling to adjust to changing weather patterns. Uchira village was singled out as one of the mostly affected area among other villages which needed an urgent intervention. *"The last decade has been really bad in terms of food production, especially in our village where we never used chemical fertilizers to grow our crops. We have been recording fewer harvests, because the dry spells have been longer and more severe while the rains have been irregular,"* says farmer Faraja Hamad from Uchira village. Reduced yields levels due to temperatures increases and frequent dry spells may leads to decline in household cropping strategies, which might leads to food insecurity and hunger in the study area. Further to that this trend leads to decline the income level of the villagers.

Through the focus group discussions and key informant's interview, the researcher requested the respondents to identify the potential, viable and sustainable economic activity/ project they think can improve their economic status. The study revealed that among the activities being undertaken intercropping drought tolerant maize varieties and dolichos lablab could improve their agricultural outputs and also seen as an adequate strategy to mitigate the impact of climate change in Uchira village. In this regard, therefore, this activity scored high rank comparing to other activities. The table shows scores as per activity.

Maize and Dolichos lab lab are the major crops grown in Uchira village and they are planted mainly in long rains season using *absolute ranking***.** It is followed by

sunflower, groundnuts and greengram**.** Due to persistent drought, farmers experience good harvest once in every four years. Sunflower, groundnuts and green gram are crops which are increasingly became important as they are drought tolerant. Green vegetable are cultivated mainly during long rains as water for irrigation is scarce during dry season.

1.3.10 Community Needs Prioritization at Uchira Village

The farming community in Uchira Village, Uchira village is in need of the following in order to enhance production of crops and livestock which is their main source of livelihood. In prioritizing the needs through a pair wise ranking method, the community which represent the lowland altitude as represented by Uchira village in order of importance are indicated in table 7 was as follows:- (i) Intercropping drought resistant maize and dolichos lab lab (climate change mitigation strategy) (ii) Pest control (iii) Capital (iv) Agricultural inputs (iv)Livestock disease control

Table 1.7: Community Needs Pair Wise Ranking at Uchira Village (Lowland)

Rank	**Results**		Climate change mitigation	Agric. inputs	Capital	Pests control	Livestock disease control
1	4	Climate change mitigation*		Climate change mitigation	Climate change mitigation	Climate change mitigation	Climate change mitigation
2	2	Agric. Inputs			Agric. Inputs	Pests control	Agric Inputs
3	2	Capital				Capital	capital
4	2	Pests control					Pest control
5	0	Livestock Diseases control					

Source: Field Data, (2013)

*****Climate change mitigation strategy included intercropping drought tolerant maize with dolichos lab lab to conserve moisture and soils.

1.5 Conclusion

The focus of this part has been on participatory needs assessment which is an ideal and effective way of involving the community to identify their own problems, causes of the problem and existing opportunities. The findings have been useful in enabling the community to identify top ranking problem and planning for the interventions that can sustainably address the existing problem.

The participatory needs assessment conducted in Kirua South Ward revealed that Climate change and variability has adversely affected the economy of its residents. The study further underlined small scale farmers in Uchira village are the mostly affected group. In other words, climate change has significant negative impacts on Uchira village's small-scale rain-fed agriculture and food production, and this undermines economic development, increasing poverty and delaying or preventing the realization of the Millennium Development Goals (MDGs). In this regard, therefore, income poverty is the major concern in the community. From this study the community members in this village came to agree to form a group in order to establish and implement an agricultural income generation project. In this regard, therefore, this project will contribute sustainable development of Uchira community by improving socio-economic status of small scale farmers. As they responded through questionnaires, experiences during the Focus Group Discussion and in depth interviews drought tolerant maize and dolichos lab lab intercrop enterprise has been

supported by significant stakeholders being District Agricultural officer, Selian Agricultural Research Institute, Community development officer and Village Care Initiative as the best solution in order to improve the income of Uchira village community. This choice is based on experience of similar initiative that has been successful in other communities in conserving moisture and soils which is the major problem. Thus the researcher has to make sure that the community members expectations are met, building on the existing team spirit.

CHAPTER TWO

2.0 PROBLEM IDENTIFICATION

2.1 Background of Research Problem

Community Needs Assessment conducted in Kirua South Ward has played a significant role in identifying the felt needs of one of the villages of this ward namely Uchira. Through this endeavor the CED researcher was able to involve the community in determining major needs and problems in the community and devise the way to address them.

The conducted study revealed that income poverty is a big problem among small scale farmers in Uchira. The study has also been able to identify various contributing factors to income poverty in the village. Climate change and variability was cited by the community members to be the main contributing factor in subjecting small-scale farmers in this area to income poverty. This phenomenon adversely affects Uchira village economy due to heavy dependence of the agricultural sector on rainfall. It was long predicted that changes in climate would have significant impacts on Tanzania's rain-fed agriculture and food production, and possibly undermine economic development, increasing poverty and delaying or preventing the realization of the Millennium Development Goals (MDGs).

Other contributing factors that were highlighted during the survey includes high costs of agricultural inputs, lack of capital as small-scale farmers lack collateral, which is a prerequisite to credit access, pests and diseases incidences results to loss in quantity

and quality of yields for various crops especially in the lowland zone due to high temperatures which favors pest multiplications.

Despite challenges aforementioned, this study has identified various opportunities within the community, among them are fertile land, availability of labor force, availability of farm yard manure for crop production and extension services are easily accessible and Selian Agricultural Research Centre is ready to provide technical and material support to this community in order to improve agricultural yields. Further to that the market for maize and dolichos lablab is available. These opportunities if well taped will bring about economic development in Uchira village.

2.2 Problem statement

Income poverty is a major problem facing most of small-scale farmers community in Uchira village. A number of factors contribute to this situation. Climate change and variability is the main contributing factor in subjecting small-scale farmers in this area to income poverty. This phenomenon adversely affects Uchira village economy due to heavy dependence of small-scale rain fed agriculture. This situation is worsened by a common practice in Uchira village to graze or remove all crop residues from their farms after harvest. This practice leaves the soil bare and vulnerable to wind and water erosion. The top fertile soil is eroded over time leaving unfertile soil and degraded soil for crop production. This is coupled with lack of adequate knowledge the use of improved drought tolerant maize intercropped with dolichos lab lab, for soil and moisture conservation together with other good management practices.

Other factors which subject small scale farmers into income poverty trap include high input prices, lack of capital as small-scale farmers lack collateral to access credit from financial institutions, pests and diseases to mention but a few. All these results to loss in quantity and quality of yields of various crops and therefore leading the farmers to the poverty trap.

According to the current study they identified consequences of income poverty in Uchira village are many. These include but not limited to most residents failing to fulfill basic family needs, specifically adequate food, quality housing and medical care. They are also facing other forms of non-income poverty such as lack of adequate quality social services such as water, health and education and environmental degradation as the result of deforestation.

This research bridges the knowledge gapes by conducting detailed study that helped to identify the viable and reliable economic activity that can be undertaken and contribute to sustainable economic development of a Uchira village. Thus the proposed project is specific and practical solution oriented.

In response to challenges facing smallholder farmers and livestock keepers in Uchira village, the ward community members and CED student and researchers from Selian Agricultural Research Institute (SARI) found the need to improve the economic condition of small-scale farmers in Uchira community productivity by establishing a project in order to strengthen maize and dolichos lab lab intercropping as an economic activity.

2.3 Project Descriptions

The project title is Strengthening drought tolerant maize and Dolichos Lablab Intercrop Enterprise to mitigate climate change and variability for sustainable community economic development in Uchira Village Community. The project will be implemented with partnership with Village Care Initiative (VCI). The identification of this CBO was done after consultation and discussion with the key relevant stake holders, as it happened to have an economic base, accepted in the study area; excellent team work and team spirit, good leadership and some of its members had attended training on entrepreneurship skills. The Selian Agricultural Research Institute being the stakeholder promised to support the CBO with technical expertise and agricultural inputs required to realize this project.

2.3.1 Target community

The primary beneficiaries of this project are 10 small scale farmers in Uchira village. These farmers are directly adversely affected by climate change impacts and therefore this project intends to improve their economic situation by increasing their agricultural productivity. Other beneficiaries would be neighboring communities, agricultural extension workers and other organizations working in the project's catchment area who may learn from this project to mention but a few.

2.3.2 Stakeholders

The identified stakeholders in this particular research include: - Village Care Initiative, **CEDE** (Community Economic Development Empowerment), KEDA (Kilimanjaro Environmental Development Association) and EWAT (Environment

Science from Sokoine University of Agriculture). Other stakeholders include: Selian Agricultural Research Institute, Financial institutions such as Banks, SACCOS, Local Savings and Credit, extension staff from the Local Government Authority (LGA). This team will contribute in one way or another to the success of the project. These stakeholders are further analysed in table8 below.

Table 2.1: Roles and expectations of various Stakeholders

SN	Name of the stakeholders	Role of the stakeholders	Expectations
1	Village Care Initiative	Implementation of the project Promotion of the project Financial support	The sustainability of the project is ensured. Income for the CBO and small scale farmers increased.
2	Moshi Rural Local LGA (Extension officer and and Trade Officer)	Provision of technical support to the project. Capacity building to the farmers in terms of Entrepreneurial operation skills, new agricultural practices Promotion maize and dolicho lablab intercropping in Uchira village control. Financial support.(Loans)	The sustainability of the project is ensured. Income for the CBO and small scale farmers increased.
3	CEDE (Community Economic Development Empowerment), KEDA(Kilimanjaro Environmental Development Association) and EWAT(Environment Science from Sokoine University of Agriculture).	Provision of technical support to the project. Capacity building to the farmers in terms of Entrepreneurial operation skills, new agricultural practices Promotion maize and dolicho lablab intercropping in Uchira village control. Financial support	The sustainability of the project is ensured. Income for the CBO and small scale farmers increased.

4	**Selian** Agricultural Research Institute	Provision of technical support to the project. Capacity building to the farmers in terms of Entrepreneurial operation skills, new agricultural practices Promotion maize and dolicho lablab intercropping in Uchira village control. Provision of agricultural inputs to the 10 farmers	The sustainability of the project is ensured. Income for the CBO and small scale farmers increased.
5	Small-scale farmers.	Improve agricultural yields by intercropping maize and dolichos lablab Provision of labor	Having reliable suppliers of inputs Having a reliable market and good price for maize and dolicho lablab. Improved economic condition by selling agricultural yields. Increased yield of maize and dolicho lablab
6	Micro finance institution	To provide soft loans. Capacity building to CBO of entrepreneurial skills.	Financially strong and capable CBO. Reliable customers.
7.	Uchira village Community.	Consumption of maize and dolicho lablab.	Improved nutrition.
8.	Selian Agricultural Research Institute	Facilitate training to the small-scale farmers. Produce and distribute improved seeds and other agricultural inputs.	Improved crops care. Increased crops production

2.3.3 The Project goal

The project goal is income poverty reduced and standard of living improved among Uchira village community.

2.3.4 Project Objectives

2.2.4.1 General objective

Increased income of 10 small scale farmers in Uchira Village, through strengthening drought tolerant maize and dolichos lablab intercrop enterprise for sustainable community economic development. In order to realize the project goal, the following specific objectives are to be achieved.

2.2.4.2 Specific objectives

i) Created awareness to Uchira village community members on maize and dolichos lablab intercropping as a strategy to increase crop productivity and climate change mitigation.
ii) Capacity building aiming at awareness creation on the magnitude of the problem to 10 small scale farmers from Uchira village, 2 Village Care Initiative, and project staff about management and operation of the Project.
iii) Collaborate with other development partners to seek advice and support for Successful project implementation. .
iv) Increased maize and dolichos lablab production by 10 small scale farmers in Uchira village.

2.3 Host organization/CBO profile

Village Care Initiative is a registered Community Based Organization. Its headquarters are in Mwanga , Physical Address: P.o. Box 289 Mwanga, Kilimanjaro Region.

Vision: Improvement of livelihoods through facilitation of community development processes.

Mission: Struggles at attaining sustainable development among the rural communities through support of mass initiative.

Purpose: Training community in Environment i.e. Climate Change mitigation, Healthy, and Nutrition.

2.3.5 Objectives:

2.5.1.1 Activities

i) Training in Use of Drought tolerant crop varieties and raise income, Tree Planting to mitigate climate change especially fruit trees to promote nutrition and reduce soil erosion. Others are water and soil conservation technologies.
ii) Training in Health and nutrition.

2.5.2 Consists the National Director, Regional Coordinators and District Coordinators, Staff

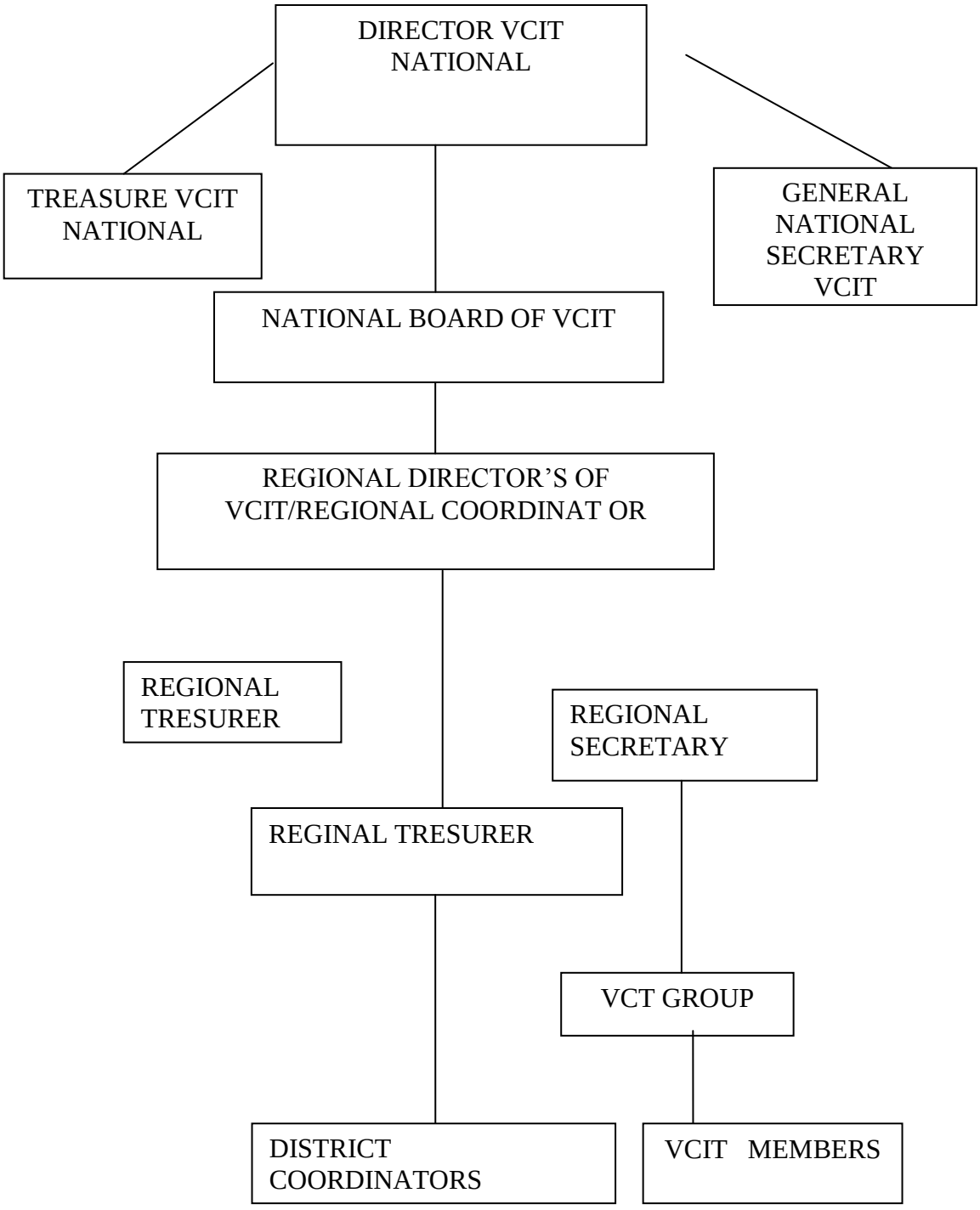

Figure 2.2: Organizational Structure

Source: Field Data, (2013)

Table 2.1: SWOC analysis

SN	Strength	Weakness	Opportunities	Challenges
1.	Strong and committed leadership	Two staff entrepreneurial training	Members are Trainable Availability of training institutions Existence of District Business Development Services-Shop	Sometimes they ever busy being engaged in individual's economic activities.
2	The group has the status of getting loan from Financial Institutions	-	Availability of Financial institutions.	They under utilize the opportunity they have. The usually invest in small projects
3	Project premises have got high security for group assets	Not easy to get rooms in case of expansion of the project/business	The group premise is within the town center thus customers are easily found.	The group is able to establish its own project premises but there is no infrastructure (water& electricity)
4	They have two full time employed staff	Employed staff has no training in their duties.	Availability of BDS-Shop sector training institutions	They work without Contract.

2.5.3 CED's Researcher's Role in the Project

My role in this project is to facilitate the establishment of the project in Uchira village, Moshi district, Kilimanjaro region. My professional goals that I want to achieve throughout my participation in the community project will be:

i) To learn more on the art and science of project planning and management using CED approach in practice. CED approach considers Community, Economy and Development to be the cornerstones of any holistic approach to improving the living condition of the people.

ii) To develop my expertise on managing projects which address the issues of climate change and adaptation strategies which can be implemented by small scale farmers and livestock keepers in order to improve their productivity.

iii) To share my expertise in agricultural and environmental science with beneficiaries of this project in addressing climate change issues strategically.

2.5.4 CBO's Roles

i) To attend the entrepreneurial project management training.

ii) Facilitate/ participate in the exercise community mobilization and awareness creation about the project

iii) To seek material and non-material support from other stakeholders and development partners

iv) To purchase equipments required for project take off.

v) To keep records and submit reports to responsible parties.

vi) To perform the administration routine.

2.5.5 Conclusion

The Community Needs Assessment revealed that small scale farmers in Uchira village are adversely affected by climate change. To address these challenges, community in collaboration with CED student and environmental and agricultural experts from Selian Agricultural Research Institute (SARI), experts from Village care Initiative the Host organization came up with a CED project with the goal to reduce income poverty and improve the standard of living among small-scale farmers in Uchira village. It is expected that the successful implementation of this project would empower small scale farmers to plan and adapt strategically to the climate change and hence improving their productivity.

CHAPTER THREE

3.0 LITERATURE REVIEW

3.1 Introduction

The focus of this chapter is on reviewing the literature concerning agricultural sector in Tanzania, climate change, its impacts and adaptation strategies implemented, especially, by small scale farmers to reduce their vulnerability to these changes. The major parts which will be covered include; theoretical review, empirical review and policy review. Finally is a brief conclusion of the chapter.

3.2 Theoretical Literature

3.2.1 Agricultural Sector

It is reported by Deressa (2006) that in Sub-Saharan Africa (SSA) agriculture is the most important economic activity and it is set to be affected badly by climate change. It is further argued that climate change will bring about substantial welfare losses especially for smallholders whose main source of livelihood derives from agriculture. In order to arrest this situation Füssel et al. (2006). calls for nations to neutralize the potential adverse effects of climate change if welfare losses to this vulnerable segment of the society are to be avoided.

In order to address this challenge, adaptation seems to be the most efficient and friendly way for farmers to reduce the negative impacts of climate change. Smallholder farmers themselves can play a significant role in taking adaptation actions in response to climate change. Governments on their part have a central role

to play by implementing policies aimed at promoting appropriate and effective adaptation measures.

In order to implement appropriate interventions Deressa et al. (2009) insists that, governments need to understand the opportunities for adaptation and the key drivers behind voluntary adaptation by vulnerable smallholder farmers or lack thereof. Some studies report that agricultural measures such as the use of improved crop varieties, planting trees, soil conservation, changing planting dates, and irrigation are the most used adaptation strategies in African countries while other studies have pointed out several socio-economic, environmental and institutional factors as well as the economic structure as key drivers influencing farmers to choose specific adaptation methods in Africa as a whole and in some specific SSA countries.

According to Andersson et al, (2005) Tanzanian agriculture is the major source of food, and accounts for about 45 percent of GDP, 60 percent of merchandise exports, 75 percent of rural household incomes and 80 percent of the population's source of employment. Furthermore, agriculture stimulates economic growth indirectly through larger consumption linkages with the rest of the economy than other sectors. Statement by the United Republic of Tanzania (2003) shows that higher and sustained agricultural growth is needed to meet Tanzania's National Strategy for Growth and Reduction of Poverty (NSGRP) and Millennium Development Goals of halving poverty and food insecurity by 2015.

Kilimo Kwanza – "agriculture first" in Kiswahili is an agricultural strategy which was adopted in 2009 by Tanzania. This strategy recognises that agriculture can do

much more than it has in the recent past, in the right conditions and with the right support. This came after the country adopted an Agricultural Sector Development Strategy in 2001 and the Agricultural Sector Investment Programme in 2005. All the same in both cases progress in implementation was slow.

It is further reported by the United Republic of Tanzania (2003) that despite these strategies, agricultural growth in Tanzania is facing many challenges. Some of these barriers include: unmanaged risks with significant exposure to variability in weather patterns with periodic droughts, high transaction costs due to the poor state or lack of infrastructure; low investment in productivity enhancing technologies and limited access to technology demand and delivery channels — with 60-75 percent of households estimated to have no contact with research and extension services and limited access to financing for the uptake of technologies. These challenges are amplified by the dependency on rain-fed agriculture and the limited capacity to manage land and water resources.

3.2.2 The Concept of Climate Change and Variability

According to ISDR (2008) climate change is defined as the alteration of the world's climate that humans are causing, through fossil fuel burning, clearing forests and other practices that increase the concentration of greenhouse gases (GHG) in the atmosphere.

On the other hand Ziervogel et al. (2006) attributes climate variability to deviations in the mean state of climate and inconsistencies (e.g., in occurrence of wind and

precipitation extremes), on all temporal and spatial scales beyond those of individual weather events, including short-term fluctuations that happen from year to year. This makes Smit et al. (2000) conclude that variability is an integral part of climate change. The main cause of climate change is production of green house gases emissions mostly carbon dioxide, methane, nitrous oxide in large quantities that exceed what the atmosphere can hold from mainly human activities. These include agricultural production, industrialization, burning of fuels (fossil fuels and bio-fuels) and deforestation, wetland degradation among others.

3.2.3 Climate Change and Variability Trends in Tanzania

The climate of Tanzania is mainly influenced by its location close to the equator, the effect of the Indian Ocean and the physiographic in general. Hence, Tanzania has several climatic conditions ranging from humid coastal to alpine deserts. The coastal area and all of the islands in the Indian Ocean experience a tropical climate, and most of the country is sub-tropical except for the areas at higher altitudes. Temperature variations have significant impact on the agro-ecological zones and the adaptation strategies in the agriculture sector. Rainfall and temperature are critical determinants of crop performance and eventual agricultural production. Increase in temperature could, for instance, result in increase in evapo-transpiration which could, in turn, reduce the soil moisture, and ultimately, the rate of plant growth, development and hence yields. Tanzania is also prone to droughts and flooding. It is reported by Kandji et. al. (2006) that the last four decades, the country has been hit by a string of severe droughts and flooding, the most recent droughts occurring in 1971, 1975-76, 1983, 1985, 1987, 1992, 1996-97, 1999-2000. On the other hand, some of the most

severe flooding episodes in recent years occurred in 1993, 1997/98 (El Niño) and 2000/01.

3.2.4 Small Scale Farmers Knowledge on Climate Change and Variability

Economists and other scholars have done work on understanding farmers' awareness of climate change, options for adaptation to climate change and the factors influencing choice of adaptation methods to climate change.

It is argued by Gbetibouo (2009) that farmers' ability to perceive climate change is a key precondition for their choice to adapt. For him, a number of factors influence the likelihood that farmers will perceive climate change. Having fertile soil and access to water for irrigation decreases the likelihood that farmers will perceive climate changes, whereas education, experience, and access to extension services increase the likelihood that farmers will perceive climate changes. In the same line of thought Trench et al. (2007), confirms that majority of farmers are aware of their environment they live in.

In the area of climate adaptation Nyong et al (2007) underscore that indigenous knowledge (IK) systems have been applied in weather forecasting, vulnerability assessment and implementation of adaptation strategies. For him local knowledge is vital in preserving bio diversity which is considered a very successful mitigation strategy. The study further revealed that West African farmers had developed intricate systems of gathering, prediction, interpretation and decision making in relation to weather. These systems of climate forecast have been helpful to farmers in managing their vulnerability.

3.2.5 Effects of Climate Change and Variability on Agriculture

According to FAO, (2013) some of the major effects of climate change and variability include but not limited to the following: declining crops yields and increasing food insecurity, melting of snow caps and glaciers, increased frequency and intensity of droughts and floods, reduced water supply, increase in pests and diseases for livestock and wildlife and crops. This is in line with the findings of the needs assessment survey conducted in Kirua South War.

3.2.6 Small Scale Farmers' Adaptation to Climate Change and Variability

According to Smit et al. (2003) adaptation is an adjustments in ecological, social, or economic systems in response to actual or/and expected climatic stimuli and their effects or impact, as well as to the changes in processes, practices, and structures to moderate potential damages and/or to benefit from opportunities associated with climate change. In response to climate change and variability, farmers have developed different farming systems well tuned to many aspects of their environment. Hatibu et. al. (2003) claims that adaptation measures include adjustments to planting dates, rainwater harvesting (RWH), and the opportunistic cultivation of food and cash crops to meet some of their needs.

A study by Shetto (1998) revealed that farmers in Hanang have also developed their indigenous intensive crop management systems that they refer to as iraqw system by the Iraqw tribe. The iraqw systems are prepared in the hilly areas, where the crop residues in the field and manure from stall fed cattle is incorporated into cultivated ridges. Terraces are made to control soil erosion, and fodder is cropped on the edges

of the terraces for the cattle, being supplemented by grass from fallow fields. Trash lines and cut off drains are also used to slow down surface runoff and to increase infiltration.

On his part Thiombiano (2004) further argued that, a rapid change of the vulnerability context due to more frequent and severe climate events does not always allow for traditional coping mechanisms to take place and often results in an overall loss or severe ineffectiveness in the adaptive capacity of the communities. In this regard, exogenous and improved technologies may play a crucial role through their integration, where appropriate, into local strategies. In this context, therefore, it is said that the efficiency of traditional practices can be increased, not by introducing completely different ones, but by identifying those elements, which could be improved in the local context.

According to NAPA (2005) some of the possible exogenous and improved technologies for adaptation to climate change and variability include; small scale irrigation, drought tolerant seed varieties, strengthen early warning system, cross breeding for resistant breeds, strengthened livestock extension services, improve livestock marketing infrastructure and zero grazing Despite the fact that these improved technologies have yielded positive results in some places where they have been implemented, adoption is still very low.

3.2.7 Role of Education in Climate Change Adaptation

Once Prapaland (2009) argued that education has a key role to play in promoting understanding and helping individuals, society and governments to make informed

choices. For climatic change adaption strategies to be promoted sustainably, education is key and assessing the levels of education for any affected community helps to design the mechanisms for effective delivery of the required climatic related information for sustainable development. The higher the education level the greater the chances for interpreting and the environmental policies and the higher chances for innovation for better climate change adaptation and response mechanisms. Education could take both the formal and informal and enables exposure of communities to external knowledge for better learning and making informed choices.

3.3 Empirical Literature

Various studies conducted in Tanzania and other African countries confirm that climate change has negative impacts on agriculture. Some of these studies have been very instrumental in the understanding of climate change and variability in the context of local perceptions, historical climate data, coping and adaptation strategies from the perspective of smallholder farmers.

A house hold survey by Fosu-Mensah *et al. (*2010) analyse dataset to understand farmers' perceptions and adaptation to climate in Sekyedumase District located in the Northern part of Ghana. The survey was carried out between February and October 2009. In this study crop diversification and changing crop planting dates were identified as major adaptation strategies to warmer climate. It also finds that land tenure, soil fertility level, access to extension services, access to credit and community lived by the farmers are significant determinants to adapting to climate change. The study findings concur with those of Gbetibouo (2009) on variables such

as land tenure, soil fertility, extension services and credit that influence the farmer to adapt to climate change although household size was excluded in the model.

A study carried out by Juana J.S. et al. (2013) indicated that Climate change has the potential of undermining sustainable development efforts in Africa, if steps are not taken to respond to its adverse consequences. This study reviewed existing and available literature on farmers' perceptions and adaptation strategies to climate change in sub-Saharan Africa. The major finding of this study is that the majority of farmers are aware of changes in precipitation patterns and temperature. In order to cope with climate change farmers have taken various measures such as crop diversification, planting different crop varieties, changing planting and harvesting dates, irrigation, planting tree crops, water and soil conservation techniques, and switching to non-farm income activities to mention but a few.

According to Mengistu (2011) Climate change adversely affects Ethiopian economy due to heavy dependence of the agricultural sector on rainfall. The study was conducted in central Tigray, Adiha tabia, to examine the perception of farmers on trends of climate changes and existing coping strategies. One of the major recommendations of this study was a call to improve forecasting and dissemination of climate information, developing drought resistant varieties and promoting farm-level adaptation measures like use of irrigation technologies and adjusting planting dates should be prioritized to improve community resilience to climate change.

Mongi, et al. (2010) conducted a vulnerability assessment of rain fed agriculture to climate change and variability in semi-arid parts of Tabora Region in Tanzania. This

study concludes that there is strong evidence demonstrating the vulnerability of rain fed agriculture to negative impacts of climate change and variability in the study area. It is suggested that there is a need for multi-level interventions on adaptation to climate change and variability taking into account a wide range of stakeholder involvement.

Mary and Majule (2009) carried another study in two villages of Kamenyanga and Kintinku of Manyoni District, central Tanzania. The overall objective of this study was to understand local communities' perceptions on climate and variability issues and establish its impacts and adaptation strategies within agricultural sector. Findings showed that local people perceived changes in rainfall and temperature. The changes have affected crops and livestock in a number of ways resulting in reduced productivity. This study further concluded that, the wealth of knowledge on coping and adaptation that farmer has should form a foundation for designing agricultural innovation systems to deal with impacts of climate change and variability.

All these studies have been the source of inspiration and assistance to many similar initiatives on climate change and adaptation strategies and to the CED student as well. This study is unique because on climate change and adaptation strategies in a ward which has two different geographical zones, in Kilimanjaro region. Thus it adds value to other studies and projects undertaken elsewhere.

3.4 Policy Review

According to Agriculture Policy (2013) agriculture is the mainstay of the Tanzanian economy contributing to about 24.1 percent of GDP, 30 per cent of export earnings

and employs about 75 percent of the total labour force. The policy further states that the growth in agriculture is higher than the average annual population growth rate of 2.6 percent implying growth in incomes. All the same the average agricultural growth rate of 4.4 percent achieved by the country is insufficient to lead to significant wealth creation and alleviation of poverty, given the low level of agricultural development. Attaining poverty alleviation requires annual agricultural growth rate of from 6 to 8 percent.

The National Agriculture Policy takes into account the existence of huge potential and opportunities for development of the agricultural sector. Potential exists for expansion of agricultural area under cultivation for small, medium and large-scale farming in areas with available land for expansion while intensive farming shall be applied in densely populated areas in efforts to commercialize agriculture.

3.4.1 Climate Change Policies and Adaptation Strategies in Tanzania

Recognizing the challenges posed by Climate change to the economy of the country, the United Republic of Tanzania (2007) adapted a National Adaptation Programme of Action (NAPA). This document is informed by the aspirations National Development Vision 2025 for high and shared growth, quality livelihood, peace, stability and unity, good governance, high quality education and international competitiveness. The fact that the economy of Tanzania is largely dependent on agriculture, it is deemed that sustainable development can only be achieved when strategic actions, both short term and long term are put in place to address climate change impacts on agriculture and other key economic sectors.

The overall vision of Tanzania's NAPA is to identify immediate and urgent Climate Change Adaptation Actions that are robust enough to lead to long-term sustainable development in a changing climate. It will also identify climate change adaptation activities that most effectively reduce the risks that a changing climate poses to sustainable development.

In this regard, therefore, we may conclude the CED project implemented in Uchira village contribute towards achievement of the country Agriculture Policy (2013) and the National Adaptation Programme of Action (NAPA) of 2007.

3.5 Literature Review Summary

This chapter has explored on the different aspects concerning agricultural sector, climate change and variability and adaptation strategies issues. The literature has revealed that climate change has adverse effect on agricultural sector in Tanzania Africa as a whole. Small scale farmers are mostly affected by this phenomenon.

Major impacts of climate change and variability on agricultural sector in Tanzania have been extensively reported. Regularly mentioned impacts include recurrent droughts, floods, increasing crop pests and diseases and seasonal shifts. Literature has further indicated that farmers' ability to perceive climate change is a key precondition for their choice to adapt. In order to improve small scale farmers to mitigate the negative impacts of climate change and variability, various initiatives in different countries conduct education programs on the same. One of these is Village care Initiative where I am doing my field work. There are many other similar projects in different countries of the world.

The country has developed sound Agriculture Policy (2013) and a Climate Change adaptation program to address the adverse impacts of climate change in the region and harness any potential opportunities posed by climate change within the principle of sustainable development. In the same line Tanzania has numerous policies that govern the use of environmental resources and some of which are aimed at mitigating the causes of climate change.

CHAPTER FOUR

4.0 PROJECT IMPLEMENTATION

4.1 Introduction

This part provides information on the project planning and implementation. A critical analysis of the products and outputs from the project, activities undertaken to meet the set objectives, resources requirement is clearly indicated in the project budget, responsible personnel and time frame to accomplish the project. Further to that the commitments of various stakeholders as they showed great interest to support the project implementation during the interview focus group discussions is stated. These commitments include VCI the implementer of the project, Training, tools/equipments and agricultural inputs from Selian Agricultural Research Institute Agricultural Institute, follow ups and support from ward extension officer.

This project had been planned to start operation by on 1st January 2013**.** Outputs from the project include identified stakeholders interested in the project, available and reliable source of agricultural inputs such as improved drought tolerant seeds, skills development on good agricultural management practices and entrepreneurial skills.

The anticipated project product was sustainable community economic development of the first group of 10 small scale farmers of Uchira village. The experience of this group may be replicated to a wider community. The impact of the project will be realized later as the project is at the initial stage. This will be possible after the conduct of summative evaluation of the project by 1st June 2013.

4.2 Outputs

The expected output of the establishment of this project is created awareness on improved drought tolerant maize intercropped with dolichos lab lab, together with good management practices to 10 small scale farmers in Uchira village. This is a strategy to increase crop production and climate change mitigation measure. Other expected outputs include collaboration created with other development partners to seek advice and support for Successful project implementation and small scale farmers' access to reliable agricultural inputs and market for maize and dolichos lablab secured by the end of the project. Further to that this project seeks to increase maize and dolichos lablab production by 10 small scale farmers in Uchira village.

The outcome is expected to be reached after realization of income from the sale of agricultural yields. In order to meet the goal the following activities were planned and implemented:

i) Conducting one day Sensitization meeting to Uchira village community members about the project
ii) Training of 10 small-scale farmers in Uchira village community improved drought tolerant maize varieties intercropped with dolichos lablab and improved agricultural management practices.
iii) Capacity building to six CBO members and four project key players
iv) Conducting one day study tour to Mwangaza B CA Farmer Field School (FFS) in Rhotia village, Karatu district, Arusha.
v) To undertake lobbing and advocacy meeting with various development partners to seek technical and material support.
vi) To organize purchase and distribution of agricultural inputs

i. Monitoring and evaluation of project implementation

After the implementation of this project, the following achievements were recorded:

i) A total of ten small-scale farmers were mobilized on the importance in the use of improved drought tolerant maize varieties intercropped with dolichos lablab and good agricultural management practices.
ii) Six CBO members and four project key players gained knowledge and skills on project management.
iii) Thirteen people, participated in the study tour (ten small scale farmers, one CBO leader, project manager and CED Student)
iv) Lobbying and advocacy done to three Stakeholders

4.3 Project Planning

Project planning is a key part in the project design and management process. This included the following:

i) Identifying project objectives
ii) Sequencing activities
iii) Identifying responsible person for carrying out the activities
iv) Identifying facilities equipments and service needed
v) Preparing the budget

4.2.1 Implementation Plan

In order to ensure smooth implementation of the project, a work plan was prepared indicating different activities to be carried out, the required resources, time frame and

person responsible for each project objective. The project implementation involved different stakeholders physically and others were consulted at their working places to get their views especially on technical aspects. The host organization Village Care Initiative leaders were fully engaged from the beginning of this project as they are key implementers of the project together with the CED student.

Among the major activities in project implementation are securing community participation, coordination of activities, monitoring and evaluation. The implementation of the project involves small-scale farmers, CBO members, CED student, consultants from Selian Agricultural Research Institute and extension agents. Constant coordination has been done to ensure smooth execution of activities. Monitoring has been carried out regularly to checking whether the work is proceeding according to the plan.

Table 4.1: Project Implementation Plan

Objective	Output	Activity	Project Implementation month												Resource Needed	Responsible
			1	2	3	4	5	6	7	8	9	10	11	12		
1. Created awareness to Uchira village community members on improved drought tolerant maize varieties intercropped with dolichos lablab and good agricultural management practices.	A total of 10 Uchira villagers have been mobilized and sensitized about the project.	1.1. Sensitization meeting done to Uchira Village community.													Human, Funds Transport, Time Stationery	CED Student,. Extension Officer, CBO leaders& other Stake holders
2.Capacity building to CBO leaders , small scale farmers and other project staff on project development	2 Village Initiative Care staff, 10 small scale farmers, project staff trained on project development and management.	2.1. 2.1. Training to 2 CBO leaders and 10 farmers on project management project management 2.2.Conducting training to 10 small scale farmers on maize and dolichos lablab intercrop and other agricultural practices 2.3. Conduct study tour to Rhotia village,													Human, Funds Transport, Time Stationery	CED Student,. Extension Officer, CBO leaders& other Stake holders

		Karatu district visiting small scale farmers practicing successfully maize and dolichos lablab intercrop by 10 small scale farmers and 3 project staff															
3. Collaborate with other development partners to seek advice, resources	Various development partners contribute to the project with material and non	3.1. Undertaken lobbying and advocacy meeting with 4 development partners.														Human, Funds Transport, Time Stationery	
4.Increased maize and dolichos lablab production by 10 small scale farmers in Uchira village by December 2013	4.1. Maize production increased from 400kg/acre(2012) to 2000kg/acre (2013). 4.2. Dolichos lab lab production increased from 200kg/acre (2012) to 400kg/acre(2013)	4.1 Planting improved drought tolerant maize intercropped with dolichos lab lab, together with good management practices														Human, Funds Transport, Time Stationery	CED Student,. Small scale farmers, Extension Officer, CBO leaders& other Stake holders
	Monitoring was done regularly during the implementation of each activity.	4.2Conducting Monitoring and Mid and annual evaluation of project implementation														Human, Funds Transport, Time Stationery	CED Student,. Extension Officer, CBO leaders& other Stake holders

Source: Field Data, (2013)

Implementations of project activities involve securing community participation, management of activities, monitoring and evaluation. The implementation of this project has been involving a number of stakeholders as aforesaid. Monitoring has been carried continuously in order to establish whether the implementation of activities is according to plan and project activities are actually been achieved.

Resources for implementing the project were contributed by various institutions being Selian Agricultural Research Institute who facilitated the training to small scale farmers on new agricultural practices and the benefits of maize and dolichos lablab intercropping. Further to that this institution contributed project equipments and agricultural inputs for the 10 famers. Village Care Initiative contributed funds for purchase of working facilities and project professionals who facilitated trainings and follow ups. Farmers on their part contributed manpower by preparing their farms. Other stakeholders were played a big role in providing technical support as it has been indicated in the stakeholders' analysis table 8. The CED student was responsible for facilitating trainings and advice in project management, planning, collaboration with various development partners, implementation, and monitoring of planned activities.

Table: 4.2: Project Logical Framework

Hierarchy of Objectives	Objectively Verifiable Indicators (OVIs)	Means of verification (MOV)	Assumptions
Goal (Impact): Income poverty reduced and standard of living of small scale farmers in Uchira village improved	Increased income and improved standard of living of small scale farmers	Survey and auditing and annual sales reports at beginning and end of project	People are aware and are open and honest about their income-status
i. **Objective 1:** Created awareness to Uchira village community members on improved drought tolerant maize varieties intercropped with dolichos lablab and good agricultural management practices.			
Output 1: Uchira villagers, village officials and CBOs members mobilized and sensitized about the project.	Response of CBO and community members (suppliers and consumers)	Project progressive report	Community members became aware about the project.
Activities			
Sensitization meeting done to Uchira Village community.	10 small scale farmers attended	Project progressive report	Readiness of the small scale farmers to support the project.
Objective 2: Capacity building to CBO leaders , small scale farmers & project staff on project development			
Output 2. Village Initiative Care leaders, small scale farmers, project staff trained on project development and management.	Number of CBO Staff, small scale farmers and project staff attended	List of participants	Willingness and readiness of CBO Members to attend training
Activities			
2.1 Training to CBO leader on project management	5 CBO members attended the training.	Training report	,,
2.2Conducting training to 10 small scale farmers on maize and dolichos lablab intercrop and other agricultural practices	10 Small scale farmers attended the training.	,,	,,
2.3 Conduct study tour to Rhotia village, Karatu district visiting small scale farmers practicing successfully maize and dolichos lablab intercrop	13 people visited the farmers	Study tour report r	Funds available for study tour

Objective 3: Collaborate with other development partners to seek advice, resources for the project**.**			
Output 3: Various development partners contribute to the project with material and non material resources	List of development partners and their support	Records of material support in project inventory.	Willingness and readiness of CBO/NGO and development partners to support the project.
Activities			
3.1: Undertake lobbying and advocacy meeting with development partners.	3 Lobbing/advocacy meeting conducted Number of development partners consulted.	List of material support.	‘’
Objective 4: Increased maize and dolichos lablab production by ten small scale farmers in Uchira village.			
Output 4 Maize and dolichos lablab production increased (small scale farmers access a reliable agricultural inputs)	Number of farmers connected to reliable suppliers of agricultural inputs and buyers of maize and dolichos lablab	List of small scale farmers, agricultural inputs suppliers and buyers of agricultural yieds secured.	Readiness of agricultural input suppliers to distribute inputs timely and small scale farmers readiness to acquire inputs from the suppliers
Activities.			
4.1 Identify agricultural inputs suppliers	2 agricultural inputs suppliers	Weekly and monthly report	Availability of fund and readiness of inputs to supply implements to farmers
4.2 Purchase and distribution of agricultural inputs for 10 small scale farmers	Quantity and types of agricultural inputs purchased and distributed	Weekly and monthly report	Availability of fund and readiness of inputs to supply implements to farmers
4.5 Conducting Monitoring, and annual evaluation	4 People to participate	Evaluation report	Willingness of members of evaluation team

Source: Field Data, (2013)

4.2.2 Inputs

In the course of project implementation various inputs employed included human resources inputs from, financial resources inputs and materials input. Human resources were Village Care Initiative CBO members, Officers and extension staff from Kirua South Ward, researchers from Selian Agricultural Research institute, and other development partners from different institutions and NGOs. Financial resource is the major component in the implementation which were used for capacity building, purchase of project equipments and for payment of various expenses such as consultation cost, water and electrical bills, fares, rent and transportation.

4.2.3 Staffing Pattern

The project was managed in by CED volunteer, Village leader, extension agent and two Village Care Initiative staff, one of whom being the project manager. The 10 farmers, who are the beneficiaries of this project, participated fully in day to management of the project as well.

4.2.4 Project Budget

The project annual budget was TZS**.** 1,114,000. Out of the total budget 558,000 cash was a contribution from Village Care Initiative, SARI contributed TZS.446,000, Uchira comminity farmers contributed 110,000. The procurement was done by Village Care Initiative leaders and technical personnel from Selian Agricultural Research Institute. The project budget was developed as table 12 indicates.

Table 4.3: Project Budget

Objective	Output	Activity	Resources needed	Quantity	Unit price	Total
1. Created awareness to Uchira village community members on maize and dolichos lablab intercropping as a strategy to increase crop production and climate change mitigation.	A total of 10 Uchira villagers, mobilized and sensitized about the project.	1.1. Sensitization meeting done to Uchira Village community.	Papers Ream Flipchart Mark pens Photocopy Facilitator's allowance Food and drinks	2 2 10 130 2 13	10,000 10,000 500 100 30,000 5,000	20,000 20,000 5,000 13,ooo 60,000 65,000
2.Capacity building to CBO leaders , small scale farmers and other project staff on project development	2 Village Initiative Care staff, 10 small scale farmers, project staff trained on project development and management.	2.1. Training to 2 CBO leaders and 10 farmers on project management	Papers Ream Flipchart Mark pens Photocopy Facilitator's allowance Food and drinks	2 2 10 120 2 14	10,000 10,000 500 100 30,000 5,000	20,000 20,000 5,000 12,ooo 60,000 70,000
		2.2.Conducting training to 10 small scale farmers on maize and dolichos lablab intercrop and other agricultural practices	Papers Ream Flipchart Mark pens Photocopy Facilitator's allowance Food and drinks	2 2 10 120 2 13	10,000 10,000 500 100 30,000 5,000	20,000 20,000 5,000 12,ooo 60,000 65,000
		2.3. Conduct study tour to Rhotia village, Karatu district visiting small scale farmers practicing successfully maize and dolichos lablab intercrop by 10 small scale farmers and 3 project staff	Transport Food and drinks Communication	13 13	14,000 7,000	182,000 91,000 20,000
3. Collaborate with other development partners to seek advice, resources	Various development partners contribute to the project with material and non	3.1. Undertaken lobbying and advocacy meeting with 4 development partners.	Transport Food and drinks Communication	2 6	40,000 10,000	80,000 60,000

4.Increased maize and dolichos lablab production by 10 small scale farmers in Uchira village by December 2013	4.1. Maize production increased from 400kg/acre(2012) to 2000kg/acre (2013). 4.2. Dolichos lab lab production increased from 200kg/acre (2012) to 400kg/acre(2013)	4.1 Planting improved drought tolerant maize intercropped with dolichos lab lab, together with good management practices	Cultivation and seeding Planting fertilizer Top dressing fertilizer Weeding Harvesting Pesticide application and storage	1 acre 1 acre 1 acre 1 acre 24 bags	110,000 82,000 65,000 65,000 74,000 30,000	110,000 82,000 65,000 65,000 74,000 30,000
	Monitoring was done regularly during the implementation of each activity.	4.2Conducting Monitoring and evaluation of project implementation	Perdiem	13	10,000	130,000
Grand Total						**1,114,000**

Source: Field Data, (2013)

NB: A detailed analysis of benefit cost is Table 17.

4.4 Project Implementation

4.4.1 Project Implementation Report

The project implementation was the responsibility of CED student, Village Care Initiative, the target group of small scale farmers and village leaders and other stakeholders to ensure effectiveness and efficiency in project implementation. In other words, the implementation of this project was participatory in nature whereby various stakeholders were involved and engaged. The implementation process begun with awareness rising to Uchira villagers, Capacity building to implementers, Village Care Initiative, Project staff, target group. Training was conducted in collaboration with Ward extension officer, experts from SARI and other stakeholders already mentioned in this paper.

Figure 4.1: Awareness Creation Session on Effect of Climate Change and Variability

The CED student, CBO leaders and extension officer conducted monitoring on weekly basis for the first three months. Evaluation of the progress of project implementation was done after one year implementation of the project. It is worth noting that the objectives and planned activities were done as planned. The implementation of this project has received a positive response from the various stake holders who were approached for technical, material and financial support. More importantly, small scale farmers in the project catchment area have been highly motivated and to show their enthusiasm these farmers work hard in order to achieve the project goal.

Figure 4.2: Farmers Planting Crops during Implementation Phase of the Project In Uchira Community

Training conducted for stakeholders and project staff on new agricultural practices and entrepreneurial skills is expected to be instrumental in ensuring the success of the project. The CED student managed to get in touch with various stakeholders who

played big role in training CBO members whereas now members are skilled to run the project.

After the conception of this project the CED research in collaboration with the target community and Village Care initiative organized a study visit in Rhotia village, Karatu district, where some small-scale farmers have been practicing successfully maize dolichos intercropping for some years. This tour was very informative as host farmers a very encouraging account that they started with small amount of capital, without much support from other organisations and now their agricultural yields have increased which is making them able to afford to pay for agricultural inputs and meet other needs for their family. This made the project target members more enthusiast as they considered themselves privileged to have agricultural experts and other stakeholders ready to support their project. They, then, deliberated to put all their energy and effort to ensure that this project was materialized. After the visit the farmers from Uchira village embarked seriously on implementing their project by using drought tolerant seeds with good agricultural management practices.

In this regard, they were putting in practice the knowledge they have gained through the training they have undergone in the course of implementation of this project. Signs show that this project may be replicated to other small holder farmers in Uchira village and far beyond as more farmers are showing interest after seeing how this small group of small scale farmers has been able to improve agricultural yields despite the fact that climate change is still a challenge in this village.

Figure 4.3: Farmers Practice: Drought-Affected Maize Grown From Farmers' Seed. Unimproved Variety, No Legumes Intercrop, No Soil and Water Conservation Technologies

Figure 4.5: Improved Technologies: Drought Tolerant Variety, Stuka I Intercropped with Dolichos Lab to Conserve Moisture And Soil To Mitigate Climate Change And Variability

4.3.2 Project implementation Gantt chart

Table 4.4: Project implementation Gantt chart

Objective	Output	Activity	Project Implementation month											
			1	2	3	4	5	6	7	8	9	10	11	12
1. Created awareness to Uchira village community members on improved drought tolerant maize intercropped with dolichos lab lab, together with good management practices.	A total of 10 Uchira villagers, Ward and village officials and CBOs members mobilized and sensitized about the project.	1.1. Sensitization meeting done to Uchira Village community.												
2.Capacity building to CBO leaders , small scale farmers and other project staff on project development	2 Village Initiative Care staff, 10 small scale farmers, project staff trained on project development and management.	2.1. Training to 2 CBO leaders and 10 farmers on project management project management 2.2.Conducting training to 10 small scale farmers on maize and dolichos lablab intercrop and other agricultural practices 2.3. Conduct study tour to Rhotia village, Karatu district visiting small scale farmers practicing successfully maize and dolichos lablab intercrop by 10 small scale farmers and 3 project staff												
3. Collaborate with other development partners to seek advice, resources	Various development partners contribute to the project with material and non	3.1. Undertaken lobbying and advocacy meeting with 4 development partners.												
4.Increased maize and dolichos lablab production by 10 small scale farmers in Uchira village by December 2013	4.1. Maize production increased from 400kg/acre(2012) to 2000kg/acre (2013). 4.2. Dolichos lab lab production increased from 200kg/acre (2012) to 400kg/acre(2013)	4.1 Planting improved drought tolerant maize intercropped with dolichos lab lab, together with good management practices												
	Monitoring was done regularly during the implementation of each activity.	4.2Conducting Monitoring and Mid and annual evaluation of project implementation												

Source: Field Data, (2013)

CHAPTER FIVE

5.0 PROJECT PARTICIPATORY MONITORING AND EVALUATION

5.1 Introduction

This chapter gives a comprehensive approach put in place monitoring, evaluation and sustainability plan of the project. This project is committed to ensure that monitoring and evaluation is part of the organizational commitment to work with other stakeholders in order to ascertain that the set objectives are achieved efficiently and effectively.

5.2 Participatory Monitoring

In this piece of work, monitoring of the project activities were conducted in order to assess whether activities were implemented according to plan as well as assessing if project's resources were employed efficiently. This process was continuous and project staff (Management team, consultants and CED volunteer) did the first level of monitoring. The Management team was responsible for monitoring the staff and activities under them and the CED volunteer was given a responsibility of facilitating all the aspects of project's monitoring. Development partners and community members did the second level of monitoring in order to ensure that resources were used to achieve the set objectives.

Monitoring was done through field visits, review of project documents and management information system. Information that was planned to be collected included; the use of time, people, money and other material resources under the

project. Monitoring of activities was done on weekly and monthly basis where by team members would meet and discuss on the progress of the project visa a vis the implementation plan.

5.2.1 Monitoring Information System

In order to make sure that monitoring of project activities is done smoothly, monitoring information systems was developed right in the planning stage. This system is designed to gather and report data on project activities in order to help the project manager to plan, monitor and evaluate the operations and performance of the project as a whole. For this project, the Monitoring and Information System (MIS) designed to establish a data base by recording relevant information to activities that were planned in a specified period. Information required include project facilities required and available, Staff required and available, number small scale farmers, numbers of agricultural inputs suppliers, project beneficiaries ,project stake holders, training required and actual implementation, number of people who participated in project activities, information on fund received and list of tools/ equipments (Inventory of project equipments). Monitoring will also cover utilization of funds, items purchased as authorized by relevant authorities, bought items and their respective receipts. Obtaining all these information help the project manager to plan, monitor, evaluate and report project operations easily. The CED student in collaboration with the host organization staff and representative of small scale farmers recorded on daily basis all proceedings of the project. It was done so because the CBO committee member is responsible to check daily records which will enable him/her to prepare a week report to be presented in a monthly meeting.

5.2.2 Participatory Monitoring Methods Used

Participatory monitoring & evaluation (PM&E) is a process through which stakeholders at various levels engage in monitoring or evaluating a particular project, program or policy, share control over the content, the process and the results of the M&E activity and engage in taking or identifying corrective actions. PM&E focuses on the active engagement of primary stakeholders.

Different methods were used to collect information during the monitoring exercise. These methods are further elaborated here below:

5.2.2.1 Focus Group Discussion

Focus group discussions were conducted using the checklist prepared by the CED volunteer in collaboration with the Management team before the discussions. The discussions were conducted by this committee in collaboration with CED volunteer and consultants from Selian Agricultural Research Centre by involving community members in the two villages' beneficiaries of this project. The aim of these discussions were to establish the progress of activities aimed at achieving the goal of strengthening capacities of smallholder farmers and livestock keepers in Kirua South communities to adapt to climate change.

5.2.2.2 Observation

Observation was done in participatory way by attending different community activities such as community meetings, markets, visiting farms and other cultural activities just to name but a few. The aim of doing this was to establish as how

community members were actively participating in these activities. This was also done in order to learn how community members participated in decision making process keeping in mind that the decision to begin this project come from the community members.

5.2.2.3 Review of Records

Records review was useful for determining the understanding of communities on climate change and adaptation strategies which are implemented in the project catchment areas. Different records such as community meetings reports, workshops and seminar reports, quarterly reports, financial records and registers to mention but a few.

5.2.2.4 Administration

Data collection and monitoring process was carried out by the project management team, CED volunteer, consultants through meetings and other occasions.

5.2.2.5 Data Analysis, Interpretation And Reporting

Interpretation of monitoring data was done by involving the Management team, CED volunteer, consultants and community members through meetings and other occasions.

i) On weekly basis the Management team, CED volunteer did the interpretation of data.
ii) On quarterly basis the interpretation of data was done in community meetings.
iii) Information was presented orally, in writing and with visual aids. Formal reports were also used.

5.2.3 Participatory Monitoring plan

Table 5.1: Monitoring Plan

Objective	Output	Activity	Indicators	Data sources	Methods	Responsible person	Time frame
1. Created awareness to Uchira village community members on maize and dolichos lablab intercropping as a strategy to increase crop production and climate change mitigation.	A total of 10 Uchira villagers, mobilized and sensitized about the project.	1.1. Sensitization meeting done to Uchira Village community.	List of Attendants	CBO report	Meeting	CBO Members, Extension officer CED student	
2.Capacity building to CBO leaders , small scale farmers and other project staff on project development	2 Village Initiative Care staff, 10 small scale farmers, project staff trained on project development and management.	2.1. Training to 2 CBO leaders and 10 farmers on project management	Training report List of participants	CBO report	Lectures Group discussion Study tour Case study	CBO Members, Extension officer CED student	
		2.2.Conducting training to 10 small scale farmers on maize and dolichos lablab intercrop and other agricultural practices	Training report List of participants	CBO report	Lectures Group discussion Study tour Case study	CBO Members, Extension officer CED student	
		2.3. Conduct study tour to Rhotia village, Karatu district visiting small scale farmers practicing successfully maize and dolichos lablab intercrop by 10 small scale farmers and 3 project staff	Training report List of participants	CBO report	Lectures Group discussion Study tour Case study	CBO Members, Extension officer CED student	
3. Collaborate with other development partners to seek advice, resources	Various development partners contribute to the project with material and	3.1. Undertaken lobbying and advocacy meeting with 4 development partners.	Letters Resources received	CBO report	Direct contact Internet,	CBO Members, Project Staff	

	non				Mobile phones	CED student	
4.Increased maize and dolichos lablab production by 10 small scale farmers in Uchira village by December 2013	4.1. Maize production increased from 400kg/acre(2012) to 2000kg/acre (2013) see Table 17. 4.2. Dolichos lab lab production increased from 200kg/acre (2012) to 400kg/acre(2013) see Table 17	4.1 Planting improved drought tolerant maize intercropped with dolichos lab lab, together with good management practices	Agricultural inputs received Production reports	CBO reports	Field visits Group discussion	CBO Members, Project Staff CED student	
	Monitoring was done regularly during the implementation of each activity.	4.2Conducting Monitoring and evaluation of project implementation	Number of Evaluation conducted List of participants	CBO report	Participatory Evaluation (PRA)	CBO Leaders Farmers stakeholders	

Source: Field Data, (2013)

5.3 Participatory Evaluation

Evaluation means activities that are done to see how a program is progressing. Evaluation was done in order to assess immediate objectives, outputs and activities. In evaluating this project, Participatory Rural Appraisal (PRA) method was chosen as the best option for this exercise. This is because the idea to begin this project was born from the community and planning and implementation was carried out by the community through selected representatives. Evaluation was in this regard also planned to be a participatory undertaking by the community.

The PRA techniques used are Key informant Interview, Focus Group Discussion, Direct Observation and Workshop. A team comprising of the Management team, CED volunteer, and consultants from Selian Agricultural Research Centre and community , small scale farmers representatives villages were involved evaluation of the project. The evaluation process was done through interviews, review of progress reports, existing records and project financial documents. The CED volunteer formulated an evaluation plan which consisted both formative and summative evaluation.

The results of this evaluation can be used to recruit new catchment areas, funding sources, participants publicize the project. Key areas addressed by this evaluation were; relevance, project design and delivery, project success and program cost effectiveness. The following were the objectives of conducting this evaluation:

i. To assess the extent to which the project objectives have been achieved.

ii. To examine whether the project's activities have been carried out according to plan.

iii. To assess the impact of the project on smallholder farmers and livestock keepers in the project catchment area.

iv. To ascertain whether the objectives of the project addressed the needs originally identified during the Community Needs Assessment conducted in the project area.

5.3.1 Performance Indicators

Both qualitative and quantitative performance indicators are used to evaluate this project. To measure the input indicator members were to examine resources that were mobilized and utilized in the implementation of project activities in order to achieve its objectives. This include number of hours, money spent while for output indicators involves number of CBO members, small scale farmers and project staff trained whereas impact indicators will be measured by examining actual change small scale farmers on agricultural productivity and income levels. 10 small scale farmers in the project catchment area are expected to improve their income levels and hence improving their standard of living by fulfilling their basic needs. Project goal and project objectives performance indicators were developed as shown in TableNo.15

Table 5.2: Project Performance Indicators

Objective	Output	Activity	Resources needed	Performance indicator
1. Created awareness to Uchira village community members on maize and dolichos lablab intercropping as a strategy to increase crop production and climate change mitigation.	A total of 10 Uchira villagers, mobilized and sensitized about the project.	1.1. Sensitization meeting done to Uchira Village community.	Papers Ream Flipchart Mark pens Photocopy Facilitator's allowance Food and drinks	Number of Participants attended the awareness meeting.
2.Capacity building to CBO leaders , small scale farmers and other project staff on project development	2 Village Initiative Care staff, 10 small scale farmers, project staff trained on project development and management.	2.1. Training to 2 CBO leaders and 10 farmers on project management	Papers Ream Flipchart Mark pens Photocopy Facilitator's allowance Food and drinks	Attendance list
		2.2.Conducting training to 10 small scale farmers on maize and dolichos lablab intercrop and other agricultural practices	Papers Ream Flipchart Mark pens Photocopy Facilitator's allowance Food and drinks	Attendance list
		2.3. Conduct study tour to Rhotia village, Karatu district visiting small scale farmers practicing successfully maize and dolichos lablab intercrop by 10 small scale farmers and 3 project staff	Transport Food and drinks Communication	List of participants
3. Collaborate with other development partners to seek advice, resources	Various development partners contribute to the project with material and non	3.1. Undertaken lobbying and advocacy meeting with 4 development partners.	Transport Food and drinks Communication	List of development partners visited and collaborating with the project

				Resources received from partners
4.Increased maize and dolichos lablab production by 10 small scale farmers in Uchira village by December 2013	4.1. Maize production increased from 400kg/acre(2012) to 2000kg/acre (2013) see Table 17 4.2. Dolichos lab lab production increased from 200kg/acre (2012) to 400kg/acre(2013) see Table 17	4.1 Planting improved drought tolerant maize intercropped with dolichos lab lab, together with good management practices	Cultivation and seeding Planting fertilizer Top dressing fertilizer Weeding Harvesting Pesticide application and storage	Cost benefit analysis report
	Monitoring was done regularly during the implementation of each activity.	4.2Conducting Monitoring and evaluation of project implementation	Perdiem	Monitoring reports

Source: Field Data, (2013)

5.3.2 Project Evaluation Summary

Table 16 below summarizes the project evaluation process basing on the project goal, objectives, performance indicators, expected outcomes and actual outcome. Planned activities have been implemented timely. Generally speaking the project evaluation gives evidence that there are strong commitments of various stakeholders from the planning stage to the implementation activities. This indicates that the project is the real need to the direct beneficiaries and community at large.

Table 5.3: Project Evaluation Summary

Objective	Output	Activity	Performance indicator	Expected outcomes	Actual outcomes
1. Created awareness to Uchira village community members on improved drought tolerant maize intercropped with dolichos lab lab, together with good management practices.	A total of 10 Uchira villagers, mobilized and sensitized about the project.	1.1. Sensitization meeting done to Uchira Village community.	Number of Participants attended the awareness meeting.	Positive response rate	10 small scale farmers attended and sensitized
2.Capacity building to CBO leaders , small scale farmers and other project staff on project development	2 Village Initiative Care staff, 10 small scale farmers, project staff trained on project development and management.	2.1. Training to 2 CBO leaders and 10 farmers on project management	Attendance list	Project practices management improved	2 CBO leaders and 10 farmers trained
		2.2.Conducting training to 10 small scale farmers on maize and dolichos lablab intercrop and other agricultural practices	Attendance list	Knowledge improved drought tolerant maize intercropped with dolichos lab lab and good agricultural management practices disseminated to farmers	10 farmers trained
		2.3. Conduct study tour to Rhotia village, Karatu district visiting small scale farmers practicing successfully maize and dolichos lablab intercrop	List of participants	Participants gained knowledge and experience	Participants attended a study tour on maize and dolichos lab lab farms in Rhotia village

		by 10 small scale farmers and 3 project staff			
3. Collaborate with other development partners to seek advice, resources	Various development partners contribute to the project with material and non	3.1. Undertaken lobbying and advocacy meeting with 4 development partners.	List of development partners visited and collaborating with the project Resources received from partners	Positive response from four partners	Meaningful positive response two partners
4.Increased maize and dolichos lablab production by 10 small scale farmers in Uchira village by December 2013	4.1. Maize production increased from 400kg/acre(2012) to 2000kg/acre (2013) see Table 17 4.2. Dolichos lab lab production increased from 200kg/acre (2012) to 400kg/acre(2013) see Table 17.	4.1 Planting improved drought tolerant maize intercropped with dolichos lab lab, together with good management practices	Cost benefit analysis report	4.1.Maize and dolichos lab lab production increased 4.2.Improved cost effectiveness of agricultural practice 4.3. Improved income of farmers	4.1.Maize production increased by 80% and lab lab by 20% 4.2.Improved farmers total income from Tsh. 237,500 to Tsh. 1,265,000 see Appendix2. 4.3.The project has achieved Benefit Cost Ratio of 2.02 after using improved drought tolerant maize intercropped with dolichos lab lab, together with good management practices as compared to BCR of 1.26 before adopting improved practices see Appendix 2
	Monitoring was done regularly during the implementation of each activity.	4.2Conducting Monitoring and evaluation of project implementation	Monitoring reports	Positive response	The project has achieved its objectives

Source: Field Data, (2013)

5.3.3 Costs of Farmer Incurred for Drought Tolerant Maize and Dolichos Lab Intercrop Enterprise at Uchira Village Community

Table 5.4: Analysis of Drought Tolerant Maize and Dolichos Lab Intercrop Enterprise for Uchira Community Project

ITEM	II*	I*	REMARKS
Grain Yields (kgs/acre)			
Maize	2000	400	
Dolichos Lab Lab	400	200	
Gross Revenue			
Maize Tshs 400/=/kg	800,000	160,000	
D. Lab Lab 1000/=/kg	400,000	200,000	
*Maize Stover /acre	15,000	15,000	
D. Lab Lab Straw /acre	50,000	50,000	
Total revenue for crops and Stover	**1,265,000**	**425,000**	
Production cost			
1st Cultivation	40,000	40,000	
2nd Cultivation	25,000		
Seeding maize using hand hoe	30,000	30,000	
Seeding D. Lab Lab using hand hoe	15,000	15,000	
Total Cost for cultivation and Seeding	**110,000**	**85,000**	
Seeds			I* farmers are using low rates level
Improved maize seeds @ 2,500/=/kilo	37,500		
Maize seeds(Un improved)		5000	
D. Lab Lab @ 1000/=/kilo	20,000	15,000	
Total cost for seeds	**57,500**	**20,000**	
Fertilizer	67,000		
Basal fertilizer TSP 1,100/=/kg			
Cost for fertilizer application	15,000		
Total Cost for Planting fertilizer	**82,000**	**0**	
Top dressing fertilizer @1000/= kg	50,000	25,000	
Cost for fertilizer application	15,000	7,500	
Total for top dressing fertilizer	**65,000**	**32,500**	
Weeding			
1st weeding	40,000	40,000	
2nd weeding and thinning	25,000		
Total Cost for weeding	**65,000**	**40,000**	
Harvesting			
Maize harvesting bags @ 1000/=/ bag	20,000	4,000	
Transport @ 500/=/ bag	10,000	2,000	
Threshing and winnowing @ 1000/=/bag	20,000	4,000	
D. Lab Lab harvesting 20,000/=/acre	20,000	20,000	
Threshing, winnowing & packing D. Lab Lab @ 1000/=/bag	4,000	3,500	
Total cost for harvesting	**74,000**	**33,500**	
Pesticide application and storage			
Storage maize 40% –Actelic Super gm 100 @ 1000/=/bag	8,000	2000	Farmers store 40 percent of the harvest
Cost for pesticide application @ 500/=/bag	4,000	1,000	
D. Lab Lab –Actelic Super gm 100 @ 000/=/bag	4000	2,000	
Cost for pesticide application @ 500/=/bag	2000	2,000	
Cost for empty bags @ 500/=	12,000	2,000	
Total cost for pesticide application andstorage	**30,000**	**10,000**	
Total cost	**418,500**	**187,500**	
Net Benefit	**846,500**	**237,500**	
B/C RATIO	**2.02**	**1.26**	

Source: Field Data, (2013)

II* YEAR 2013 After Project whereby improved drought tolerant maize intercropped with dolichos lab lab, together with good management practices.

I* YEAR 2012 Before the project whereby unimproved maize seed was used intercropped with dolichos with low management practices(Farmers practice).

*It is a common practice to harvest Maize stover and stored to be used in dry periods

5.3.3.1 Results and Discussion on Cost of Production

Table 17 above shows the expenditure on materials and operations incurred by farmers in the production of maize and Dolichos lablab intercrop. The average variable cost of production of in year 2013 drought maize and Dolichos lab lab intercrop was Tshs 418,500 per acre. This is relatively higher compared to the year 2012 farmers unimproved management practice. This is both due to increases in both improved drought tolerant maize seed, labour costs as time and also due to increases in physical quantity of labour used when the primary output is seed to ensure good productivity.

Also the other components of the total variable costs, expenditure on labour for second ploughing, second weeding, harvesting, roughing, plant . The study results shows that the net benefit on the use drought tolerant maize and Dolichos intercrop were much higher with net benefit of Tshs. 846,500/= and Benefit cost Ratio(BCR) of 2.02 which is very attractive enterprise as realized by the Uchira community group while net benefit realised by use of un improved maize seed intercropped with

Dolichos lab lab was as low as 237,500/= with BCR of 1.26 which is a slight higher than a breakeven point. The big difference in net benefit was due to two major factors; namely, high productivity originating from use of improved drought maize verities and Dolichos Lab lab coupled with high management practises.

5.3.4 Sensitivity Analysis of the Net Benefit of Farmer Maize Dolichos Intercrop in Uchira Village Community

A sensitivity analysis using the estimated economic values (costs and benefits) was undertaken to incorporate uncertainty into economic evaluation. To assess the stability of net benefit accrued from drought maize and Dolichos lab lab intercrop enterprise when there is price reduction by 10 and 20%; and new gross margins computed for year 2013. Another scenario for simulation was done for yield to assess the likely impact of improvement or increase in yield due to various factors on the net benefit of maize and Dolichos lab lab intercrop enterprise.

Table 5.6: Sensitivity Analysis of the Net Benefit of Farmer Maize Dolichos Intercrop in Uchira Community

Item description	Original	10% reduction in price	20% reduction in price	10% increase in yield	20% increase in yield
Maize Tshs 400/=/kg	800,000	720,000	640,000	880,000	960,000
D. Lab Lab 1000/=/kg	400,000	360,000	320,000	440,000	480,000
Maize Stover /acre	15,000	13,500	12,000	16,500	18,000
D. Lab Lab Straw /acre	50,000	45,000	40,000	55,000	65,000
Total revenue	1,265,000	1,138,500	1,012,000	1,391,500	1,523,000
Total cost	418,500	418,500	418,500	418,500	418,500
Net benefit	**846,500**	**720,000**	**593,500**	**973,000**	**1,104,500**
Net benefit as % of total revenue	**67**	**63**	**59**	**70**	**73**

Source: Field Data, (2013)

The results of the sensitivity analysis shows that drought tolerant maize and Dolichos lab lab intercrop enterprises were likely to be sensitive to both to price fluctuations and yield. A reduction in price by 10% reduced the net benefit by about 4%, while a similar increase in yield increased net benefit by 10% increase net benefit by also 4%. A further reduction in prices by 20% reduced the net benefit by 6%, implying that a huge change in price will be required to significantly alter the net benefit realized by Uchira community farmers in the project. A simulation with 20% yield increase shows that farmers are likely to get also 6% of their revenue as profits. This means that with the yield increase advantage for the improved tolerant maize and Dolichos lab lab farmers are likely to realize a steady increase in net benefits.

5.4 Sustainability

For the sustainability of this project, three factors are necessary to be taken into account:

i) Articulation of the need
ii) A response from within the community in the project catchment area indicating readiness to meet this need.
iii) Availability of support from outside the community.

One cannot expect community involvement without a perceived need, and support should be accorded to the community concerned only when it is willing to address the need so identified. This project believe in this philosophy that is the reason as to why before the community members were actively involved in problem identification, project design and implementation process. Politically speaking, a

project which is not related to some government policies has limited chance to be sustained.

This project is ensured sustainability through the capacity building given to local community members and community involvement in the whole identification of the problem faced by the community and coming up with solutions by using participatory approach. This has created a very crucial social environment which makes the project accepted and owned by community members.

Technically speaking, this project is guaranteed by the training workshops on various topics such as climate change and project planning and management given to the management team and communities at large. This will ensure sustainability because knowledge on climate change and adaptation strategies will continuously be transferred to other community members.

Further to that, this project is receiving support from both community members, volunteers and other development partners. These are ready to offer their material and financial support in terms of labor and knowledge in order to ensure that planned activities are implemented accordingly. During implementation period, this project received funds and support from Village Initiative Care, Selian Agricultural Research Centre, the Management team members and extension officer to name but a few.

Politically, the project is well supported by government policies, political local leaders and government as whole and other organizations. . Involvement of different government staffs from village level to district council ensure sustainability of the project in the long run

5.4.1 Conclusion

This chapter has given a broad account on how the monitoring and evaluation of this project were conducted in order to ensure that program was achieving its objectives. The results of evaluation which have been qualitative to great extent indicate that this project is going on the right direction despite many challenges which have impaired in one way or the other the implementation of this project.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This section highlights the results of the CED project implemented in Uchira Village. Briefly it analyzes the processes that were carried out from project identification up to the project implementation result. The information within the chapter includes Community Needs Assessments, Problem identification, Literature review, Project implementation, Participatory Monitoring, Evaluation and sustainability of the project. Further to that this part will carry a conclusion which will enable researchers, decision makers, policy makers and other developments partners in the agricultural sector get the necessary information about the project and come up with concrete suggestions and improvement.

6.2 Conclusion

The implemented project is directly supporting the Tanzania Agricultural Policy, the National Strategy for growth and Reduction of Poverty II. The CNA exercise indicated that among other things there are many opportunities and possibilities to support small scale farmers, hence bringing sustainable economic development in Kirua South ward and particularly in Uchira village. Findings of assessment further showed that agricultural yields of small scale farmers in this village are declining, which contribute to high poverty rate among the farmers.

The survey findings shows that one of the barriers experienced by farmers in the study area leading to their poverty was drought as a result of experienced climate

change as reported by 81.7 and 72.3 percent of respondents in lowland and intermediate zones respectively. Both zones have been hit by drought for four consecutive years from year 2008. High costs of agricultural inputs such as high breed seed and pesticides were also highlighted as one of the challenges facing small scale farmers. Lack of capital was another constraint as mentioned by 6.8 percent of farmers on the average. 3.4 percent of the respondent indicated that pests and diseases incidences results to loss in quantity and quality of yields for various crops especially in the lowland zone due to high temperatures which favors pest multiplications. Sometimes diseases managements is hardly practices by small-scale farmers therefore losses are considerably high. All these are contributing factors to the declining agricultural outputs of famers in the study area . This is a major cause of income poverty facing small scale farmers in Uchira village.

Prior to establishing the foregoing project the planning, implementation and evaluation involved various stakeholders who are conversant and committed to support the project. Data gathered during the CNA exercise and literature review prompted the CED student together with the target community and other stakeholders afore mentioned to start this project in Uchira village community to address the major problem of climate change and variability. During the assessment the CED researcher noted the readiness of community members towards contributing to their economic development, availability of a fertile land in the village and readiness of various organizations to support the implementation of this project financially, technically and materially. The project was implemented according to plan. Return to investement for the project was very attractive which would invite

other members of the community to venture into drought tolerant maize varietiesintercropped with dolichos lab lab to mitigate climate change and variability the area.

In order to ensure that this project is sustainable the CED student involved the community members, CBO members and other stakeholders from the project identification, project planning, implementation and monitoring and evaluation of ongoing activities. In the process of project implementation the CED student realized that community and CBO members gained adequate knowledge and skills necessary for the management of this project on their own

It is expected that after the project take off the income of 10 small scale farmers in Uchira would be improved. The success of this project will be a catalyst for other farmers in this village and beyond to establish similar project which will eventually improve the income level of farmers and the nation as a whole.

6.3 Recommendations

Based on experiences from the implementation of this project it was realized that when participatory community needs assessment is conducted accordingly, community members or beneficiaries are willing to commit the manpower, material resources and financial resources in order to realize such initiative. In this regard, therefore, genuine participation, transparency and sense of ownership can easily be determined and are the fundamental for the sustainability of the project. We would recommend to anyone interested to establish a maize and dolichos lablab project to

use participatory community development methodologies as they allow for shared learning between local people and outsiders (development practitioners, government officials) to plan together on appropriate interventions.

The participatory needs assessment should involve the representative of community residents, small scale farmers, business people, and stakeholders from government, private institution and sector experts. This helps to share knowledge and experiences that minimize wastage of resource especially during the planning, designing, budgeting exercise.

It is also important to improve economic positions of small scale farmers. We recommend the project should liaise with financial institutions and other organizations which can finance smallholder farmers so that they may have adequate inputs to undertake their activities. It is recommended that the drought tolerant maize varieties to be planted in future includes *STUKA I and STUKA M I, TZH 523, VUMILIA etc.*

From the needs assessment survey to the summative evaluation of the project, financing challenge was highlighted by respondents and/or beneficiaries of this project to be one of the critical challenges when it comes to implementing climate change adaptation strategies.

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APPENDICES

Appendix 1: Structured Questionnaire

Date ……Questionnaire number ……..

Village ……..... Ward ……..

Region …….Agro-ecological zone 1.Low 2.Intermediate

Name of respondent …...……..

Enumerator ……

A: General Information

A1: Socio-economic household characteristics

1. Sex of the respondent…….. 1) Male 2) Female

2. Age of the respondent…… (Years)

3. Marital status of respondent…… (1) Married (2) Single (3) Separated/divorced (4) Widow/widower

4. How long have you lived in this village? …… (Years)

5. How many years have you been in farming? ……. (Years)

6. Farmer household composition (including relatives, house girls, e.t.c.)

Age group	**Number of household members**	**No. of members disaggregated by sex**	
		Male	**Female**
Adults (≥15 years)			
Children (< 14 years)			
Total			

7. Household sources of income (beginning with the most important) …….

(1) Crop Production (2) Livestock keeping (3) Both crop production and livestock keeping (4) Business (5) Others, (specify) ……

8. Household adults working on-farm and off-farm either permanently or part-time basis

Adult family members	**No. working on farm permanently**	**No. working on farm on part-time basis**	**No. working off farm permanently**	**No. working off farm on part-time basis**
Male adults				
Female adults				
Total				

A2: Farming and land allocation pattern

1. How much land do you own? ..... Acres

2. How much land is under farming? ……. acres

3. Amount of land area rented in …… (Acres), Rented out …….. (Acres)

4. Please provide the following information with respect to your farm this season.Trend in farm size and area: (*If observed changes are due to climate variability*)

Item	Crops	Year 2012(*before)	Year 2013(*After)	Remarks
Farm size (acres)	Maize			
	Dolichos Lab lab			
Average output (kg)	Maize			
	Dolichos Lab lab			
Average yield (kg/acre)	Maize			
	Dolichos Lab lab			
Price per kg(farm gate)	Maize			
	Dolichos Lab lab			

*Before the project *After the project

5. Generally, what problems do you face in farming? (Begin with the most constraining)

(1) …… (2) ……

(3) …… (4) ……

(5) …… (6) ……

B: Knowledge of climate variability

1. The world's climate is changing …… (1) Strongly agree (2) Agree (3) Neither agree nor disagree (4) Disagree (5) strongly disagree

2. Climate change is the result of human behavior…… (1) Strongly agree (2) Agree (3) neither agree nor disagree (4) Disagree (5) strongly disagree

3. Climate change is a natural occurrence…… (1) Strongly agree (2) Agree (3) Neither agree nor disagree (4) Disagree (5) Strongly disagree

4. Climate change has become more of an issue for me in last year……

(1) Strongly agree (2) Agree (3) Neither agree nor disagree (4) Disagree (5) Strongly disagree

5. I personally can help to limit the effects of climate change…….

(1) Strongly agree (2) Agree (3) Neither agree nor disagree (4) Disagree (5) Strongly disagree

6. What words or images do you associate with climate change (narratives) ……

7. Has anything you have seen, heard or participated in during last year about climate change?..... (1) Yes (2) No

If yes, please describe it?.....

…….

.8. Have you ever heard about Climate Variability? ……. (1) Yes (2) No

If yes, where?..... (1) From a school event (2) From a teacher (3) From students (4) From other farmers (5) word of mouth (6) Others, (specify)…….. ……..

9. Have you participated in any of the Climate Change initiative projects in the community? …… (1) Yes (2) No

If yes, please comment on your experience …….

……

C: Vulnerability

1. What was the vulnerability/problem perceived by climate variability? Please tick all that apply…….1) Increased rainfall 2) Decreased rainfall 3) Increased risk of droughts 4) Others, please specify:……

2. What are the potential impacts of climate change-driven changes in your area?.....1) crop loss 2) Livestock loss 3) Conflicts between water users 4) Damage to property/infrastructure 5) Health damage 6) Loss of lives

7) Others, specify ……

3. What are the potential impacts of climate change in agriculture?.....1) Decreased productivity 2) Food insecurity 3) Increased food prices 4.other, specify ……

4**.** What changes have you observed over the past years as a result of climate change on (*any change that might be observed like loss of certain crop spp. , livestock or wild animals due to change in temperatures, precipitation etc.*

i) . Crops

i) Livestock

ii) Health.

7. Have you observed any benefit over the years as a result of climate change on

i) Crops

ii) Livestock

iii) Health

D: ADAPTATION

1. What are the farmers' indigenous copping strategies on climate variability?

1)……2)……

3)……4)……

2. The following table lists a number of potential adaptation measures. Please indicate (x) which of these are planned or have been implemented in your field as a response to climate change concerns, and which of these you deem necessary and/or effective in addressing climate change-related problems. Please add additional measures if necessary.

Adaptation measure	**Implemented**	**Planned**	**Effective/ necessary (but not planned yet)**	**Not relevant/ necessary**	**Remarks**
Drought/low flow protection					
Technical measures to increase supply (e.g. reservoir volumes, water transfers, desalinization)					
Increasing efficiency of water use (e.g. leakage reduction, use of grey water, more efficient irrigation)					
Economic instruments (e.g. water pricing)					
Restriction of water uses					
Landscape planning measures to improve water balance (e.g. change of land use, reforestation, reduced sealing of areas)					
Improving forecasting, monitoring, information					
Use of drought resistant varieties					
Crop diversification mesures					
Adoption of improved farming technologies (agro-forestry, improved fallows, integrated pest management)					
Reduction of water loss through water conserving technologies					
Rainwater harvesting					
Others, please specify:					
General adaptation measures					
Policy – including new/revised legislation, bills, Acts of Parliament, etc.					
Economic incentives and financial mechanisms					
Awareness-raising or information campaigns					
Others, please specify:					

3. Who makes the decision to adapt?..... 1) Male 2) Female 3) Both

4. Who decides how to adapt?..... 1) Male 2) Female 3) Both

5. Who benefit from the adaptation exercise **……..**) Male 2) Female 3) Both

E: Input use in crop production

Consider all inputs applied in one field for intercropped maize and and Dolichos Lab lab

Crops	Chemical Fertilizer (If not used, put Zero)							Manure from Livestock					
	DAP				UREA/SA (sulphate of ammonium)			Own		Bought			Applied to crop?
	Qty	Units Code A	Total cost T.Sh	Applied to Crop?	Qty	Units Code A	Total cost T.sh	Qty	Unit Codes A	Qty	Unit Code A	Total cost T.sh	
*Year 2012													
Maize													
Dolichos Lablab													
*Year 2013													
Maize													
Dolichos Lablab													

Codes A	Codes B:	Codes C	Codes E	7. Seed treatment with aprol start
1. Kg 2. Ton 3. bag (50kg) 4. bag (100kg) 5. cups 6.tin/debe 7. truck 8.Wheelbarrow 9.Other, specify	1. Litres/cc 2. Gram 3. top cover (calibrated) (volume of the cover) 4. tea spoon full 5 table spoon full 6 bundle .	1. Spray with diamethon 2.Thionex insecticide 3.Karate insecticide 4.Others (specify)	1.Insecticides (Dursban) 2. minjingu rock phosphate, 3 .herbicide (Farmuron 50% WP) 4. fertilizers (TSP and CAN at planting) 5. farm yard manure 6. Earthing up only -(E)	8. Masherl for seed dressing 9. Storage pests 10. Others (…….. please specify

Crops	Pesticides/fungicides used					Other inputs used (Code E)									
						1----------				2----------				3----------	
	Type Code C	Qty	Unit Code B	Total cost T.sh	Target pest/diseases	Applied to Crop	Qty	Unit	Total cost T.Sh	Qty	Unit	Total cost T.Sh	Qty	1.Kg 2.Bag	Total cost T.sh
*Year 2012															
Maize															
Dolichos Lablab															
*Year 2013															
Maize															
Dolichos Lablab															

*2012 before the project Framers practice use of unimproved maize seed, low management practices

*2013 After the project is Use of drought tolerant maize intercropped with Dolichos Lablab.

I: Labour use and other services in for intercropped maize and and Dolichos Lab lab

Year 2012

Consider all the labour applied in main plot as one field even when the field is intercropped.

Main bean plot #-------------- (acres---------)			Family labour Unpaid labour			Total cost if paid labour	rental cost for other services tech Codes type: 1=tractor 2=hoe	
*Year 2012	Activity code A	Type of labour	# People	Days worked each	hours worked per day			
							cost	type
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						

Year 2012 before the project. Framers practice use of unimproved maize seed, low management practices

CODE A

1. first ploughing,
2. second ploughing,
3. seed selection
4. Masherl for seed dressing
5. drilling and sowing (planting)
6. apply fertilizers (TSP and CAN at planting)
7. first weeding and rouging
8. second weeding and roughing
9. apply DAP
10. apply SA
11. apply folia fertilizers
12. apply manure
13. apply Insecticides (Dursban)
14. apply minjingu rock phosphate,
15. apply herbicide (Farmuron 50% WP)
16. harvesting
17. transporting
18. threshing and winnowing
19. bagging and storage.
20. Seed treatment with aprol start
21. apply Storage pests
22. Others (…….) please specify

II: Labour use and other services in for intercropped maize and and Dolichos Lab lab Year 2013

Consider all the labour applied in main plot as one field even when the field is intercropped.

Main bean plot #-------------- (acres---------			Family labour Unpaid labour			Total cost if paid labour	rental cost for other services tech Codes type: 1=tractor 2=hoe	
*Year 2013	Activity code A	Type of labour	# People	Days worked each	hours worked per day			
							cost	type
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
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		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						
		men (> 14 years)						
		Women (> 14 years)						
		Children 11-14						
		Children (<11 years)						

Year 2013 after the project that is Use of drought tolerant maize intercropped with Dolichos Lablab.

CODE A

23. First ploughing,
24. Second ploughing,
25. Seed selection
26. Masherl for seed dressing
27. Drilling and sowing (planting)
28. Apply fertilizers (TSP and CAN at planting)
29. First weeding and rouging
30. Second weeding and roughing
31. Apply DAP
32. Apply SA/UREA
33. Apply folia fertilizers
34. Apply manure
35. Apply Insecticides (Dursban)
36. Apply minjingu rock phosphate,
37. Apply herbicide (Farmuron 50% WP)
38. Harvesting
39. Transporting
40. Threshing and winnowing
41. Bagging and storage.
42. Seed treatment with aprol start
43. Apply Storage pests
44. Others (…) please specify

Checklist for Key informant survey

1. Has the climate changed during the 20th century?
2. Do you believe that the global average surface temperature has risen over the last 50 years?

3. If you do not believe that the global average surface temperature has risen over the last 50 years, what is your explanation for increasing temperatures?
4. Have you ever received funding from any NGO, Government involved in production or use, or from an institution which receives such funds? If so, please give details
5. What causes this climate change?
6. How does climate variability affect your crop production?
7. How does climate variability affect your livestock productivity?
8. What climate changes are expected for the future?
9. What are the likely consequences of climate change?
10. What changes have you observed over the past years as a result of climate change on (*any change that might be observed like loss of certain crop spp. , livestock or wild animals due to change in temperatures, precipitation etc.*
11. How could climate change affect us in the future?
12. What would you comment as a way forward to climate variability so as to increase crop and livestock variability.