

**THE ROLE OF LOCAL INSTITUTION IN ADAPTATION TO CLIMATE
CHANGE IN THE CASE OF HARAMAYA WOREDA EAST HARARGHE
ZONE, OROMIA REGIONAL STATE, ETHIOPIA**

MA THESIS

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APRIL 2024

HARAMAYA UNIVERSITY, HARAMAYA

**The Role of Local Institution in Adaptation to Climate Change in the Case of
Haramaya Woreda East Hararghe Zone, Oromia Regional State, Ethiopia**

**A Thesis Submitted to the School of Geography and Environmental Studies,
Postgraduate Program Directorate
HARAMAYA UNIVERSITY**

**In Partial Fulfillment of the Requirements for the Degree of MASTER OF
ARTS IN CLIMATE CHANGE AND DISASTER RISK MANAGEMENT**

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DEDICATION

This thesis is heartily dedicated to my beloved all my family, to complete this work and for their encouragement during my work at Haramaya University.

STATEMENT OF AUTHOR

By my signature below, I declare and affirm that this thesis is my own work. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this Thesis. Any scholarly matter that is included in the Thesis has been given recognition through citation

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ACKNOWLEDGEMENTS

I am very fortunate to have performed my graduate work at Haramaya University; therefore, there are many people to thank for their part in my success. I would first like to Thank My Supervisors, Dr. Solomon Tekalign (Major Advisor) and Dr. Solomon Asfaw (Co-Advisor), for their invaluable and constructive comments on the manuscript starting from proposal development to the final thesis preparation.

I would like to thank respondents, enumerators for their cooperation in this study. My deepest gratitude goes to all Haramaya Woreda Administration Officers and kebeles local institutions for their permission and cooperation to use available data and all the necessary information from Woreda Offices. I am also grateful to all who I have not mentioned that have supported me in one way or another to this point.

I am extremely grateful to my friends Mr. Remedan Kasim for his hospitality during field work in Haramaya Woreda rural *kebeles* and his professional contribution during data collection and leading role for my study.

I would like to thank my family for their continued support and encouragement, especially my wife Aynalem Baza for her love, and her support throughout my life, and for her being the reason of all my successes.

Finally, I express my thanks to all individuals and institutions for their support and encouragement in the entire work of the research.

ACRONYMY AND ABBREVIATION

CALM	Climate Adaptation Land Management
CCA	Climate Change Adaptation
CCM	Climate Change Mitigation
CSA	Central Statistical Agency
DRR	Disaster Risk Reduction
ERCS	Ethiopia Red Cross Societies
EMA	Ethiopian Meteorological Agency
ETB	Ethiopia Birr
EWS	Early Warning Systems
FGD	Focus Group Discussion
GIS	Geographic Information System
HFA	Hyogo Framework for Action
HHH	Household Head
HWADO	Haramaya Woreda Agricultural Development Office
IFRC	The International Federation of Red Cross and Red Crescent Societies
IPCC	Intergovernmental Panel on Climate Change
ISDR	International Strategy for Disaster Reduction
KII	Key Informant Interview
NDRMC	National Disaster Risk Management Commission
NGO	Non-Governmental Organization
PSNP	Productive Safety Net Program
RUSACO	Rural Saving Cooperative Organization
SLMP	Sustainable Land Management Program
SPSS	Statistical Package for Social Service
UNFCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
UNODRR	United Nations Office for Disaster Risk Reduction
WMO	World Meteorological Organizations

TABLE OF CONTENT

DEDICATION	IV
STATEMENT OF AUTHOR	V
BIOGRAPHICAL SKETCH	VI
ACKNOWLEDGEMENTS	VII
ACRONYMY AND ABBREVIATION	VIII
TABLE OF CONTENT	X
LIST OF TABLES	XIII
LIST OF FIGURE	XIV
LIST OF PLATE	XV
LIST OF TABLES IN THE APPENDIX	XVI
ABSTRACT	XVII
1.INTRODUCTION	1
1.1. Background of the Study	1
1.2. Statement of the Problem	3
1.3. Objective of the Study	5
1.3.1.General Objectives	5
1.3.2.Specific Objectives.	5
1.4. Research Question	5
1.5. Significance of the Study	5
1.6. Scope of the Study	6
1.7. Limitation of the Study	6
1.8. Operational Definition of Key Terms	7
1.9. Organization of the Thesis	9
2.LITERATURE REVIEW	10
2.1. Climate Change and Roles Local Institution to Climate Change Adaptation	10
2.2. Impacts of Climate Change and Roles of Local Institutional in Ethiopia	12
2.3. Local Institutions for Climate Change Adaptation and Rural Development	14
2.4. Role of Local Institutions in Climate Change Adaptation	15
2.5. Institutional Linkages: Access and Articulation	17

TABLE OF CONTENT(*Continued*)

2.6. Factors Promoting Better Institutional Performance for Adaptation	19
2.7. Perception and Adaptation to Climate Change	20
2.7.1. Climate change perception	20
2.7.2. Adaptation Strategies to Climate Change	21
2.8. Review of Empirical Literature	22
2.8.1. Farmers' perception to climate change	22
2.9. Conceptual Framework of the Study	23
3. RESEARCH METHODOLOGY	25
3.1. Description of Study Area	25
3.1.1. Location and Size	25
3.1.2. Socio-Economic Features	26
3.1.2.2. Economic Activities	26
3.1.3. Relief and soil	26
3.1.4. Land use pattern and climate	26
3.2. Research Design	27
3.3. Target Population, Sampling Techniques and Sample size	27
3.3.1. Target population	27
3.3.2. Sampling techniques	27
3.3.3. Sample size	28
3.4. Types and Sources of Data	30
3.5. Methods of Data Collection	30
3.5.1. Questionnaires	30
3.5.2. Key Informant interview	30
3.5.3. Field's observation	31
3.5.4. Focus group discussion	31
3.6. Methods of data analysis	31
3.7. Definition of the variable	34
3.7.1. Dependent variables	34
3.7.2. Independent variables	35
3.8. Research Validity and Reliability	37

TABLE OF CONTENT(*Continued*)

3.9. Ethical Considerations	37
4. RESULTS AND DISCUSSION	38
4.1. Demographic and Socio economic Characteristics of Sample Household Heads	38
4.1.1. Sex, age and marital status of respondents	38
4.1.2. Family Size of Respondents	39
4.1.3. Educational status	40
4.1.4. Farm size (Landholding) of Respondents	41
4.1.5. Farming Practices and Sources of Income of Respondents	42
4.2. Smallholder Farmers' Perceptions of Climate Change in the Study Areas	44
4.2.1. Respondents' Perceptions on the Climate Change	44
4.2.2. Trends of Climate Change and Variability from Rainfall and Temperature perspective	46
4.3. Respondents' Perceptions on the Causes and Effects of Climate Change in the Study Areas	50
4.3.1. Respondents' Perceptions on the Causes of Climate Change	50
4.3.2. Effect of Climate Change on Agriculture in the Study Areas	51
4.3.3. Social Effects of Climate Change in the study areas	51
4.3.4. Economic Effects of Climate Change in the study areas	52
3.3.4.1. Yield loss	52
3.3.4.2. Livestock Price Decline and Poor Animal Health	54
3.3.4.3. Increase price of crops (foods)	54
4.4. The Role of Local Institutions and the Challenges to Adapt to Climate Change in the	55
4.4.1. Local institutions operating to climate change adaptation in the study areas	55
4.4.2. Activity of local public institutions to climate change adaptation	56
4.4.3. Activity of Local Civic Institution to Climate Change Adaptation	61
4.4.4. The Effects of access to local institutions on livelihoods of farm households	63
4.4.5. Challenges of local institutions and smallholders farmers to climate change adaptation	65
4.4.5.1. Challenges of institutions face in providing support to farmers	65
4.4.6. The Linkage between Local Institutions and with Different Rural households to Climate Change Adaptation	66
4.4.6.1. Linkage between local institutions with other institutions to adapt climate change	66

TABLE OF CONTENT (*Continued*)

4.4.6.2. Linkage between Smallholder Farmers and Institutions to adapt climate change	67
4.5. Coping Strategies of Households in the Study Areas	68
4.5.1. Diversification source of income	68
4.5.2. Engagement on daily labor	69
4.5.3. Sell Assets	69
4.5.4. Social Networks	70
4.5.5. Soil and water conservation	70
4.5.6. Improved crops and variety	71
4.5.7. Water harvesting	71
5.SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	73
5.1. Summary	73
5.2. Conclusions	73
5.3. Recommendations	74
6. REFERENCES	75
7. APPENDICES	83

LIST OF TABLES

Table	Page
1: Geophysical characteristics of the study area	30
2: Livelihood assets and their selected indicators.	35
3: Sex, Age and Marital Status of the respondents	40
4: Farm size of respondents in the study area	43
5: Respondents perceptions of climate change in the study area	45
6: Climate change from rainfall and temperature perspective in the study areas	47
7: Types of effect of climate change on farming activities in the study areas	52
8: Classification of institutions that are operating in the study areas.....	58
9: The results of logistic regression regarding the effects on health problem.....	64
10: The results of logistic regression on the effects on financial capital	65
11: The results of multiple regressions on social networks.....	66
12: Issues that affected smallholder in accessing institutional support	68
13: Association of adaptation practices with institutional arrangements.....	69
14: Types of climate change coping strategies practice by households in the	70

LIST OF FIGURE

Figure	Page
1: Conceptual Framework	25
2: Location Map of the Study Area.....	26
3: Family size of the respondents	41
4: Educational background of the household head	42
5: Farming practices and sources of income of households	44
6: Annual rainfall variability during 1990 to 2020	46
7: Trends of annual rainfall distribution from 1990 to 2020 in Haramaya Woreda.....	48
8: Trends of seasonal rainfall from 1990 to 2020 in Haramaya Woreda	49
9: Trends of annual temperature from 1990 to 2020 in Haramaya Woreda	50
10: Respondents perceptions on the causes of climate change	51
11: Economic effects of climate change in the study area	53
12: Public institutions that offer support to farmers in the three <i>kebeles</i>	58
13: Numbers of respondents beneficiary from access of public institutional.....	60
14: The main target areas and focus points of civic institutions in the study <i>kebeles</i>	62

LIST OF PLATE

Plate	Page
1. Effect of climate change on maize plants in the study areas.....	54
2. Rain water harvesting in the study areas.....	74

LIST OF TABLES IN THE APPENDIX

Appendix Table	Page
1: Rainfall data of Haramaya Woreda from 1990 to 2020.....	103

The Role of Local Institution in Adaptation to Climate Change in the Case of Haramaya Woreda East Hararghe Zone, Oromia Regional State, Ethiopia

ABSTRACT

Climate change is real and might affect all regions, countries and rural areas in some way. Smallholder farmers are most at risk to its impacts. Successful adaptation is therefore needed to increase their resilience to climate change. However, the capacity to adapt depends on specific institutional arrangements operating within the society. The main objective of this study was to investigate the role of local institution to climate change adaptation in Haramaya Woreda,. The study was used multistage sampling techniques for the survey. A household survey was conducted using 296 heads of households who were randomly selected. Face to face interviews were organized with 10 heads of institutions involved in smallholder farmer development project in the study Kebele's. Quantitative data from the field was subjected to statistical analysis such as binary logistic, multiple regressions and chi-squares tests and presented in the form of frequencies and percentages. According to the results three of the institutions were in existence and the smallholders were also confirmed that, there were climate changes in the areas. Besides, accessibility of farming households to local institutions have significant contribution for improvements of livelihood assets such as human, financial, natural, social and physical capitals at local level. Based on the findings, the study recommended that, institutions must develop innovative ways of spreading out their reach (such as outreach on market days) in order to aid farmer adaptation. In addition, the improvement of financial, natural and physical capitals of livelihood assets play remarkable role for promoting the welfare status of smallholders. Therefore, the local government bodies should work hard to improve the accessibility of all public institutions to meet the service needs of people that can change their livelihood.

Keywords: Adaptation, Climate change, Local institutions, Haramaya Woreda.

1. INTRODUCTION

This chapter covering the following areas background of the study, statement of the problem, objectives of research, research questions, significance of the study, scope of the study, limitations of the study and definition of key terms.

1.1. Background of the Study

Climate change refers to a change of climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere observed over comparable periods (The Intergovernmental Panel on Climate Change (IPCC), 2014]. This change becomes an important global issue because it brings a serious challenge to the world population. It affects human and animal health, food and water security, market and infrastructure (Charles *et al.*, 2014).

Developing countries, including Africa, are the most vulnerable to the negative impact of climate change because most of these countries' main livelihood is rainfed agriculture, which depends on climatic factors (Serdeczny *et al.*, 2017). Having limited social, economic and financial resources also contributes to the vulnerability of African countries by limiting their ability to prevent and respond to climate change impacts (IPCC, 2014). As part of Africa, the dependence of the major economic sector on agriculture makes Ethiopia vulnerable to climate change (Conway and Schipper, 2011) Higher frequency of extreme events, increasing temperature, change in rainfall, the occurrence of new pests and diseases resulting from climate change are challenging the livelihood of smallholder farmers in Ethiopia (Tesfaye and Seifu, 2016). Among climate extremes, drought caused significant damage to rural rainfall-dependent farmers. The very recent drought caused in 2015 created catastrophic livestock losses and crop failure that made 10.2 million people food insecure (FAO, 2016).

The negative impact of this change is increasing from time to time and made many resource-poor smallholder farmers vulnerable (Asrat and Simane, 2017). Climate change affects the livelihood of smallholder farmers by reducing crop yield and threatening their food security status (Yalew *et al.*, 2017). According to USAID (2017), climate change may decrease national gross domestic product by 8%–10% and 6% of each year's agricultural production by 2050. However, adaptation action for agriculture could reduce losses by half. Therefore, making the agricultural sector adaptive to the negative impacts of climate change is a priority for Ethiopia because most

of the population depends on it. Adaptation to climate change in agricultural production refers to modifications in farming activities to go with climatic conditions that reduce the possible harmful impact (Franklin *et al.*, 2012) this will help local to secure their income and reduce their vulnerability

Meanwhile, local institutions are institution which plays significant roles in climate change adaptation and mitigation. This is because vulnerability to climate change is socially and institutionally determined, even when provoked biophysically. This is why adaptation to the inevitable impacts of climate change is unavoidably local, and it is also why local rural institutions have a critically important role in promoting effective adaptation and enhancing adaptive capacity of vulnerable rural populations (Tolet *et al.*, 2004). Rural institutions are crucial in shaping adaptation and its outcomes. They are crucial as mediating bodies that connect households to local resources, determine how flows of external support will be distributed among different social groups, and link local populations to national policies and interventions

Although local institutions play a critical role in supporting adaptation, the intensity of adverse future climate impacts is likely to increase – thereby also increasing vulnerability and reducing existing adaptive capacity (Thompson *et al.*, 2006). External interventions in the form of new information and technology aimed at improving coping capacities, institutional coordination for better articulation (connections among institutions) and improved access (connections of institutions with social groups), and inflows of finances support for local leadership will be critical to strengthen local institutional capacities (Thomas *et al.*, 2006).

However, the impacts of climate change increasing in developing country. Ethiopia is one of sub-Saharan Africa countries that affected by the impacts of climate changes in general and Haramaya woreda in particular. Therefore, identifying adaptation strategies used by local institutions and factors that affect their choices of adaptation strategies is vital in designing policies to promote effective adaptation options in Ethiopia in general and to improve the adaptive capacity of smallholder and local institution in particular. Furthermore, due to low local institutional organization that is working in adaptation to climate change exacerbate the problems. Therefore, this study was focused in the role of local institution in adaptation to climate change in Haramaya woreda.

1.2. Statement of the Problem

Ethiopia is one of Africa's most vulnerable countries, suffering from drought and flooding as a result of climate change and fluctuation (Umer, 2022). The drought in 2015 was identified as the most severe in 50 years. And it affected 10.2 million people, killed 1.2 million animals and affected another 7 million livestock, caused 35% reductions in surface and groundwater, and consumed 25% share of the country GDP for its mitigation (Muluaem, 2019). For example, According to Rapid Assessment recent report of 2023 Borana pastoralist has completely lost their livestock to prolonged drought. As a result, above 2.3 million heads of livestock have died due to prolonged drought, which left above 67,000 households with no livestock.

Moreover, in Ethiopia, the agricultural sector employs above 80% of the labour force and contributes to 45% of its GDP, and hence it is usually called as the backbone of the Ethiopian economy. On the contrary, the rainfall in many places in Ethiopia is known by erratic, unreliable, and variable characteristics and their frequency of occurrences are decreasing since the last few decades (Bewket, 2009). As a result, socio-economic impacts due to drought is increasing. Dependence on rain-fed agriculture, land degradation, and poor institutions all contribute to the country's vulnerability to natural disasters. Furthermore, Ethiopia is ranked 36th most vulnerable and 40th least ready to adapt to climate change among the nations covered by the Global Climate Change Adaptation Index (GAIN) study for 2015. According to Bewket (2015) stated that climate change is a major development challenge to Ethiopia. Climate change is expected to adversely affect all economic sectors, eco-regions, and social groups. Agriculture is one of the most vulnerable sectors as it is highly dependent on rainfall. This situation similar with Haramaya woreda where, the intensity and frequency recurrence of drought due to climate change has been increasing from year to years due to shortage of rainfall (Haramaya Woreda Agricultural Office, 2021).

Meanwhile, the main livelihood activity of Haramaya woreda is almost fully dependent on rain-fed agriculture and the area is often hit by Climate change and variability. As such drought causes serious economic, social and environmental problems. Furthermore, the intensity and frequency recurrence of drought has been increasing from year to years due to shortage of rainfall, failure of the long rains or average rain (Haramaya Woreda Agricultural Development Office, 2021). According to crop assessment conducted by Haramaya woreda agricultural

development office (HWADO) in 2021 stated that sorghum 50 %, wheat 22% and maize 91% production reduced due to Climate change particularly drought. In the assessment year from 6929 hectare, irrigated farmland of maize only 638 hectare of productions is harvested. In general, in 2020 due to drought 40.6% of agricultural productions were reduced. In the same year, livestock production declined by 28% it means that milk, meat and number of cattle in quality and quantity (HWADO, 2021). Besides, majority of the people livelihoods and living standard are affected by the impact of drought. Consequently, 19,864 households were vulnerable to food insecurity (HWADO, 2021). These reductions of agricultural production were started from 2015 as Woreda Agricultural Development Office report indicated in 2021.

Several studies have been conducted on the role of local institutions and climate change adaptation in our country. For instance, Firew Bekele (2020) conducted studies on appraising dysfunctional and functional roles of local institutions in Sidama. Similarly, Dejene Debsu (2013) conducted studies on the role of local institutions in adaptive processes to climate variability in Borana. However, there is not studies exist in Haramaya woreda especially in agro ecologically sensitive areas of the Woreda like Melka Gemachu, Ifa oromiya and Awmera kebeles. Hence there is a huge knowledge gap on the role of local institutions and climate change adaptation in the Woreda. This study was intended to fill this knowledge gap in a way to adapt the impact of climate change related problems at the woreda level. Thus the study is contributory to different levels of government in the woreda and to make sound decisions on the role of local institutions and climate change adaptation related issues. That is why this study was focused on the role of local institutions and climate change adaptation in the 3 kebeles of Haramaya Woreda.

1.3. Objective of the Study

1.3.1. General Objectives

The overall objective of this study was to investigate the role of local institution to climate change adaptation in Haramaya Woreda, East Hararghe Zone, Oromia regional state, Ethiopia.

1.3.2. Specific Objectives.

- ✓ To assess smallholder farmers perceptions to climate change in the study area.
- ✓ To examine the role of local institutions and the challenges to adapt to climate change in the study area.
- ✓ To examine the linkage between local institutions and with rural households in the study area.

1.4. Research Question

1. What are smallholder farmers perceptions to climate change in the study area ?
2. What are the role of local institutions and the challenges to adapt to climate change in the study area?
3. What is the linkage between local institutions and with different rural households in the study area?

1.5. Significance of the Study

Role of local institution to climate change adaptation strategies differs from district to district and hence it needs detail study to identify the adaptation methods that fits with specific place. However, there are not studies exist in Haramaya Woreda on the role of local institution to climate change adaptation especially in agroecologically sensitive parts of the rural *kebeles* of Haramaya Woreda (Haramaya Woreda Agricultural Development Office,2021). Hence there are a huge knowledge gap on the role of local institution in the Haramaya Woreda. This study was intended to fill this knowledge gap in a way to mitigate climate change related problems at the woreda agricultural level. Thus the study is contributory to different levels of government in the Haramaya woreda and non-governmental organizations to make sound decisions on climate change adaptation related issues. Furthermore, this study is significant for local farming communities and development agent, woreda level development workers and national level policy makers and development planners by providing base line data need to cope up the impact

of climate change disaster. And also the study provides them information with regard to role of local institution to climate change adaptation and the **resultant impact** which helps them to evaluate the environmental disaster planning, preparedness and emergency mitigation programs, policies and strategies. In general, this study is an important contribution for the academic societies in making further studies and other related investigations.

1.6. Scope of the Study

This study was conducted on 3 rural *kebeles* of Haramaya Woreda which experienced the more vulnerable to climate change particularly drought risk areas of Haramaya woreda. According to information obtained from Haramaya Woreda Agricultural Development Office (2021), indicated that these three rural kebeles like Melka Gemachu, Ifa oromiya and Awmera were often hit by climate change. While based on the most frequently to take adaptation measures to climate change this study was focused on the role of local institution to climate change adaptation. However, not all types of local institution such as formal and informal institution were included on the study areas. The study was also limited to 30 years of assessment of rainfall and temperature (1990 – 2020).

1.7. Limitation of the Study

One of the limitations of the study was a language barrier faced in responding to written questionnaires due to educational level of household in the study area. The investigator thus used trained research assistant translated in the language of their best understanding helped in mitigating such challenges. The study was not affected by the limitations. The final limitation of this study was focused on the role of local institution to climate change adaptation. Similarly, the study was not cover all local institution that were found in the study areas due to time and budget constraints. Also, the study was limited in the three sample rural *kebeles* of Haramaya Woreda. This may limit the representativeness of the study.

1.8. Operational Definition of Key Terms

Adaptation: actions and adjustments undertaken to maintain the capacity to deal with stresses induced as a result of current and future external changes (Nelson *et al.* 2007:396, Alland 1975).

Adaptive Capacity: preconditions that enable actions and adjustments in response to current and future external changes; dependent both on social and biophysical elements (Nelson *et al.*, 2007: 397).

Community: group of individuals united by commonality of purpose, characteristics, beliefs, and/or actions. Most communities are also internally differentiated (Agrawal and Gibson 1999).

Coping: use of existing resources to achieve various desired goals during and immediately after unusual, abnormal, and adverse conditions of a hazardous event or process. The strengthening of coping capacities, together with preventive measures, is an important aspect of adaptation and usually builds resilience to withstand the effects of natural and other hazards.

Decentralization: downward redistribution of resources, responsibilities, and decision-making powers in a territorial and administrative hierarchy.

Environmental Risks: Institutions: humanly created formal and informal mechanisms that shape social and individual expectations, interactions, and behavior (Ostrom 1990, North 1990, Bates 1981). Institutions structure and shape outcomes through the actions of individuals and decision makers associated with them. To understand their impacts it is necessary to examine their internal processes, external relationships, and linkages with different social groups and households.

Institutional Access: degree to which households and different social groups in a given location are connected to institutions and have the ability to gain institutional benefits as a result of such connections.

Institutional Articulation: extent to which different institutions in a given territory are linked to each other, and the nature of such linkages.

Livelihoods: comprise the capabilities, and material and social assets necessary for a means of living; includes the idea of coping with and recovery from external stresses (Carney 1998, Chambers and Conway 1992, Scoones 1998), and the sustainability of the resource base on which livelihoods depend (Ashley and Carney 1999, Norton and Foster 2001).

Mitigation: actions and policies that reduce exposure to climate change, for example, through regulation and institutional changes, technological shifts, alterations in behaviors, or change in location (Nelson *et al.*, 2007).

Organizations: concrete manifestation of institutions with an identifiable location, personnel, and rule structure. For this paper, classifiable into three broad, sometimes overlapping sectors: public (bureaucratic administrative units, and elected local governments), civic (membership and cooperative organizations), and market sectors (service and business organizations) (Uphoff and Buck 2007: 47).

Vulnerability: the susceptibility of a system to disturbances and loss, determined by exposure to perturbations, sensitivity to perturbations, and the capacity to adapt (Smit and Wondel 2006). The nature of perturbations (slow onset or sudden and episodic) and the location of the system in the risk cycle are crucial in shaping vulnerability.

1.9. Organization of the Thesis

This study has five chapters. Chapter one is the introduction to the study covering the following areas: background of the study, statement of the problem, objectives of research, research questions, significance of the study, scope of the study, limitations of the study and definition of key terms. Chapter two comprises the literature review which addresses what has been done in relation to the topic of study and help identify the knowledge gap that exists locally. It covers the following areas: Concepts of climate change and roles local institution to climate change adaptation, impacts of climate change and roles of local institutional, local institutions for climate change adaptation and rural development, role of local institutions in climate change adaptation, factors promoting better institutional performance for adaptation, and conceptual framework. Chapter three contains the methodology which comprises:, description of the study area, research design, data types and sources, sample size and sampling technique, data collection method, methods of data analysis, instrument validity, instrument reliability and ethical consideration of the research. Chapter four consists of results and discussions. Its components are introduction, demographic and socio-economic features of respondents, respondents' perceptions on the climate change, the role of local institutions and the challenges they face in enhancing the ability of smallholder farmers to adapt to climate change and the linkage between local institutions and with different rural households in the study area. Chapter five contains summary and Conclusions. Finally, references and appendixes' are attached at the end of the thesis.

2. LITERATURE REVIEW

This chapter comprises the literature review which addresses what has been done in relation to the topic of study and help identify the knowledge gap that exists locally. It covers the following areas: Concepts of climate change and roles local institution to climate change adaptation, impacts of climate change and roles of local institutional, local institutions for climate change adaptation and rural development, role of local institutions in climate change adaptation, factors promoting better institutional performance for adaptation, and conceptual framework.

2.1. Climate Change and Roles Local Institution to Climate Change Adaptation

Climate change defined by gradual changes in mean temperatures and precipitation, greater range in seasonal and inter-annual variation, increased frequency and intensity of extreme events, and potentially catastrophic transformations of ecosystems (Tompkins and Adger 2004). These manifestations will correlate with both slow-onset hazards such as erratic rainfall, sea level rise, water table changes, and increasing temperatures, and rapidly unfolding phenomena such as droughts, floods, failure of rains and crops, and storm. They will lead to greater exposure and sensitivity rural populations through three major impacts on their livelihoods: increase in environmental risks, reduction in livelihoods opportunities, and in consequence, greater stresses on existing social institutions (IPCC, 2007).

Climate change is a multifaceted biological and physical process. It is impossible to precisely predict future climate conditions, but the scientific consensus is that global land and sea temperatures are warming under the influence of greenhouse gases, and will continue to warm regardless of human intervention for at least the next two decades (IPCC, 2007). According to Joel et al. (1998), the climate has changed, is changing, and will continue to change regardless of what investments in mitigation is made.

The main consequences of negative impact of climate change or climatic hazards are poverty, unequal access to resources, food insecurity, social and political conflicts and incidences of diseases. This impact of climate change presents a considerable challenge to regional agricultural development. The Sub-Saharan African countries in particular have low adaptation mechanism and are vulnerable to the widespread effect of climate change. With this bid serious problem, GDP is predicted to lost in the coming 2100 in most part of the continent. For instance, 2-7% in

part of Sub-Saharan Africa, 2-4.5% in West and Central Africa, and 0.4- 1.3% in North and Southern Africa (FAO, 2009). According to IPCC (2007), increase in global average temperature above the range of 1.5- 2.50C will negatively influences species distribution and survival.

In most developing countries where the majority of the population is dependent on natural resources based livelihoods, it has an impact on socio-economic and threat to overall sustainable development. It was predicted that during 21th century, greenhouse gases mission will increase by 25-90%. This will be continuing for future periods. Climate change affects many sectors, including water resources, agriculture and food security, infrastructures, ecosystems and biodiversity, human health and coastal zones. Because of its innate link to natural resources, agricultural production is at the mercy of uncertainties driven by climate variation, including extreme events such as flooding and drought (Kurukulasuriya and Rosenthal, 2013).

Climate change has become a global reality Sach, (2008), and it will render large parts of the planet unfit for agriculture unless people manage it to mitigate its effects and adapt at the right time (Sach, 2008 and IPCC, 2007). This change has a demanding impact on the lives and livelihoods of all human systems IPCC, (2014) involving several million firms and calling for trillions of decisions Nunes, (2016) in the form of responses at various levels from individuals to communities across the world (IPCC, 2014, Nunes, 2016, Christopher et al., 2011, Karki et al., 2011, Difolo and Erwin, 2009). At a theoretical level, institutions are important in many ways in the relationship between human beings and the environment, including causing climate change itself Mathewas, (2009) and addressing its negative impacts (Hameso, 2012).

Local institutions Kummo, (2016) play different positive roles in climate change adaptation. They (a) initiate, influence, and mediate the flow of external interventions in the contexts of coping, adapting, mitigating, and they (b) initiate, shape, and reshape the actions and abilities of households and communities to respond to climate impacts and to pursue different adaptation practices. At a practical level, local institutions play a multitude of adaptation roles, which exhibit interchanged and integrated features. Some of them supply climate-related information (informative role), while others disseminate it (broadcasting role). Still, others do work on preventing climate crises (protecting role) IPCC, (2014) promoting resilience Nunes (2016), and smoothening crises (Mubaya and Mafona, 2017 and Christopher, 2011). Three types of local institutions relevant to adaptation can be defined: civic, public, and private in their formal and

informal forms. They shape the livelihoods impacts of climate hazards through a range of indispensable functions they perform in rural contexts: information gathering and dissemination, resource mobilization and allocation, skills development and capacity building, providing leadership, and networking with other decision makers and institutions. This is because vulnerability to climate change is socially and institutionally determined, even when provoked biophysically. This is why adaptation to the inevitable impacts of climate change is unavoidably local, and it is also why local rural institutions have a critically important role in promoting effective adaptation and enhancing adaptive capacity of vulnerable rural populations.

- **Local public institutions:** local governments, local agencies (extension services and other arms of higher levels of government operating at local levels).
- **Civil society institutions:** rural producer organizations, cooperatives, savings and loan group
- **Private institutions:** service organizations such as NGOs and charities, private businesses that provide insurance or loans.

The more these institutions are synergetic and harmonized in terms of the roles and culture they share among and between them, the better their outcome becomes. This mode of functioning is commonly referred to as functionality Difalco and Erwin, (2009), and its absence is called dysfunctionality. Institutional arrangements are known (Sach, 2008, IPCC, 2007, Christopher et al., 2017) to account for people's success or failure to adapt to their planning and to adapt to their vulnerable state. Similarly, various environmental anthropology literature (Mubaya and Mafona, 2017, Korkiet *al.*, 2017, Difalco and Erwin, 2009) advocates for the use of community-based institutions for climate change adaptation at a local level as a point of entry while recognizing the leading role of public institutions (Sach, 20008 and Young *et al.*, 2008).

2.2. Impacts of Climate Change and Roles of Local Institutional in Ethiopia

Local institutions could play an important role in enhancing social value in the community. One important social impact of local institutions is the development of social capital which can be built and developed through social interactions among social actors. Climate change is the greatest developmental challenge of the 21st century (IPCC 2007). Its impacts are far-reaching and, to varying degrees, potentially very damaging to all nations, sectors and communities.

Climate change undermines the gains accrued from development investments and hits the poorest and most vulnerable sections of the society hard.

Especially in semi-arid and arid areas of developing countries its potential impact could reverse the economic contribution of vulnerable sectors to the national development and put additional pressure on fragile resources. By constraining the productivity of critical livelihood bases, such as agriculture, water, energy, wildlife and tourism, climate change would undermine poverty reduction endeavors. Developing countries are most vulnerable to climate change due to their low objective and subjective adaptive capacity, in addition to their heavy reliance on sectors sensitive to drought, flooding, epidemics, shortages of water, pasture etc. that are brought about or exacerbated due to climate change.

The majority of the sub-Saharan African population is dependent on rain fed farming and/or pastoralism, which are sensitive to climate change. Among social groups, the poor, women, the elderly and children would suffer the most from climate change (Ayal and Muluneh 2014; Aklilu and Alebachew 2009; IPCC 2007). Food security will severely be compromised by climate change (ESAP, 2013). Thus, the poorest of the poor in rural areas with the least financial, institutional and technological capacity to adapt to climate change would bear the brunt of climate extremes (IPCC 2007).

Ethiopia is among the most affected countries by climate extremes. For instance, severe drought that occurred in 1958, 1965, 1973, 1984, 1992, 2002, 2006, 2010 and 2011 (Hassan 2006; Desta et al., 2002) caused substantial damage to the livelihood of its citizens. Frequent and severe drought, especially in the northeast, south and southeast lowlands and northern highlands of Ethiopia causes extensive damage to livestock and crop production. It jeopardizes food security, availability and access to pasture and water (Destaet *al.*, 2002; Littleet *al.*, 2012), thereby causing extra resource commitments to manage livestock and crop production (Ayal and Muluneh, 2014).

Ethiopia facing recurrent and severe climate-change-driven droughts that have subsequently resulted in chronic food insecurity and mass hunger (Hameso, 2012, Mathewos, 2019). In particular, climate change is becoming one of the major development challenges in the Bilate Basin Agro pastoral Livelihood Zone of Sidama (Hameso, 2012, Kummo, 2016, Ragassa, 2011).

The high poverty rate and fragile ecologies, as well as bad governance, have created Ragassa, (2011) a situation where farmers and pastoralists are highly sensitive to even a relatively small rainfall decrease. These factors combine to create high vulnerability to drought and associated food insecurity (Mathewos, 2019). This situation appears to have been exacerbated over the last half-century with the addition of the changing climate (Christopher *et al.*, 2011). As a response, Ethiopia's national government has been striving to address the observed impacts of climate change through policy instruments based on assessments conducted at a national level. The level, types, and associated risks of climate change and variability vary across times and space, as does its derivative impact. Therefore, at a local level, there is a critical need for information about climate change and trends, change-driven impacts, and local institutions' roles concerning local-level adaptation.

2.3. Local Institutions for Climate Change Adaptation and Rural Development

Adaptation to climate is inevitably local social institution plays they structure impacts and vulnerability, they mediate between individual and collective responses to climate impacts and thereby shape outcomes of adaptation, they act as the means of delivery of external resources to facilitate adaptation, and thus govern access to such resources (Agrawal 2008:2). In examining the role of rural institutions in adaptation, it is necessary to pay attention to three sets of factors: their nature and goals, patterns in how specific types of institutions facilitate particular types of adaptation strategies, and their linkages with each other and with different rural households. An understanding of the above three aspects helps identify the characteristic features of institutions relevant to successful adaptation outcomes. It plays three general roles in relation to climate variability and change: structuring risks and impacts, acting as links between individual and collective actions, and mediating external interventions (IPPC, 2018).

Although households and communities have historically adapted to climate variability through many different strategies, their capacity to adapt depends in significant measures on the ways institutions regulate and structure their interactions: both amongst themselves and with external actors. All adaptation practices depend for their success on specific institutional arrangements -- adaptation never occurs in an institutional vacuum. They all, thus, depend on clear property rights and other institutions that regulate access to resources and exposure to risks. Storage requires physical infrastructure, but it also depends on institutionalized monitoring and

Sanctioning in case of individual or collective infractions of rules governing storage. Mobility can take place only with adequate information about the spatial and temporal structure of variability in precipitation and range productivity. No wonder many indigenous pastoralist systems developed strong norms of information storage and exchange (Agrawal 1999, Nyong^{*et al.*}, 2007).

Indeed, the role of institutions at multiple scales, including local contexts, is broadly accepted in many analyses of climate and adaptation (Batterbury and Forsyth 1999, Thompson *et al.* 2006, Young and Lipton 2006). Specific studies focusing on themes such as water conservation, agricultural development, rural livelihoods, forest governance (Adger 2000b, Droogers 2004, Naess 2005, Shepherd *et al.*, 2006, Ziervogel, 2003) have all identified local institutions as being key to adaptation. And yet, relatively little of the existing work has undertaken a careful or systematic analysis of the different types of institutions relevant to climate hazards-related adaptation, the different roles of local institutions in the context of adaptation, or the features of institutions most important for successful adaptation in rural contexts in the developing world (but see Bakker 1999, Tompkins and Adger 2004).

Local institutions are obviously critical to adaptation. The relative absence of systematic, comparative work to enable targeted policy initiatives that can strengthen local institutions and enhance adaptive capacity is therefore all the more striking. Undertaking such an analysis would require significant empirically based research on a selected, comparable set of adaptation projects. However, it is still possible to identify a basic institutional typology relevant to local adaptation efforts, the types of roles local institutions perform in relation to the broad classes of adaptation strategies identified in section three, and begin to focus on some of the factors presented in the institutional literature as leading to improved institutional performance. This section makes an initial attempt along these three directions.

2.4. Role of Local Institutions in Climate Change Adaptation

Local institution play great role to adopt climate changes, these included, tree planting and reforestation, selection of appropriate crop varieties, better implementation of forest laws, soil and water conservation, construction of drainage, controlled burning, community-based organizations, logging ban, coordination among local government units, information sharing, development of water sources, research and capacity building, provision of relief goods, creation

Of task forces, and infrastructure repair and construction. More interestingly, local governments saw themselves playing a key role in ensuring the success of adaptation measures in different sectors such as water and forest. The most important concern the need to examine the trade offs across adaptation options, involve community members to lower costs of interventions, and effectively represent local needs to policy makers and external actors. (Source: Lasco et al., 2006).

Mitigation and adaptation are two fundamental societal response options to deal with the problem of climate change (IPCC, 2001; Füssel, 2007; de Perthuis *et al.*, 2010; Locatelli, 2011). These two methods have not been treated symmetrically in the context of implementation of actions to address climate change. If mitigation has traditionally received much greater attention in the climate change community, both scientifically and from a policy perspective, adaptation has been for a long time ignored in the debate on climate change (Füssel, 2007; de Perthuis, 2010). But the realization that the climate will change anyway (Meehl and Stocker 2007), in spite of mitigation policies conducted at the international level, made the adjustment all the more urgent, especially at local level (Füssel, 2007; de Perthuis *et al.*, 2010).

Indeed, climate is already changing due to anthropogenic greenhouse gas and aerosol emissions, which affect average climate conditions as well as climate extremes (Hegerl and Zwiers, 2007). Also, the climate will continue to change for the foreseeable future and the rate of global warming in the next few decades is projected to be substantially faster than in the last few decades (Füssel, 2007; Meehl and Stocker, 2007). From then on, there is needed to focus the debate on adaptation measures to climate change for preparing communities including the most vulnerable systems to cope with its impacts. But, because of the multiplicity of authors who reflect on the issue of climate change, the definitions adopted the concept of adaptation are diverse.

According to IPCC (2001), adaptation is an adjustment of natural or human systems in response to actual or expected climatic stimuli or their effects, in order to mitigate the harm or exploits beneficial opportunities. De Perthuis (2009) in turn defines adaptation to climate change as the set of organizational changes, localization techniques and operated by the communities to limit the negative impacts of these changes and maximize their beneficial effects. But just as vulnerability, adaptation is not a single action, to move from one stable situation to a new

situation, different but stable as well. It is a dynamic process as its main determinant, that is, climate is always changing and evolving. For Füssel (2007), adaptation to climate change is a continuous process. Indeed, the in coming decades or even centuries, societies will be faced with a climate increasingly fickle and unpredictable with most atrocious consequences. Thus, it is important to consider adaptation as a transitional permanent and long-term process; an adaptation plan of a few years being one step in this process (de Perthuis *et al.*, 2010).

In addition to the diversity of definitions, adaptation to climate change reverts forms of action also applies in a wide variety of contexts and sectors (de Perthuis *et al.*, 2010). According to him, two forms of adaptation can be distinguished: reactive adaptation and proactive adaptation. The first is to respond *ex-post* to the adverse impacts of climate change. The second on other hand is to act before the impacts occur to reduce vulnerability to these impacts and mitigate its adverse consequences or reap the benefits new. The anticipatory adaptation uses resources today to prevent possible crises in the future or reap the benefits of climate change (de Perthuis *et al.*, 2010). But whatever its form, adaptation can lead to undesirable results in helping to pervert the climate and increase the vulnerability of ecosystems.

As defined by the IPCC, (2014) adaptation is “a change in natural or human systems leading to increased vulnerability rather than reducing it”. So, it is necessary to conduct an assessment of the options used for consistency adaptation to minimize the adverse consequences of adverse events. But because of the increasingly inevitable of climate change, it is required to implement adaptation policies in complementarily with mitigation. Indeed, it is increasingly realized that mitigation and adaptation can yield better results if both strategies are seen as complements. The two approaches are, therefore, necessary. Mitigation is an intervention to reduce greenhouse gas emissions or enhancing their sinks (IPPC, 2014). So it is a preventive measure to stop the degradation of the environment and mitigate negative consequences.

2.5. Institutional Linkages: Access and Articulation

The capacity of particular institutions is obviously important in how they affect adaptation. But equally important are the interconnections of institutions in a given location. Institutional linkages are critical to adaptation because of the ways in which institutional linkages affect flow of resources and influence amongst themselves and to households and social groups. Institutional linkages can be of two types. One type of linkages can be defined as institutional access.

Households and social groups in a given territory or village have different degrees and types of links with the institutions in that location. Some households may participate in the meetings, day-to-day functioning, and decision making of a rural institution. Other households may be unconnected. Some households may benefit as a result of their connections or of institutional policies. Other households may be left untouched. Some households may work to shape what an institution does. Others may try and fail, or not even try. The degree and type of access of households to different institutions will affect the nature of benefits they gain from these institutions.

Another type of institutional linkage refers to those that institutions have with each other. These linkages can be called institutional articulation. Even if there are multiple rural institutions in a given location, the nature of their impacts on adaptation will be very different depending on the degree to which they are connected, whether and how they coordinate their actions and responses to climate hazards, and how they articulate with institutions and resources outside their immediate area of operation. Institutions without any link to other institutions usually an empirical impossibility or with conflictual links to other institutions are likely to be far less effective than those with multiple positive links with other institutions

The importance of institutional articulation has already been implicitly indicated in which points to co management, public-private partnerships, and private-social partnerships as being potentially highly relevant to adaptation to climate change. But given the importance of institutional linkages, it is crucial to use analytical tools that can help identify, visualize, and analyze institutional access and articulation. Social network analysis provides useful tools for this purpose. A better understanding of institutional linkages – both access and articulation – is essential to gain a grasp on how local rural institutions are likely to shape adaptation practices and responses in any given context. Such mapping provides a sense of the possible synergies among existing institutions, key entry points for external interventions, identity of key institutions and their capacities, the nature of flow of resources across institutions and from institutions to social groups, and thereby identify the appropriate leverage points for channeling resources for adaptive development in a given context. In contrast, much existing institutional analysis rarely attends to the nature of links among institutions and social groups, instead focusing upon specific institutions and their individual capacity.

2.6. Factors Promoting Better Institutional Performance for Adaptation

➤ Characteristics of Institutions

- Organizational rules are simple and easy to understand
- Broad local involvement in organization and its rules
- Fairness in resource allocation
- Clear mechanisms for enforcing rules
- Clear, broadly acceptable mechanisms for sanctioning rule infractions
- Availability of low cost adjudication
- Accountability of decision makers and other officials

➤ Characteristics of the Context of Institutions

- Mechanisms for dissemination of new technologies and training in their use
- Favorable returns for products sold in markets
- Central governments facilitate the functioning of local institutions by
- Creating effective support for sanctions used by local institutions
- Provide necessary support in terms of information, finances, and skill development
- Develop indicators of performance against which institutions can be assessed over time
- The network of institutions present in a context and their links with different social groups

➤ Characteristics of groups served by the Institutions

- Clearly defined boundaries of the group
- History of successful shared experiences; existence of social capital\
- Appropriate leadership that changes periodically– young, familiar with changing external
- Environments, connected to local traditional elite
- Interdependence among group members,

Heterogeneity of endowments among group members, homogeneity of identities and interests (Agrawal, 2001, Baland and Platteau 1996, Ostrom 1990, Ribot 2002, Uphoff, Buck 2006).

➤ **Characteristics of the Ecological Context**

- Match between demands on ecological system and its output
- Information availability about the ecological system
- Possibility of storing benefits from the system
- Group dependence on resources available from the ecological system (Agrawal 2001, Baland and Platteau 1996, Ostrom 1990, Ribot 2002, Uphoff and Buck 2006, Wade 1994).

2.7. Perception and Adaptation to Climate Change

2.7.1. Climate change perception

In agrarian communities, the linkage between agriculture and climate is much more complex than others, and farmers are able to identify specific and important weather patterns. Farmers usually base their crop and other production decisions using local knowledge systems which are developed from years of observations and experiences. Local knowledge forecasts provide more than just information about the forecast. They provide a set of behavioral rules that households and communities follow when certain indicators are or are not observed. Predicting climate is also an important cultural component for farmers (Burton et al., 1992). According to Maddison (2007), perceiving change and then deciding whether or not to adopt a particular measure is process in climate change adaptation. Whenever they have the opportunity, farmers tend to adopt new variety of measures or technologies in response to the perceived changes of weather conditions. The supports from extension workers, information gained and technologies available to them will highly influence their adaptation and response capacity. For instance, farmers use water conservation techniques whenever the rainfall patterns are changed and amounts of rain are reduced. They tend to plant different crop varieties and use short term crops with adjustment of planting dates. These adjustments are done when they perceive reduction in rainfall and changes in the onset and offset of rainy seasons. For poor farmers, adaptation strategies to climate change are vital because failure to take adaptation measures could lead to social problems and displacement (Downing et al., 1997).

To approach the issues of climate change appropriately, the local communities' or farmers understanding and level of awareness about climate change is determinant factor. Farmers perceive climate change as having a strong spiritual, emotional, and physical dimension (Apata et al., 2009). The study by Benedicta et al. (2010) showed that farmers are well aware of climate change, but few seem to actively take steps toward adjusting their farming activities. According to Temesgen et al. (2011), majority of farmers were able to recognize that temperatures have increased and there has been a reduction in the volume of rainfall, still few farmers' lack the perception of change in climatic condition of their area to take steps to adjust their farming activities. The degree of farmers' perception on climate change also depends on its impact on farmers' livelihood, their social, institutional and economic background. It is different and depends mainly on level of education, livelihood activity, location and age.

2.7.2. Adaptation Strategies to Climate Change

Over the coming decades, climate change impacts on agriculture are likely to increase due to greater climate variability, and increased frequency and intensity of extreme events. Policy makers have largely focused on tackling climate change through mitigation of human induced emissions of greenhouse gases and sequestration of carbon in order to address the expected pressures on the agricultural as well as other economic sectors. However, it is becoming widely accepted that mitigation alone is implausible to be sufficient as a climate policy (Pielke, 1998).

Adaptation and mitigation are two different policy responses to the issue of climate change. They are however inherently linked. Since mitigation measures alone will not be able to immediately avoid global warming, adaptive measurements are needed to avert the negative consequences of climate change at the short-term. On the long-term, mitigation measures will be able to avoid further warming or even reduce the effect (Parry et al., 2007). The main aspect of climate change adaptation constitutes building resilience which is the capacity of a system to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes (FAO, 2003). There are many different strategies that the farmers can implement to reduce the risk of climate change impacts. Farmers use different adaptation strategies that fit with the types of the problems caused by climate change

they faced. This is due to the fact that impact of the climate change is unevenly distributed over different geographic areas and hence the adaptation mechanisms also vary with types and level of the impact of climate change (IPCC, 2007). A number of adaptation strategies that the farmers used to reduce the impact of climate change are identified in different literatures. These include; changing planting dates, changing crop variety, mix crop and livestock production, planting short season crop, planting trees, decrease livestock, moving animals or temporary migration, change livestock feeds, soil and water management, change from livestock to crop production, change animal breeds, irrigation or water harvesting, and seek off-farm employment are among some of the several strategies available to enhance social resilience in the face of climate change (Bradshaw et al., 2004;Nhemachena and Hassan, 2007).

Studies carried out independently by Temesgen et al. (2009), the World Bank (2010), and Mengistu (2011) also showed that diversification, using different crop varieties, changing planting dates, planting trees, adoption of drought tolerant and early maturing crop varieties, changing cropping densities, water harvesting techniques, increased use of soil and water conservation techniques or soil erosion prevention programs, increased use of irrigation and or use of irrigation techniques, changing fertilizer application, pesticide application, applying different feed techniques, the pastoral system or the herd composition, improvement or rehabilitation of terraces, home-garden agriculture are among the common adaptation strategies farmers carry out in response to climate change.

2.8. Review of Empirical Literature

Different researches have been undertaken by scholars to understand farmers' perception to climate change, to explore adaptation strategies in response to these changes, and to investigate the determinants of perception and choice of adaptation methods. Results of these researches provided varied verification about farmers' perception and choice of adaptation strategies in their respective study areas.

2.8.1. Farmers' perception to climate change

Fosu-Mensah et al. (2012) conducted study on farmers' perception and adaptation to climate change in Sekyedumase district in Ghana. Results showed that about 92% of the respondents perceived increases in temperature, while 87% perceived decrease in rainfall over the years.

Even though the communities are highly aware of climate issues, only 44.4% of farmers have adjusted their farming practices to reduce the impacts of increasing temperature and 40.6% to decreasing rainfall, and mentioned that lack of funds as the main barrier to implementing adaptation measure.

A research was undertaken by Bryan et al. (2009) on adaptation to climate change in Ethiopia and South Africa which examined farmers' perceptions of climate change in Ethiopia and South Africa. The result showed that even though farmers perceived changes in temperature and rainfall, a large percentage of farmers did not make any adjustments to their farming practices. Belaine et al. (2013) also found that there are nearly unified perceptions of climate variability and change among gender and social groups.

A study has been conducted by Nega et al. (2015) on perception of climate change and its impact by smallholders in pastoral/agro pastoral systems of Borana, South Ethiopia. The results suggested that most participants perceived climatic change and its negative impact on agriculture and considered climate change as a salient risk to their future livelihoods and economic development. Different levels of perception were expressed in terms of climate change and the impact on traditional rain-fed agriculture. Age, education level, livestock holding, access to climate information and extension services significantly affected perception levels. Solomon et al. (2016) also undertook a research on perception and adaptation models of climate change by the rural people of Lake Tana Sub-basin, Ethiopia by employing Heckman probit and MNL models. The farmers' perceptions to climate change found to be statistically and significantly related to factors such as marital status, farm size, climate change information access and the level of income generations.

2.9. Conceptual Framework of the Study

This study was focused on assessing and identifying adaptation strategies by smallholder farmers' under the cause of climate change impacts and their interaction between different stakeholders to reduce this impact and farmers to adopt and used different climate change crop production adaptation strategies. This chain of interaction shows us to increase crop production by coping/adapting the current situation with minimum or reduced climate variability impact and government intervention actions for ultimately to come up with

Recommendation for what to do with these adaptation strategies. There was a need to evaluate the interrelationship and interactions of various factors revolving around the Adaptation strategies by smallholder farmers of the rural community.

However, the impacts of drought are different from one place to another. Hence, agricultural droughts are usually related to a period of low soil moisture caused by absence or reduction of precipitation. Therefore, this study was used a framework developed by the authors (Figure 1). Accordingly, the framework was highlighted the impact of agricultural drought on social and economic sectors. Particularly, smallholder farmers and livestock sectors. Drought events can affect household livelihood directly. As Figure 1 below shows that the effects of drought on a social dimension are probably experienced more severely because they directly human beings. The rural communities whose livelihoods are highly dependent on climate sensitive sectors are the most affected by drought.

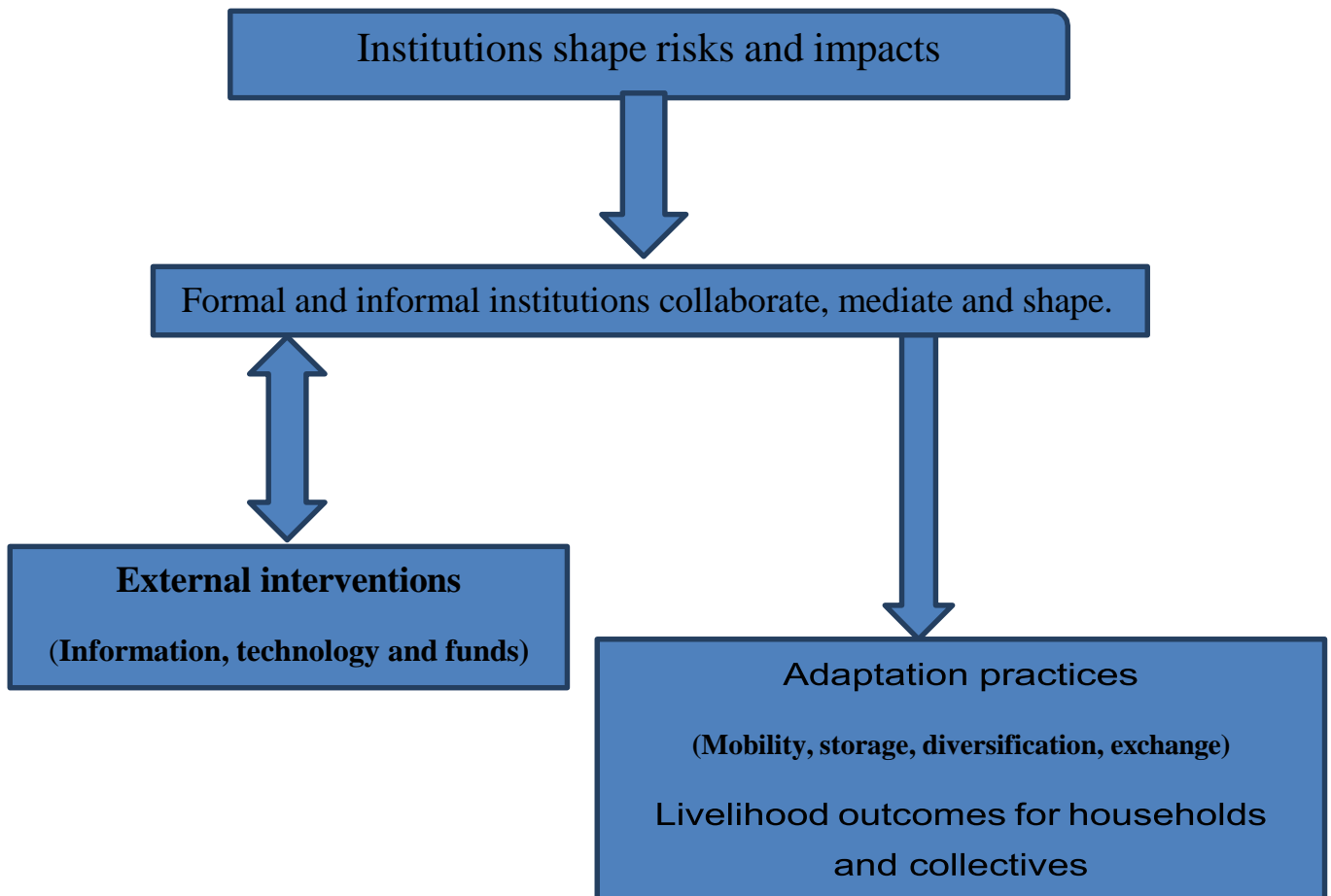


Figure 1. Conceptual framework

Source: (Adapted from Agarwal, 2008)

3. RESEARCH METHODOLOGY

This chapter contains the methodology which comprises, description of the study area, research design, target population, sampling technique and sample size, data types and sources, data Collection method, methods of data analysis, instrument validity, instrument reliability and Ethical consideration of the research.

3.1. Description of Study Area

3.1.1. Location and Size

The study was conducted at Haramaya Woreda, which is located 21 km Northwest of Harar town and 514 km East of Addis-Ababa the capital city of Ethiopia. It is one of the 20 Woreda of Eastern Hararghe zone of Oromia Regional State, Ethiopia. Astronomically, it is situated at $9^{\circ}00' 00''$ - $9^{\circ}36' 00''$ North latitudes and $41^{\circ}48' 00''$ - $42^{\circ}18' 00''$ East longitudes (Figure 2). It has a total land area of 53,123 hectares. According to the information obtained from the Woreda Agricultural Development Office, it has 34 administrative rural *kebeles*.

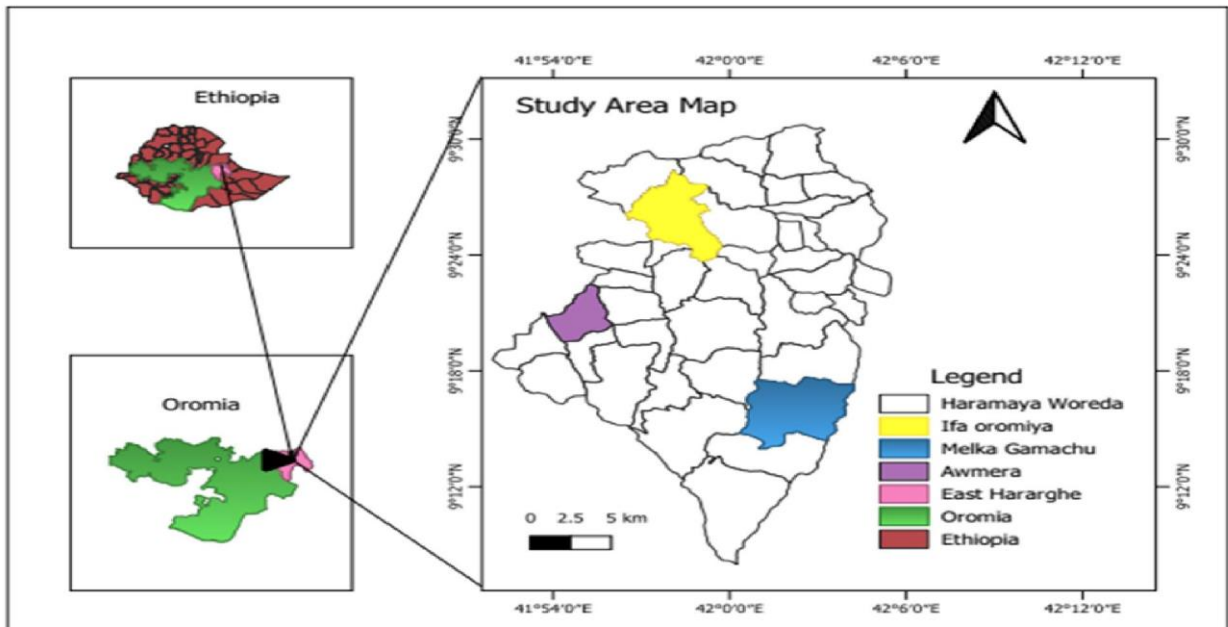


Figure 2. Location Map of the Study Area

Source: (Own Survey, 2023)

3.1.2. Socio-Economic Features

3.1.2.1. Population Characteristics

According to the population projection data of CSA (2013), the estimated total population of Haramaya woreda was about 361787 of which about 51% were male and 49% was female. Average family size for the woreda was five persons per household (CSA, 2013).

3.1.2.2. Economic Activities

Haramaya woreda dwellers are engaged in to primary, secondary and tertiary economic activities to sustain their livelihood, especially agriculture and trade. However, a woreda economic characteristic mostly representing agriculture economic activity which accounts 95% of total economic activities. While Only 5% of residents are engaged in non-agriculture activities. Moreover, the cereal crops most commonly grown are sorghum, maize, wheat and barley. Chat and vegetables are known as cash crops. Whereas, Cattle, goat, and sheep are among the livestock species reared by the community (Woreda Agricultural Development Office , 2021).

3.1.3. Relief and soil

The average altitudinal range of the woreda is between 1600 m and 2150 m above Sea Level. According to data obtained from woreda agricultural office. Rugged topography with large steepness, deep gorges and very small plain areas characterize the relief condition of the woreda. There are five types of soils in Haramaya woreda. The predominant soil types of the district are Rigo soil 60% and heavy black clay soils (Vertisols) 40% Soil texture is sandy loam (Woreda Agricultural Development Office, 2023).

3.1.4. Land use pattern and climate

Total 53,123 hectares of land, of which 22,533 hectares of land has been used for cultivations according to Woreda Agricultural Development Office, while according to data obtained from the University of Haramaya, the average monthly temperature of the Woreda ranges between 26⁰c and 4⁰c. It is characterized by a *Woina Dega* (59.3%) and *kola* (40.7%) agro-climatic zone that receives a mean annual rainfall of the woreda is about 678 mm. The rainy seasons start from March and last up to the end of November with maximum rain in summer season (June, July and August).

3.2. Research Design

The research design for this study complemented by proper techniques of data generation and collection methods that enhance reliable data and result of analysis. Data and information that collected addressed the objectives of the study. To achieve the research objectives a concurrent triangulation research design selected from other type of mixed method used in this study, because it helps the investigator to collecting both quantitative and qualitative data in the research procedure, analyzing the quantitative and qualitative data separately and combining the results together (Creswell et al., 2003 and Clark, 2017).

3.3. Target Population, Sampling Techniques and Sample size

3.3.1. Target population

The target population of this study was smallholder farmers of the three *kebeles* of Haramaya Woreda and local institutions that offer adaptation intervention to them. Institutions in the area such as agriculture development offices, Waltaha guddina cooperative, Badhadhina red meat (youth), Finxa bas red meat (farmers), Chaya tokkumma poultry, Balla community watershed, Jiru siresa (dairy cooperative), Abdi boru cooperative (RUSACO), Malka Gemachu multi-purpose cooperative, Bilisumma poultry youth, Gammachu red meat (female), Cooperative Union, Micro finance institutions, Rural Community Based Development Initiative, Equib, Idirs, PSNP (Productive Safety Net Program), SLMP (Sustainable Land Management Program) and CALM (Climate Adaptation Land Management) and others which were working in the areas were targeted for the study.

3.3.2. Sampling techniques

In this study, a two stage sampling approach was employed. At the first stage, three rural *kebeles* was selected out of 34 rural *kebeles* in the Woreda purposively based on agro-ecological sensitivity zones, food insecurity and the intensity of the impact of the climate variability and change like recurrent drought and erratic nature of rainfall (HWADO,2021). Accordingly, these three rural *kebeles Ifa Oromiya, Awmera and Melka Gemachu kebeles* were selected. The sample rural *kebeles* were selected based on the information obtained from elders, agricultural development office and other individuals proximity to the areas of the Woreda.

Second, using systematic sampling method, households particular households were selected from each of the three *kebeles* proportionally total household sizes. In this case the lists of the households were collected first from the *kebeles* office. An element of randomness was usually introduced in systematic sampling method by using random numbers to pick up the unit with which to start. This sampling procedure was useful when sampling frame is available in the form of a list. In such a design the selection process starts by picking some random point in the list and then every *n*th element is selected until the desired number is secured.

3.3.3. Sample size

The researcher selecting *n* samples of target respondents from the total population (*N*) of *Kebeles* by using the following sampling size. In this study, a simplified formula provided by Yamane (1967) was employed.

$$k = \frac{N}{(1+N(e)^2)} \dots\dots\dots \text{Equation (1)}$$

Where:

n = required sample size,

N = total household in three *kebeles*

e = precision level (sampling error) 5% (0.05), and

$$.k = \frac{1146}{(1+1146(0.05)^2)} = 296$$

Furthermore, in the study area, there are 45 local institutions within the three *kebeles* was purposively select a sample of 10 local institution which have total members of 1146 which consider having crucial role in shape risks and climate change impacts in the context of social ecologies in the form of formal and informal institutions by collaborate, mediate and shape adaptation practices to climate change impacts. Which means two *kebeles* from low land zone (*kola*) had a sample of 8 local institutions and one *kebele* from mid land (*woinadega*) had 2 sample local institutions (Table 1)? The total rural household heads residing in the three selected *kebeles* 5,499. Out of this, 1146 members of sampled 10 local institutions. Among this members 296 samples rural household heads were picked for household survey sampling. The choice of these three *kebeles* was obtained by Woreda Agricultural Development Office reports that they are usually the most affected by climate change (HWADO, 2021).

The sample size of household heads (n_1) proportionally for each rural *kebeles* using the following formula:

$$n_1 = \frac{N_1(n)}{\sum N} \dots\dots\dots \text{Equation (2)}$$

Where,

(n) = Total sample size

(N) = Total household heads size

n_1 = Distribution of sample size of household heads of each rural *kebeles*

N_1 = Total size of household heads in each rural *kebeles*

Therefore, 296 sample households head were selected by using probability proportional to sample size. Accordingly 111 households from Melka Gemachu *kebele*, 71 from Awmera and 114 was from Ifa Oromiya sampled for household from three *kebeles*.

Table 1. Geophysical characteristics of the study area

<i>Kebeles</i>	Climate	Total HH	Sampled Local Institution	TSS	SS
Melka Gemachu	Low land	1936	• Abdi boru cooperative (RUSACO)	160	40
			• Malka Gemachu multi-purpose cooperative	240	60
			• Bilisumma poultry youth	25	7
			• Gemmachu red meat (female)	10	4
Awmara	Low land	1323	• Waltaha guddina cooperative	197	57
			• PSNP	10	4
			• Finxa bas red meat (farmers)	21	6
			• Chaya tokkumma poultry(farmers)	10	4
Ifa Oromiya	Mid-land	2164	• Balla community watershed	360	80
			• Jiru siresa (dairy cooperative)	120	34
Total		5499	10 Local Institutions	1146	296

Where HH house hold, TSS total sample size, SS:-sample size

Source: (Woreda Agricultural Development Office, 2021)

3.4. Types and Sources of Data

In this study, both primary and secondary data sources were used. The primary data sources were collected from head of households, officials and experts. Sources of the secondary were from published journals, magazines, articles, documents, and websites. The primary data were collected from questionnaires, key information interview and field observation from 296 households. All the necessary secondary data were collected from relevant agencies, websites, published journals, magazines, articles and government office report documents as well as reports for the respective study areas. Seasonal and annual rainfall and temperature data of 1990-2020 was collected from National Meteorological Service Institute (NMSI) of Ethiopia .

3.5. Methods of Data Collection

Both quantitative and qualitative data were collected through questionnaires, key informants ‘interviews (KII), field observation and focus group discussion (FGDs). This method of data collection helps the researcher to combine the strength and adjust some of the inadequacy of any one of the sources of data.

3.5.1. Questionnaires

A household survey was conducted to investigate the role of local institutions to adapt climate change in the study area and factors influencing their strategies. The questionnaire was prepared in English and translated into Afan Oromo language then, it was distributed to respondents. Data that were gathered through this process includes 1) socio-economic profile of the respondents 2) perceptions households to climate change 3) role and types of local institutions 4) linkages of local institutions with others 5) smallholder farmers adaptation to climate change in the study area (Appendix I).

3.5.2. Key Informant interview

Key informant interviews were conducted to generate in depth information with regard to the role of local institutions to adapt climate change in the study area. A total of 31 key informants interview were conducted one from Woreda agricultural development office representative, one from Woreda cooperative office, 2 from each kebele local institutions that were working on the areas, one from each *kebeles* development agent and three local leaders, three model farmers were interviewed (Appendix II).

3.5.3. Field's observation

Direct field observation was undertaken to collect firsthand information. Both the biophysical and social environments in which households interact and respond was observed. This was utilized to gather data from respondents in the study area. Moreover, various pictures were captured for some observed situations. In addition, GIS technology was used for identifying the study areas and analysis. Information obtained in this process was used to cross check the data obtained by other data collection methods. (Appendix III).

3.5.4. Focus group discussion

Focus group discussion (FGDs) was used to generate data on group dynamics, and allows a small group of respondents guided by author, to focus on key issues of the research topic. For focus group discussions, after information obtained from elders, the researcher selected 21 respondents based on socially respected within the society and are known to have better knowledge on the present and past about climate change, frequency of drought, role of local institutions to adapt climate change in the study area. As such three different groups containing seven participants were conducted to generate information about impacts of climate change, local institutions to adapt climate change and linkages of local institutions with farmers and other in the study area. Seven participants were involved in each FGD. FGD was in each selected three *kebeles*. Moreover, household heads from different age groups, females, wealthy category, civic societies' representatives and educational status were constituted the members of the respective FGDs (Appendix IV).

3.6. Methods of data analysis

Data obtained from various sources were analyzed by using quantitative and qualitative data analysis techniques. Mann–Kendall test and Sen's slope estimates (MAKESSENS) was employed to test the trends of rain fall and temperature of the study area over the past thirty years from 1990 to 2020 (Kendall 1975). The Mann–Kendall (MK) trend test tool Gibbons *et al.* (2003) is commonly used, among other alternative models of trend analysis, to determine if a trend exists and to handle seasonal patterns' data. Unlike a parametric analysis, regardless of the normal distribution of the population (N) of the study, the nonparametric regression (Mann–Kendall's (MK) test) fits temporal scale changes of the units corresponding to each time. It was therefore

employed to test the rainfall and temperature trends of thirty years of east Hararghe drought-prone districts. Under the context of changing climate defined by the varying trends of rainfall and temperature, survey-based data were analyzed using descriptive (univariate) statistics under the STATA 16 version. On the other hand, PRA and other source-based data were analyzed issue-by-issue and theme-by-theme in such a way to ensure triangulation.

To examine the role of local institutions with their respective gains on livelihood assets of household heads, the study employed the binary logistic and multiple regression models contingent on the nature of the proxies used to represent the livelihood assets. The binary logistic regression models were used for livelihood assets characterized by dichotomous proxies while the multiple regression models were used for livelihood assets with quantifiable proxies

Descriptive statistics were run to give frequencies. Multiple response questions were also analyzed to give frequencies and percentages. Tables and graphs were also used to present different variables. Quantitative data which is collected from household surveys; Statistical Package for Social Science (SPSS) version 26 and Microsoft Excel 10 were used for the purpose of analysis of this data. Cross tabulation and chi-square methods were used in order to find out the degree of association of each independent variable to the dependent variable. The qualitative data, generated through focused group discussions (FGDs), key informants interviews (KIIs), and direct field observation was described and presented thorough discussion to supplement the household survey. The collected data from different sources were therefore organize into meaningful facts and made detail explanation.

Model specification: As it is mentioned above for the analysis of the data collected, binary logistic and multiple regression model was used. According to Ayele Tesema, (2008) , this model have been applied to test the effects of access to local institutions on the livelihood assets as well as the effects of selected livelihood assets on the welfare status of farming household heads. Before the application of the models, the multi collinearity of explanatory variables has been detected with use of variance inflation factor (VIF). Besides, the fitness of both models was checked and their P-values are less than 5 percent. During model specification procedure Alvi, (2016), the logistic regression model characterizing access to local institutions by the sample households is used as follow:

$$P_i = \frac{e^{Z_i}}{1 + e^{Z_i}} \dots\dots\dots (\text{Equ.3})$$

Where Pi is the probability of the support being provided for the ith household and Zi is a set of factors affecting access to institutions (Xi) and the level of participation (Ui) expressed as

$$Z_i = \beta_0 + \sum_{i=1}^n \beta_i X_i + U_i \dots\dots\dots (\text{Equ.4})$$

Where β0 is the intercept, βi are the slope parameters in the model and n is the number of explanatory variables. The null hypothesis was tested using the chi- square test of independence. This is because; this statistical test best determines the association between the distributions of responses to the outcomes across two or more independent samples. The chi-squared test was also performed to find out whether there was any relationship between age and gender to access to institutional support. The chi-square test was conducted using the formula:

$$X^2 = \sum \frac{(o-e)^2}{e} \dots\dots\dots (\text{Equ.5})$$

- Where, X2 = chi- square test
- Σ = the summation
- o = observed frequencies
- e = expected frequencies

Research Variables: According to Tadesse et.al., (2015), a variable is a measurable characteristic that assumes different values among subjects. They are therefore logical grouping or expression of attributes. DFID, (1999), indicate that variables help in moving a research from a conceptual to an empirical level, employing the variables as key elements of the research problem. Literature review on adaptation studies conducted in Ethiopia shows that, adaptation is dependent on variables such as household assets, markets and institutions. By these studies, households that have more access to any one or all of these resources were found to be able to adapt successively and vice versa (ibid). With these understandings and in line with the emphasis

of this study, the variables for the study comprised livelihood assets such as, human capital, financial capital, natural capital, social capital, physical capital and local institutions that are working in the areas are among others. Brief explanations are to be presented in the Table 2.

Table: 2 Livelihood assets and their selected indicators

Explanatory Var.	Description	Measurement
Human capital	Health problem/illness faced Farming training gained	Dummy: 1 for 'yes', 0 for 'no'
Financial capital	Access to credit Presence of saving habit	Dummy: 1 for 'yes', 0 for 'no' Dummy: 1 for 'yes', 0 for 'no'
Natural capital	Cultivated Farming land size in Hectares	Categorical: 0 for 0.01-2 hectares, 1 for > 2 hectares
Physical Capital	Total livestock unit	Categorical: 0 for 0-5, 1 for > 5
Social Capital	Number of social networks	Categorical: 0 for 1-3, 1 for > 3

Source

3.7. Definition of the variable

3.7.1. Dependent variables

The dependent variables of this study were the adaptation options that the farmers' was employed in response to climate change. The most common adaptation methods cited in the literatures include; different crop varieties, mixed crop, soil conservation, tree planting, changing planting date, diversifying from farm to nonfarm activity and irrigation (Hassan and Nhemachana, 2007, Deressa et al 2008).

Based on the literatures and investigator knowledge of the study area, the study used indigenous variables such as crop varieties, improving crop and livestock farming, soil and water conservation, irrigation and no adaptation.

Crop variety: This means that farmers can change the date of planting crops with respect to the drought (early or late planting) that survive in adverse drought conditions.

Improving crop: This includes planting of short duration crop, drought tolerant crop and improved variety.

Soil and water Conservation: Includes soil erosion preservation, management and care of soil in order to make it suitable for their crops, dam construction, conservation of rain water for watering the crops in times too little rain, ground water harvesting and agro forestry , etc.

Irrigation: Includes irrigation development from rivers or lakes in order to cope up with the challenges of climate change.

No adaptation: Is the other option that smallholder farmers may not response (not use an adaptation method) to climate change..

3.7.2. Independent variables

The independent variables are the factors that affect adaptation strategies to drought. Different literatures were reviewed on the factors that affecting farmer' strategies of adaptation method to drought. Majority of them have been focused on household characteristics, farm characteristics, institutional factors and environmental factors (Temesgen et al., 2009).

Accordingly, the investigator was conceding the following as exogenous variables i.e. factors influence farmers choice of adaptation strategies to drought.(Kurukulasuriya and Mendelsohn, 2008; Hassan and Nhemachena, 2008, Temesgen et al.,2009)

Age of the household head (age):- This is a continuous variable and represent the experience of household in the farming activities. This variable is resulted a positive sign.

Gender of the household head (sex): Gender is a dummy variable which indicate 1 if male household head and 0 for female household head. The expecting sign of this variable is indeterminate.

Level of education of the household head: This is the number of years spent by the head of the household for acquiring education and the expecting sign is positive. As the level of education of the household head increased the farmers' proximity for new information and the probability of accepting new technology also increase.

Household size: household size is the total family member of the household. Large number of family member can adopt the effect of drought easily. Therefore, it expected that household size had a positive sign for the farmers' who are use adaptation method to climate change. This variable is also a continuous variable.

On farm income (on farm): On farm, income is an income return to the household from farming activities. This is measure in the form of Ethiopian Birr. This is a continuous variable and expecting a positive sign for the farmers' who are use adaptation method to climate change.

Off farm income (off farm): this is an income of household obtains from outside of farming activities. For example, trade, remittance and governmental employer are among others. Such income is makes the farmers not to follow up or motives properly to agriculture. Therefore, the expect sign of this variable is negative for the farmers' who are use adaptation method to climate change and it is a continuous variable. This variable also measure in Ethiopian Birr.

Access to credit service (credit): The availability of credit is important for the farmers' in order to make adaptation strategies. Credit can be used as for the farmers to introduce new technology, to buy modernize crop, fertilizers and oxen. Therefore, thus was expected a positive sign for the farmers' who are used adaptation method to climate change and is a dummy variable indicating 1 if the farmers has access to credit 0 otherwise.

Agricultural extension service: This is a formal service and plays a great role that affects for farmers' to adopt strategies in response to climate change. This variable is also a dummy, which represent 1 if farmers' get agricultural extension service 0 otherwise and the expecting sign is a positive.

Farm size: - Farm size is the total landholding of the farm household that uses for the farming activities. The farm household with holding big farmland has more to use adopted and the farm size measure in terms of hectare. Therefore, the variable is continuous and it's expected is a positive sign for the farmers' who are use adaptation method to climate change.

Distance to the market:-This is a continuous variable, which measures in terms of time spend from the residence of farm household to the market area. The residences of farmers' are nearest to the market they get many opportunities as compare to the far ones. Because the nearest one obtains agricultural inputs, information has and experiences. Therefore, this is variable is expected a negative sign for the farmers' who are use adaptation method to climate change.

Access to climate information: This is dummy variable indicating 1 if the household head access to drought 0 otherwise. This variable is also expected a positive sign for the farmers' who are use adaptation method to climate change

3.8. Research Validity and Reliability

To ascertain validity of the instrument, the investigator addressed content and construct validity, extent to which the domain of interested was comprehensively sample by the items in the questionnaire. The time constrain could not allow a repeat of questionnaires to determine repeatability of the study. Measurements bias is a systematic error that affects the results of the study. If measurement issue not properly considered, it may affect the findings of the study. The questionnaire was translating into local language (Afan Oromo) from its English version then back to English with the guidance of a senior professional. Data collectors trained for two day on how the data collected and recorded. Data collectors are supervise while collecting the data by the principal investigator and other supervisor so that technical support provided accordingly. Data checked daily for completeness and consistency throughout the data collection period. In addition, double data entry also used to ensure data quality. Therefore, measurement error was less likely to affect the results and may not be a problem for this study

3.9. Ethical Considerations

Ethical issues are quite delicate in any research. In his endeavor to accomplish the research objectives, the principal investigator sorted for ethical approval from all relevant bodies, which includes Haramaya Woreda Administration Office, local institutions, rural *kebeles* administration being the epicentre of the survey area official letters of co-operation written to obtain their co-operation in facilitating the study. Informed consent was also sought from the respondents through an assurance that any information they gave was to be treated with ultimate confidentiality it deserves. Above all the investigator trained his two research assistants on the vital roles Ethics plays for two days before embarking on data collections.

4. RESULTS AND DISCUSSION

In this chapter, the findings of the study and their logical interpretation have been presented according to specific objectives of the study in the three sections. The first section describes smallholder farmer's perception of climate change in the study area. The second section describes the role of local institutions and the challenges to adapt to climate change in the study area. The last part presents findings on the linkage between local institutions and with different rural households in the study areas. Findings are presented as follows in the following sub topics below.

4.1. Demographic and Socio economic Characteristics of Sample Household Heads

4.1.1. Sex, age and marital status of respondents

As the data revealed in (Table 3), the results of the study revealed that among the total 296 surveyed households, the majority of the households 74.% were male headed and 26% were female headed households. Marital status of household is one aspect of determining demographic characteristics of sampled households. Among these respondents, 86.5% were married, 2% were divorced. 1% of were single and 10.5% were widowed. In terms of age of the respondents, about 22% of respondents are aged between 50 to 54 years,. 2% of respondents are aged between 20 to 24 years while 7% of respondents are aged 25 to 34 and the remaining 10% of the respondents are aged above 65 years old respectively. The youngest household head that was interviewed was aged 24 years whilst the oldest was aged 68 years with a mean age of 46 years. Age was considered as a proxy to the farming experience of the household, which was likely to have a significant influence on choice of crop production adaptation strategies to climate change and variability. The findings of the study showed that the average age of the respondents indicated the existence of productive work force in the study area .

Table 3: Sex, age, and marital status of the respondents

Sex of respondents	Frequency	Percentage
Female	77	26
Male	219	74
Total	296	100
Age of respondents		
20 – 24	7	2
25- 34	21	7
35 – 44	46	16
45- 49	85	29
50 – 54	65	22
55 – 60	43	14
> 65	29	10
Total	296	100
Marital status of household heads		
Married	256	86.5
Widowed	31	10.5
Divorced	6	2
Single	3	1
Total	296	100

Source: (Household Survey, 2024)

4.1.2. Family Size of Respondents

Around 68 % the average household size of the respondents lies between seven to eight people per household in the study areas, and 21% household size of the respondents' lies between five to six peoples. While the rest have between one to four household members. The sampled households have generally large household size. As the data revealed on the Figure 3 below, with regards to family size of the respondents in the study areas 52% of households have 7 to 8 people. Generally, high and low family sizes have different impressions to show the effect droughts induced disaster.

The findings of the study revealed that on average, approximately 7 members with an approximate composition of 4 males and 3 females. The findings of the study further revealed that average family size was above the national household size average (4.6 or approximately 5 persons) (CSA, 2013).

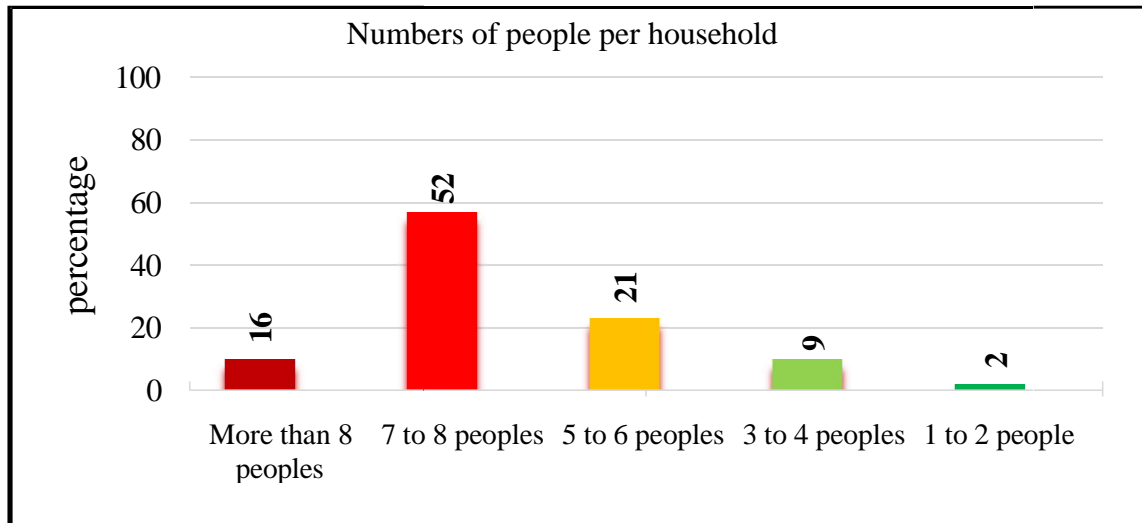


Figure 3. Family size of the respondents

Source: (Household Survey, 2024)

4.1.3. Educational status of respondents

Educational level of sampled household heads was believed to be an important feature that determines the readiness of the household head to accept new ideas and innovations regarding climate change and variability. Pertaining to educational status of households in the study areas 0.8% of the households had attained tertiary (College, University), 2.2% of the households had attained secondary education, while 10% of the households had a primary level education and the majority (about 87%) unable to read and write. The findings shown in Figure 4 revealed that the majority of the respondents unable to read and write may entail to lack of some fundamental knowledge and skill, which may lead to facing socio-economic difficulties, such as difficulties in making key and informed decisions and choice in their production and marketing activities. Moreover, the lack of ability to read and write may deter the farming households to adopt new means of agricultural production on which their livelihood mostly depend on.

Even though education is very important in developing a community that is resilient to drought impacts, the majority of the households were illiterate, This finding a correspondent with the finding of Nori and Davis (2006).

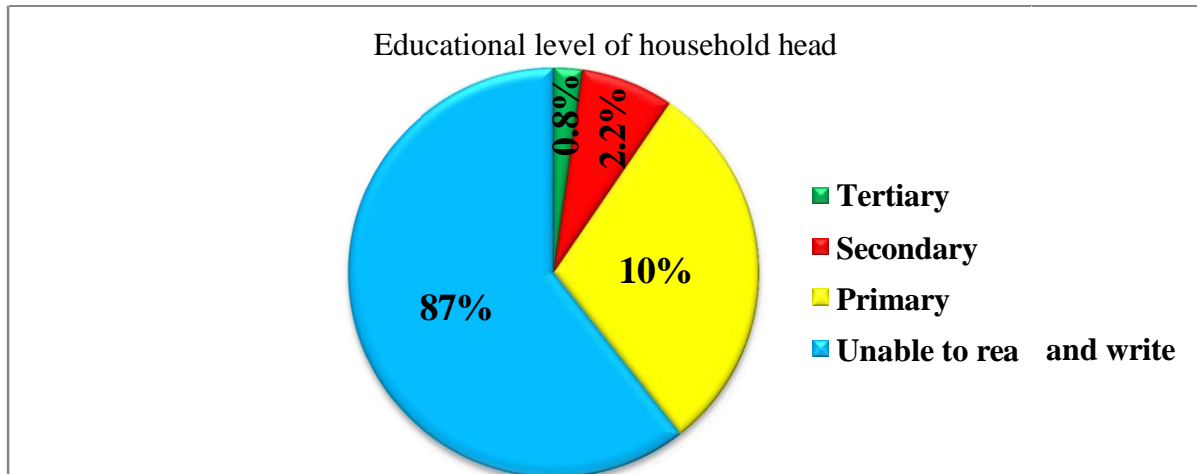


Figure 4. Educational background of the household head

Source: (Household Survey, 2024)

The lack of ability to read and write may deter the farming households to adopt new means of agricultural production on which their livelihood mostly depend on.

4.1.4. Farm size (Landholding) of Respondents

Land is one of the most significant factors of agricultural production. Landholdings continually Diminished both in size (due to redistribution among family members) and quality (due to continuous cultivation leading to soil nutrient mining and erosion). Landholdings make the top in the list of productive public assets that rural smallholders see a greater potential to lift themselves out of poverty, ensure food security and promote rural development (Barrett et al., 2008). Landholding in that respect is very important to the households of the residents of the rural *kebeles* of Melka Gemachu, Awmara and Ifa Oromiya. The households in the study area were known for intercropping use of their land. However, the size of land is very fragmented and it differs among households in the study area. Based on the result of Table 4 belows, 21% of the households had one to more than one hectare of farm size. These contributed for high yielding. While the majority 47% of the households had 0.5 hectare of farm size. About 2% of

the households had the minimum landholding size 0.25 hectare in the study area. Small farm land size limit their level of income and application of adaptation strategies of households.

Table 4: Farm size of respondents in the study area

S/N	Farm size	Frequency	Percentage
1	>1 hectare	19	6
2	One hectare	46	15
3	0.75 hectare	88	30
4	0.5 hectare	138	47
5	0.25 hectare	5	2
	Total	296	100

Source: (Households survey, 2024)

In general, most of the respondents (79%) had farm land size less than one hectare. Based on their landholdings in the study areas, the households fit the definition of the smallholder farmer who owns land of less than one hectare (FAO, 2012).

4.1.5. Farming Practices and Sources of Income of Respondents

Although rural communities generate the bulk of their income from agricultural activities, they also engage in non-agricultural activities to obtain working capital to invest in their agricultural activities or complement their agricultural income (Barrett et al., 2008). Figure 5 below shows that agriculture is the major economic activity of the household heads in the study area. In the study area the key sources of income reported by household heads can be divided into three. These are namely, crop production only, livestock rearing only and mixed farming. Based on this farming practiced, mixed farming was the major kind of farming practiced in the study area.

Accordingly, 89.6. % of respondents was engaged in these practices. About 9.8% of respondents were engaged in crop production and 0.6% of respondents were engaged on livestock rearing activities in the study areas.

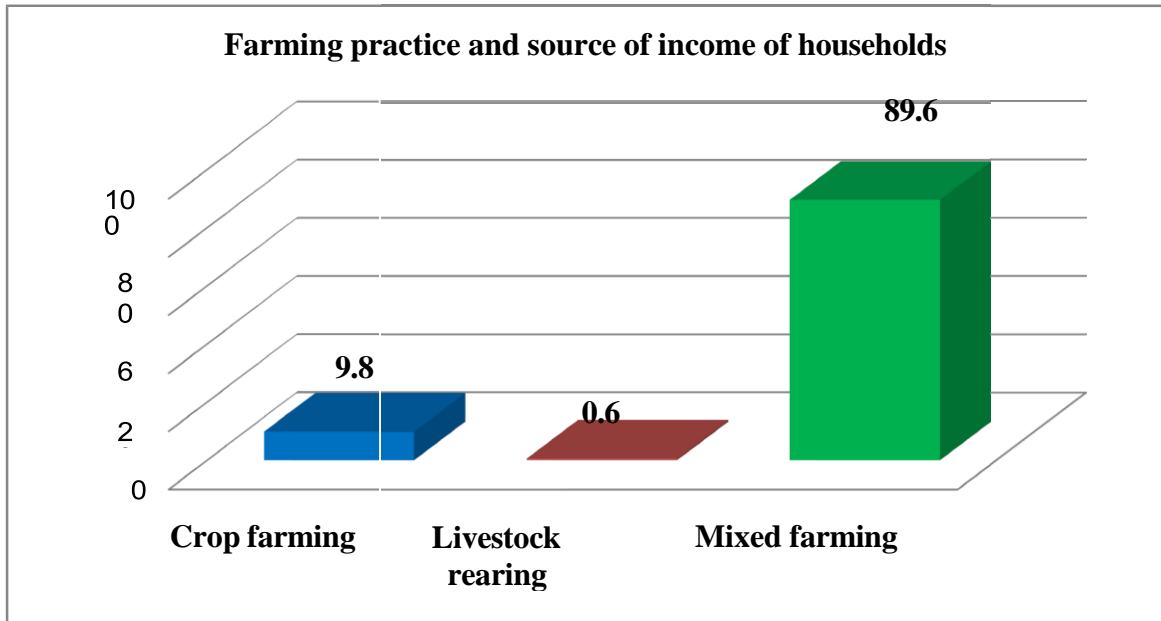


Figure 5: Farming practices and sources of income of households

Source: (Household Survey, 2024)

On the other hand, the households in the study area produce different types of agricultural products for their livelihoods. These include livestock (goats, cattle, sheep, donkey, chicken), cereals (sorghum, maize and rarely wheat), vegetables (chilli pepper and rarely cabbage and onion) and pulses (haricot bean and chick pea). They also produce oilseeds (mainly groundnut), chat and honey bee. The communities produce most of the agricultural products primarily for subsistence (self-consumption). chat and groundnut are mostly (90 to 95%) for commercial. Moreover, the households produce sorghum and maize as staple food (i.e., for self consumption). Evidenced by the discussion with the *kebeles* representative experts and farmers, as well as from FGD confirmed that households in Ifa Oromiya, Awmera and Melka Gemachu *kebeles* were produced more sorghum, maize, groundnut and chat among the common.

4.2. Smallholder Farmers' Perceptions of Climate Change in the Study Areas

4.2.1. Respondents' Perceptions on the Climate Change

According to the survey's results displayed in Table 5 below shows that, 92% of the sample's respondents had seen climate has totally changed during the previous three decades. Only 3% of the respondents stated that the climate had not changed, while the remaining respondents (5%) stated that they have no idea on climate change. The results from the survey indicated that the majority of farmers interviewed confirmed to the fact that they had observed some changes in the environment. Responses from local institutional heads about the climate pattern of the area indicated that, Melka Gemachu *kebele* is located in lowland areas, hence the weather/ climatic conditions of the area had always been harsh. However, currently the declining precipitation experienced by smallholder is a new scenario. In the case of lowland *kebeles* such as Ifa Oromiya and Awmera the majority of farmers experienced for the variability of rainfall in which smallholder agriculture is a recent practice. Responses received from the institutional interviews in which all the officers stated that, the area was experiencing some impacts of climate change. These changes, they stated were evident in the occurrence of flooding, crop loss, loss of soil fertility, in coming of unexpected rains, droughts, and higher temperatures. Both the FGD and KII results showed that the frequency and magnitude of the variation in climatic parameters have also been increasing over the last three decades, which indicated that climate change is a problem across space and over time as stated by stern (2006).

Table 5: Sample respondent's perceptions of climate change in the study areas

Respondents' Perceptions of Climate Change/ Variability	Frequency	Percentage
Climate has totally changed	272	92
Climate has not changed	9	3
I have no idea	15	5
Total	296	100

Source: (Household Survey, 2024)

On the other hand, about 20% (59) of the respondents stated that they had observed faster changes in the climate within the past five years. About 13% of this resided in Melka Gemachu *Kebele* whilst 17% resided in Awmara and 29% in Ifa Oromiya *Kebele*.

With respect to the smallholder farmers, increasing rate and frequency climate variability was evident. In the past, they used to experience drought in the range of 10 years, but now in less than 5 years. The households have diverse responses regarding climate variability (Figure 6). Respondents who stated that they had observed changes in the climatic patterns over the past 10 years were made up 20% (58) of the sample. A breakdown of respondents within this group by location revealed that, 28% of this figure resided in Melka Gemachu *Kebele* while 8% and 22% resided in Awmara and Ifa Oromiya respectively. Furthermore, 36% of the respondents stated that they had observed changes in the climate within the past two decades. The variability of the climatic variable has shown similar trends across *kebeles* although there were few difference in the proportion of the sample households. Accordingly, 42% of this resided in Melka Gemachu *Kebele* whilst 36% resided in Awmara and 30% in Ifa Oromiya *Kebele*. The result from survey indicated that from 6 years to more than two decades in Melka Gemachu *Kebele* was experiencing for impacts of climate change/ variability than the two study *Kebeles* as shown in Figure 6.

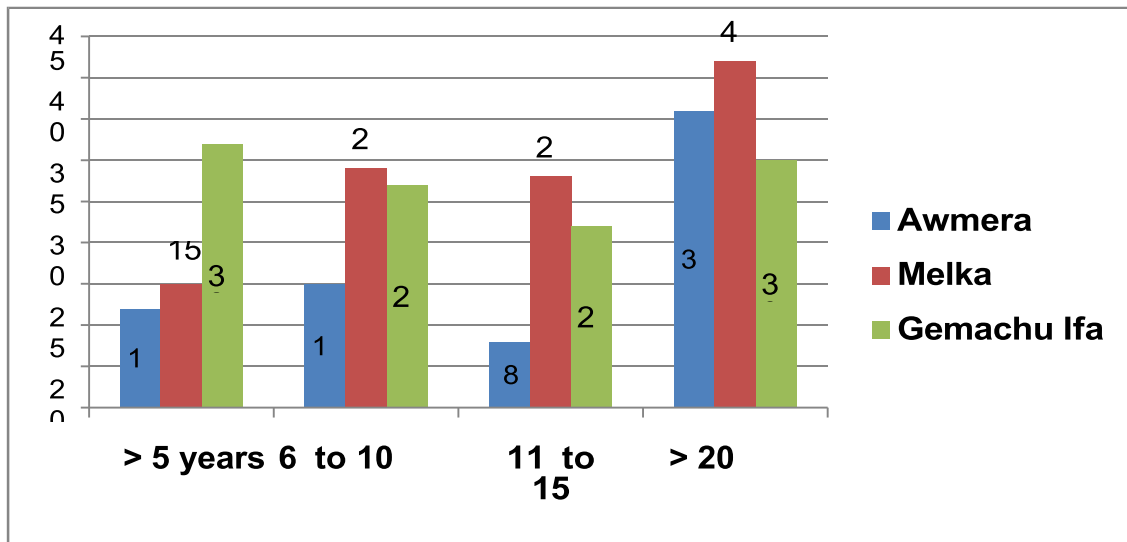


Figure 6: Number of year's respondents has observed climate changes **Source:** (Households survey, 2024)

The findings of this study also correspond to previous studies conducted in Ethiopia by Bekele (2020), which revealed that the the majority of farmers interviewed confirmed to the fact that they had observed some changes in the environment within the past two decades..

4.2.2. Trends of Climate Change and Variability from Rainfall and Temperature perspective

The researcher also questioned sample respondents' views on climate change and the fluctuation of temperature and rainfall size, distribution and timing. According to the survey's results, 90% of the sample's respondents had seen decrease in the amount of rainfall during the previous 30 years. Only 4% of the respondents stated that the rainfall had not changed, while the remaining respondents 6% stated that the rainfall had increased as shown in Table 6.

Table 6: Sample respondents perceptions of climate change from rainfall and temperature

Climate change and variability perception	Frequency	Percentage
Rainfall Distribution Perspective		
Irregular	256	86
Regular	5	2
I do not know	35	12
Total	296	100
Rainfall size		
Increased	19	6
Decreased	265	90
No change	12	4
Total	296	100
Main season rainfall timing shift		
Comes early and goes late	71	24
Comes and goes early	172	58
Comes late and goes early	53	18
Total	296	100
Temperature perspective		
Increased	264	89
Decreased	11	4
No change	21	7
Total	296	100

perspective in the study areas

Source: (Households survey, 2024)

Moreover, the data from the National Metrological Agency (NMA) showed the yearly annual rainfall decreased over time. The amount of rainfall received has shown continual reduction from

year to year, creating more scarcity of precipitation over years. The results from the Ethiopia National Metrological Agency data displayed in Figure 7 below also showed that, annual rainfall amount has decreased between 1990 and 2020 as shown by the trend line. Moreover, the year in 1990, 1991 1992, 1993, 1994, 1995, 1996, 2000, 2001, 2002, 2003, 2004, 2005, 2009, 2011, 2012, 2013, 2015, 2017 and 2018 were observed unfavorable rainfall distribution (Appendix Table 6). The outcomes revealed that large annual Variability of rainfall amounts and distributional patterns were observed in the study areas between 1990 and 2020, an average of 720 mm of rain per year was recorded. Accordingly, the lowest minimum total annual rainfall in the last thirty years was recorded was 320.9mm. while the maximum total annual rainfall was 1118.8 mm years was recorded. As expected, there is a wide range of variability in total rainfall. The amount of rainfall varied greatly within and between years, trend ($y = 7.353x + 656.8$, $R^2 = 0.098$). The results indicated that over the previous 30 years, the average annual rainfall had decreased.

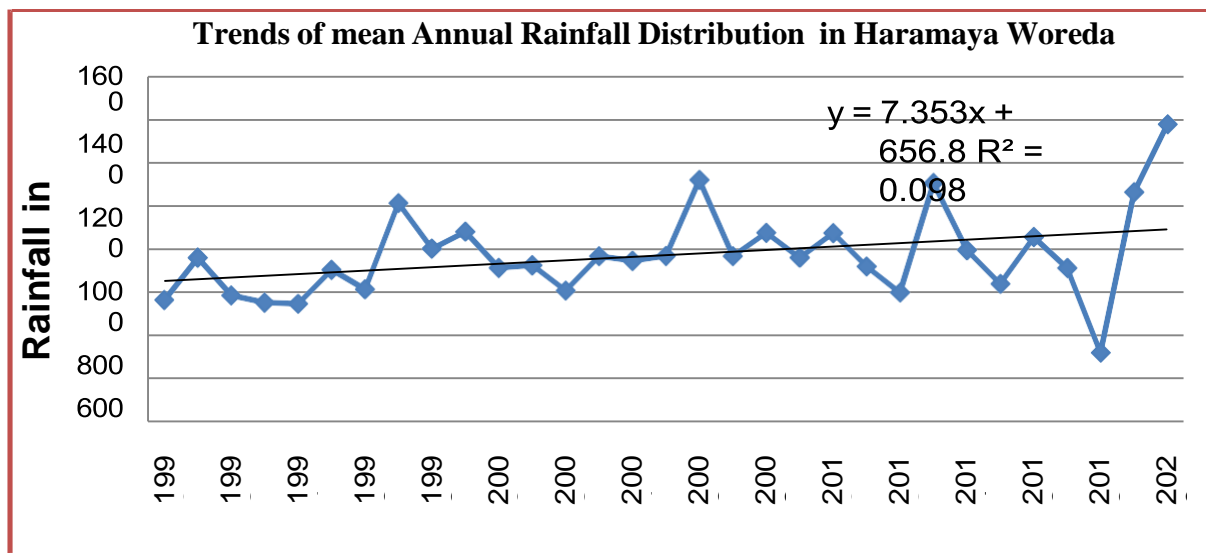


Figure 7. Trends of annual rainfall (mm) distribution from 1990 to 2020 in Haramaya Woreda

Source: (NMA, 2023)

This result is consistent with survey data results and findings from past studies (Amare et al. 2017). On the other hand, in term of the seasonal rainfall, in Ethiopia majority of agricultural production of cereals were employed during the *Kiremt* and *Meher* (Belg) season. Crop production of the country are based on the two rainy seasons (Kiremt and Belg) rainfalls that shares from 90- 95% from the Kiremt season and 5 – 10% from Belg season (Habtamu, 2018).

While the results indicated in Table 6, the vast majority of respondents (86%) observed irregularities in the pattern of rain, with all of respondents observed a shift in the timing of the rainfall throughout the main season; 18% noticing a late start and goes early to the rainfall, 58% comes and goes early and 24% noticing comes early and goes late. According to the survey, the majority of respondents believe that rainfall timing is altering during the main season and comes and goes early. The outcome of the seasonal meteorological data showed that seasonal rainfall were decreased in between 1990 and 2020 (Figure 8). Yearly seasonal rainfalls were dynamics in the study areas, because of variation of seasonal rainfall.

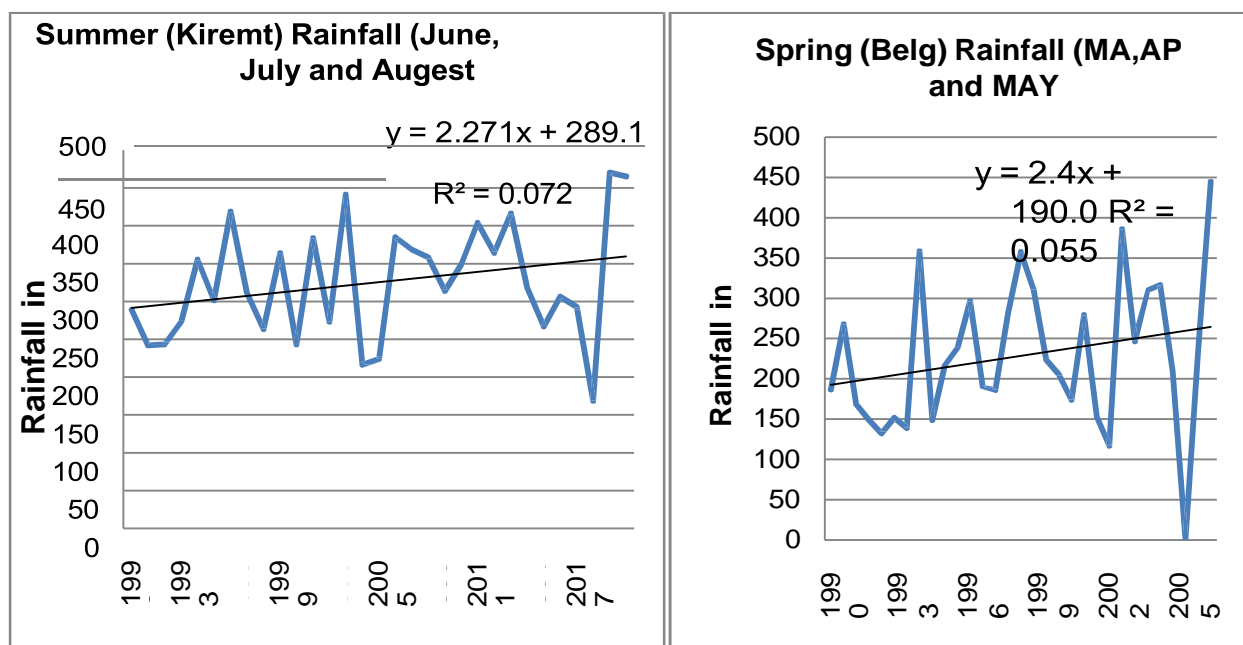


Figure 8. Trends of seasonal rainfall from 1990 to 2020 in Haramaya Woreda

Source: (NMA, 2023)

In general, extremely higher seasonal variability of rainfall during kiremt (summer) in months of (June to August) and Meher (Belg) season in months of (March to May) was observed in the study areas. Rainfall variability from season to season greatly affects soil water availability to crops, and thus poses crop production risks. The findings support the argument that, year to year agriculture is extremely vulnerable to climate variability. Higher temperature and rainfall decreasing eventually reduces yields of crop that rain fail comes and goes early than the usual causing erratic rainfall that reduced the yield (Seleshi and Zanke 2004).

On the other hands, according to the survey’s results, 89% of the sample’s respondents had seen an increase in temperature during the previous 30 years in Haramaya woreda as shown in Figure 9 below. Only 7% of the respondents stated that the temperature had not changed, while the remaining respondents (4%) stated that the temperature had decreased. The outcome of the meteorological data showed that the average yearly temperature has been rising over the last 30 years. This suggests that the average yearly temperature is increasing. Rising temperatures could also indicate the effect of reduced rainfall (water availability). This outcome is consistent with survey data (89% of sample respondents indicated a rise in temperature as well as the results of earlier research (Minwuye, 2017).

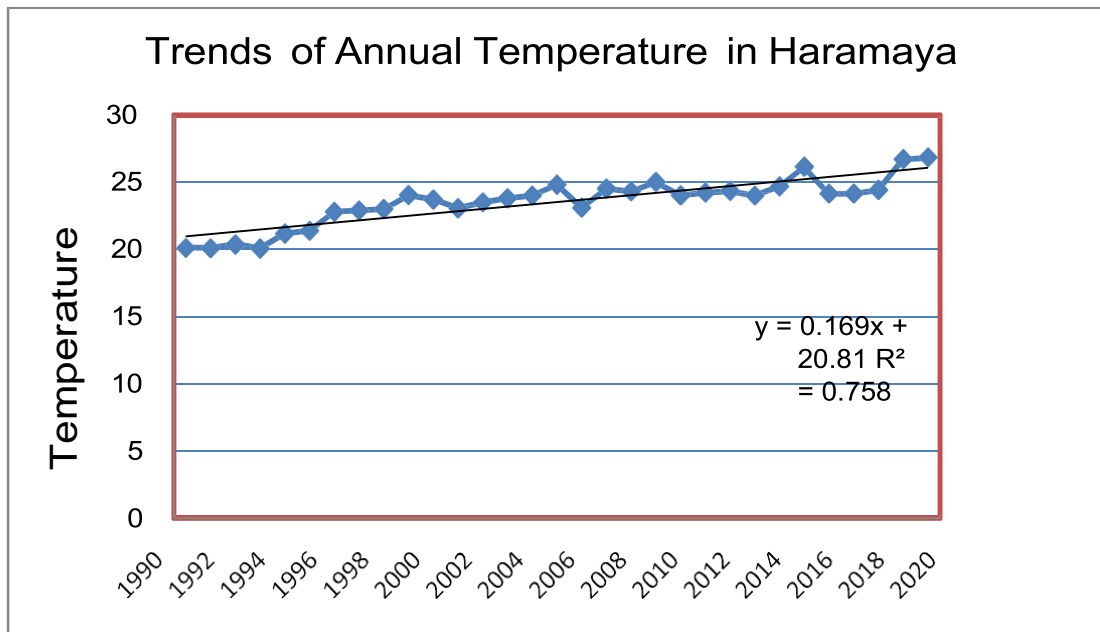


Figure 9. Trends of annual temperature from 1990 to 2020 in Haramaya Woreda

Source: (NMA, 2023)

In generally, the findings showed that the perception of respondents is found to be inline with actual climate data as recorded by the ENMSA, which revealed that temperature was increased while rainfall decreased over the last 30 years.

4.3. Respondents' Perceptions on the Causes and Effects of Climate Change in the Study Areas

4.3.1. Respondents' Perceptions on the Causes of Climate Change

When respondents were asked about the causes of changes in the climatic patterns as they were now experiencing it, 6% stated that, human activities called deforestation were to blame. Approximately 69% attributed the changes to God/sin, 5% responded that change in land use and land cover, while 8% blamed the cause were population growth, and the remaining 12% responded that, they have no idea about the causes as shown in Figure 10.

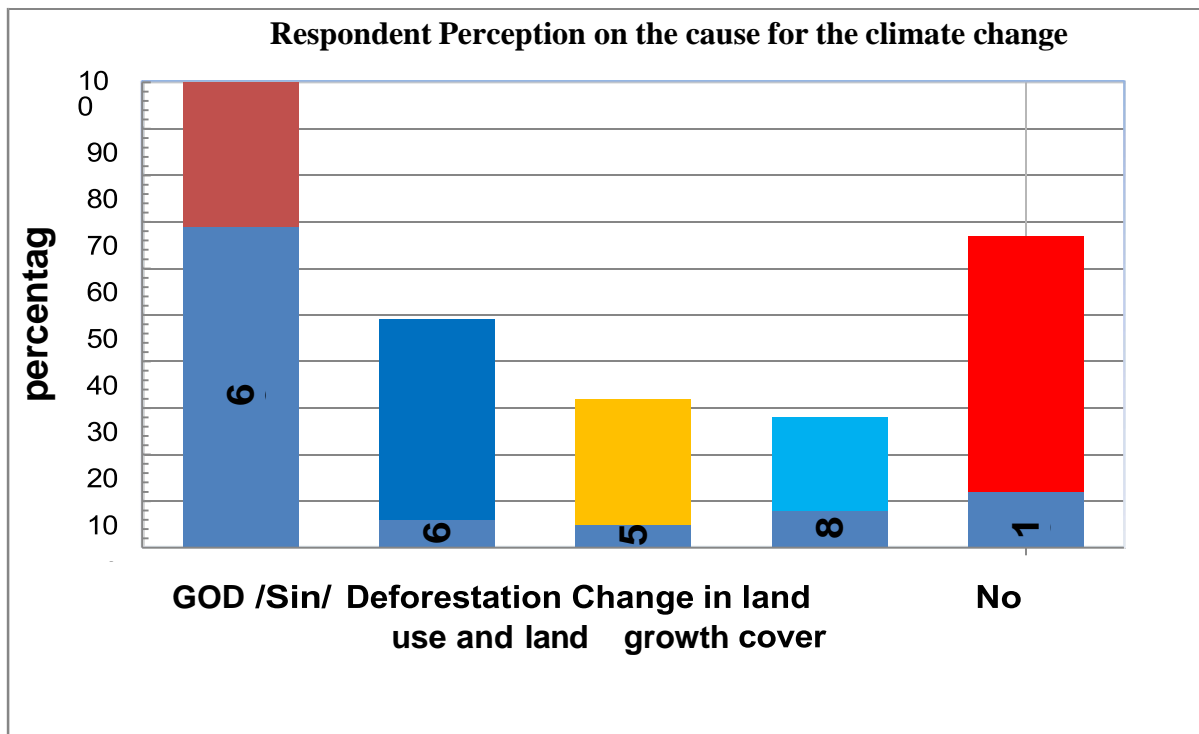


Figure 10: Respondents perceptions on the causes of climate change

Source: (Households survey, 2024)

Meanwhile, the majority of the respondents in the study *kebeles* were unable to read and write may entail to lack of some fundamental knowledge and skill, which may lead to facing difficulties to predicate the causes of climate change. The result is similarly with the study conducted by Bekele (2020), in Ethiopia which found that the majority of the respondents believed that the causes of climate change from the God.

4.3.2. Effect of Climate Change on Agriculture in the Study Areas

Agricultural drought is caused by an abnormal decrease in precipitation, and it is influenced comprehensively by land surface temperature, evapotranspiration, soil properties and physiological or ecological characteristics of the crop. Accordingly, the result from the study identified two broad categories of effect of climate change on agricultural production in the study areas. These are social and economic effect as shown in Table 7 below.

Table 7. Types of effect of climate change on farming activities in the study areas

S/N	Effect	Frequency	Percentage
1	Social	83	28
2	Economic	213	72
	Total	296	100

Source: (Household Survey, 2024)

4.3.3. Social Effects of Climate Change in the study areas

In analyzing the social effects of climate change in the study area, most respondents choose more than one effect stated on the house to house questionnaire and field observation. Accordingly, from the survey, 83 respondents were reported social effects of climate change.. The most common social effects of climate change observed in the study areas were health effect and spread of diseases. Regarding to health impacts and spread of diseases, during the survey, it was investigated that around 28% of the respondents in the study areas were exposed to health problems and spread of diseases. Accordingly, one of health problems frequently occur in the study areas was injuries, malnutrition of under <5 years children and lactating pregnant women were common in the three study *kebeles*. For example, Injuries can occur due to flooding while malnutrition can occur due to food insecurity. Furthermore, due to the prolonged inundation of water after flooding there was an outbreak of water borne diseases such as cholera and malaria. Apart from this, flood increasing debris and water stagnation for prolonged months causing community ill health in the areas. According to some of the respondents said that: *“Due to flooding the majority of communicable diseases which include cholera, malaria, common cold and dysentery were common in the areas. Furthermore, 80 % of diseases were caught by cholera due to flooding”*.

The findings from this study showed that the most significant diseases experienced in the study areas were common cold, malaria, diarrhea and cholera. And also flood causes health problems. However, 80 % of diseases caught by cholera while the remaining 20 % by other communicable diseases. This result is in agreement with the research conducted in Hirna by Abraham (2020) which is revealed that in developing countries, the majority of climate change diseases are caused by diarrhea, malaria, cholera and other waterborne diseases.

4.3.4. Economic Effects of Climate Change in the study areas

In the study area, it was examined three broad categories of economic effects of climate change in the study area. Namely yield loss, livestock price decline and poor animal health and increase price of crops (Figure 11)

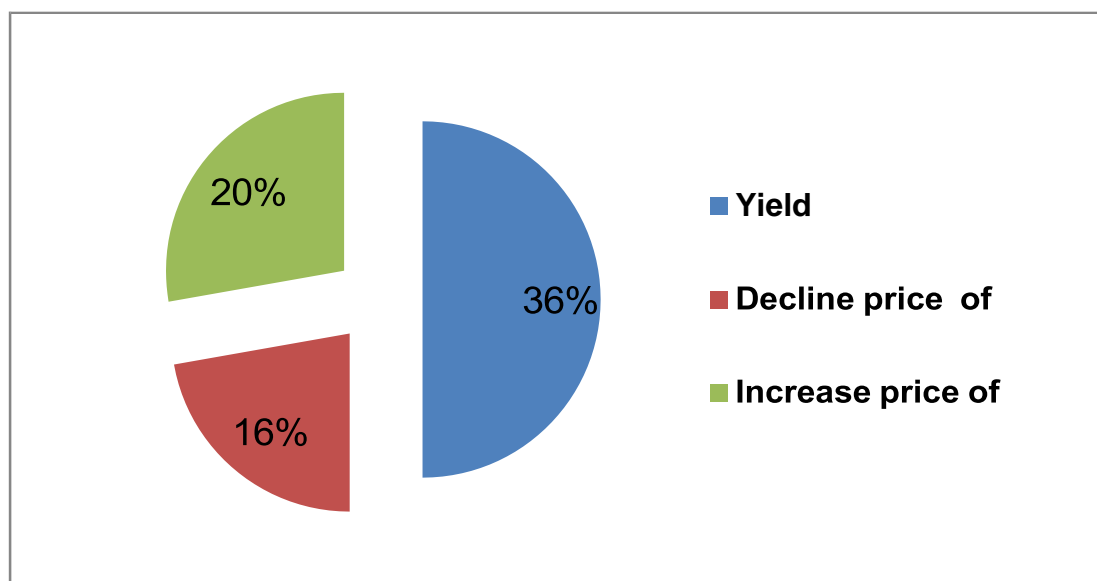


Figure 11: Economic effects of climate change in the study area

Source: (Households survey, 2024)

3.3.4.1. Yield loss

The majority (89.6%) of smallholder farmers were practiced a mixed farming (cropping and livestock rearing) in the study areas. Hence, the effects of climate change on production, measured both in terms of complete loss and partial loss of yield. Accordingly, climate change affects both agricultural crops and livestock production.

Regarding to loss of yield, the result shown in Figure 11 above about 36% of respondents reported that due to climate change, majority of farming households production like cereals crops and livestock products were reduced by climate change in the study areas. As such the result from the survey revealed that 25% and 11 % of cereals crops yield and livestock production such as milk and meat were reduced respectively. Furthermore, climate change reflects the extent to which soil moisture is lower than crop demand water, resulting in crop wilting and even failure. Since the tolerance to soil water deficit is different among crops and areas of planting. Among cultivated cereal crops, maize yield was the major affected by seasonal climate change. The result of KIIs confirmed that during long term drought, maize yield of households completely lost, the result indicates that complete loss is found to have significant effect on households coping capacity. In addition, according to KII reported that during the drought periods due to lack of fodder, livestock production were partially decreased. One of respondents from FGD said that *“climate change particularly drought can be characterized by the reduction of moisture level as a results of seasonal drought our agricultural yield were lost”*. As plate 1 below that cultivated maize plants were wilting due to seasonal drought.



Plate 1. Effect of climate change on maize plants in the study areas
Source : (Field Survey, 2023)

The result of this study was in line with the study conducted by Habtamu in kamise (2018), which revealed that due to climate change agricultural production is decreasing over the last decade years.

3.3.4.2. Livestock Price Decline and Poor Animal Health

Pertaining to livestock price decline, about 16% of households reported that during the periods of dry season and severe drought, most of the farmers sell their livestock at lower price due to lack of fodder and livestock diseases. While the data obtained from KII held with head of Woreda Agricultural Development Office. Accordingly, he said that: *during severe drought farmers sell their livestock with low price to cope the adverse effect of drought. Beside, in drought season there are lack of fodder for livestock, as such the body weight of livestock is reduced as a result for low price.* The severe drought that is experienced negatively affected on livestock (Du Pisanie, 2016). As a results shortage of adequate grazing results in lots of animals lacking essential nutrition elements, which lead to low conception rates, retained afterbirths, production of poor quality colostrum, and immune deficiencies. Hence, droughts causes poor animal health and a decline in prices of livestock in marketing.

3.3.4.3. Increase price of crops (foods)

About 20% of households reported that during the periods of severe drought the price of cereal crops was increased. According to some of the respondents said that “*during the drought season we are not selling our agricultural yield instead we use for our purposes*”. Male respondent from Awmera. The result from FGD also confirms the above result. From FGD participant in Melka Gemachu kebele said the following ‘*drought affects our yields therefore we use our yield for our consumption only this makes increase price for crops in marketing*’. In general, respondents reported that the three rural kebeles had been severely affected by the climate change due to late rainfall onset, early cessations, erratic and high dry spells. In the event of drought, there was possibility of losses of crop yield during the main crop cycle in the study area. Respondents also perceived that the patterns of rainfall distribution reduce the livestock population and increase the mortality and unwanted sales of livestock due to limited availability of pasture and water resources. Findings on the effect of climate change have been identified to have agricultural and non- agricultural impacts on societies.

4.4. The Role of Local Institutions and the Challenges to Adapt to Climate Change in the Study Area

4.4.1. Local institutions operating to climate change adaptation in the study areas

Institutions are humanly created formal and informal mechanisms that shape social and individual expectations, interactions and behavior. Institutions are further divided into formal and informal institutions. Matczak et al. (2007) views formal institutions as those introduced or enforced by the government, whereas informal institutions mostly within communities and those that are based on traditions, social forms of conduct and rules (Ibid, 2007). Interviews conducted with representatives of institutions and smallholder farmers inferred that, there were two main types of institutions in operation in the study *Kebeles*. These are namely public and civic institutions as shown on Table 8 below,

Table 8. Classification of institutions that are operating in the study areas.

Public	Civic
<ul style="list-style-type: none"> • LFSFBP • SLM/RLNP • HABP • PSNP • CALM • Micro finance institutions. • Agriculture, health, education and cooperative offices 	<ul style="list-style-type: none"> • Abdi boru cooperative, Gemmachu red meat, Bilisumma poultry • Chaya tokkumma poultry • Finxa bas red meat • Waltaha guddina cooperative • Malka Gemachu multi-purpose cooperative • Jiru siresa (dairy cooperative) • Balla community watershed • Idir (Afoosha) • Ekub • A group of five members (Tokko Shane) • A group of 7 to 12 members (Garee Misooma)

Source: (Households Survey, 2024)

Accordingly, the result from the study indicated that agriculture offices, health offices, education offices, micro finance institutions, LFSFBP, SLM/RLNP, HABP, CALM, PSNP and cooperative offices are purely public institutions. These institutions were established by legal provisions and have their resources and activities controlled by the concerned Woreda Administration Office

and *kebele* representative workers which are directly and indirectly involved in climate-change-adaptation and resource-management issues. While civic (membership and cooperative organizations as local name called Abdi boru cooperative, Gemmachu red meat, Chaya tokkumma poultry, Bilisumma poultry, Finxa bas red meat, Waltaha Guddina cooperative, Malka Gemachu multi-purpose cooperative, Balla community watershed, Idir (burial association), Ekub, Tokko Shane (A group of five members), Gare Misooma (Which are composed of as many as 7 to 12 households together) and Jiru Siresa (dairy cooperative) among civic local institutions that was found in the study areas.

The findings of the study indicated that, the two main types of local institutions such as public, and civic institutions that were found in the study *kebeles* which actively respond to climate change. The results of this study is different with research conducted in America by Agrawal (2010), which revealed that private institutions play a role in the ways rural households respond to climate change adaptation. On Contrary, the private institutions which actively support households respond to climate change adaptation.was not foind in the study *kebeles*.

4.4.2. Activity of local public institutions to climate change adaptation

Government institutions had been established to support the practices of climate change adaptation and mitigation at Woreda and *kebeles* level. Accordingly, from KII interview reported that Woreda Agricultural Developments office, Rural Land Use office, Environmental Protection office, Women's affairs office, Cooperative Union office, Micro Finance office, Security office, Health office, Education office, Woreda Disaster Risk Management office, Finance office, *Kebele* Administration and Woreda Administration office are government agencies which are directly and indirectly involved in climate change-adaptation and resource-management issues.

The results from FGDs confirmed that Agricultural Developments office, Health office, Education office and Cooperative Union office had represenatives expert and their office at *kebele* levels. However, based on the analysis of interviews with the *kebele* administrators of the study areas inferences could be made that, the *kebele* administrators did not work directly with farmers by providing inputs however, according to the legal bases of the Woreda administrators they are a facilitator for Woreda Agricultural Development Offices and with other relevent local institutions.

Results in Figure 12 show that, approximately 52% (154) of respondents received support from the agricultural development office; 16% (47) received support from health protection offices while, 23% (68) of respondents received support from cooperative union. and 9% (27) received support from education office. Moreover, the majority of farmers received support from agricultural development office in the form of PSNP, HABP, LFSFBP, SLM/RLNP, CALM, and agricultural extension service through *kebele* experts of development Agent (DA).

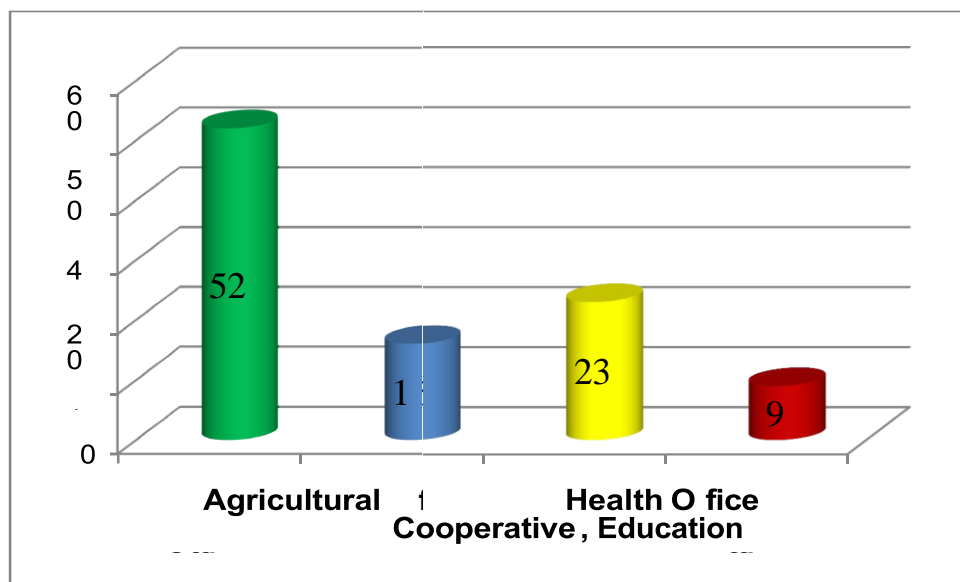


Figure 12. Public institutions that offer support to farmers in the three *kebeles*

Source: (Households survey, 2024)

The data obtained from KII held with expert of the Woreda agricultural development office.

Accordingly, he said that:

“In 2023 Haramaya University was supported improved seeds varieties like miazé and potatoes to our office. Accordingly, over 350 farmers from Awmera, Ifa Oromiya and Melka Gemachu kebele received this improved seeds varieties from our office”

While Women family planning services by *kebele* health office are the main intervention area for public institutions. Accordingly, farmer received education of family planning and also farmer received during mosquito breeding protective materials through health extension workers.

Education office support farmer during yield harvesting from unexpected rainfall through students. Access to credit services and capacity building are among the foundations required to promote agricultural extension. Furthermore, interviews conducted with representatives of cooperative union reported that *kebeles* agricultural cooperative creates the ability for the supply of required agricultural inputs to farmers to make production at the right time that enhance productivity, assure to farmer's access to market to supply and market outputs produced by individual farmers. According to some of the respondents also said that *"we received support like fertilizer urea and Dap from kebeles cooperative union office as a results our agricultural production (yield) was increased."* Female respondent from Melka Gemachu *kebeles*.

Similarly, *Kebeles* micro finance office providing farmers with small amounts of credit at reasonable interest rates give them an opportunity to set up their own business at small scale. Moreover provision of micro finance helps them to smooth their consumption level and manage unexpected risks. The results from FGDs confirmed that micro finance helps the poor to built assets, educate their children and have a better quality of life. When respondents were further investigated to find out what support they received from the institutions, beneficiaries of the Ifa Oromiya *Kebele* residents stated that, we are provided with agricultural tools to support our farming activities; we are also provided with sheep and ox for resale after fattening as a form of livelihood diversification. Counseling support was also provided.

Respondents who were beneficiaries of the Awmera *Kebele* similarly stated that, we are provided with Agricultural tools, counseling, sheep and fattening oxen, improved varieties, DAP and Urea, medication for human disease, humanitarian services and money loaning programs. Melka Gemachu *Kebele* residents stated that, we benefited from agricultural training and demonstration programs, road maintenance support, similarly as like others we are provided with, supply of inputs like improved varieties, DAP and UREA, medication for human disease and money loaning programs and linkage to market. The results of this study agree with the result of the research work by other researchers.

On the other hand, as it can see from Figure 13 farmers received support from agricultural development office in the form of PSNP, HABP, LFSFBP, SLM/RLNP, CALM, and agricultural extension service through *kebele* experts of development Agent (DA). Accordingly, 61.8% of respondents received support from PSNP. The result of KIIs revealed that PSNP improvements in natural resource management and environment through the soil and water conservation measures carried out by the beneficiary households. From field survey also confirmed that PSNP it builds household resilience to climate variability and weather extremes. It helps to avoid the need for taking mal-adaptation measures such as selling of cattle and other asset forms. In this processes however, about 5% of the beneficiaries are expected to receive the drought coping methods without participating in any developmental activities. These groups of the societies are children, pregnant women, old aged individuals and physically disabled individuals. The underlying concept is that these groups of communities cannot fully take part in the physical development activities. While 38.2 % respondents had not beneficiaries from PSNP.

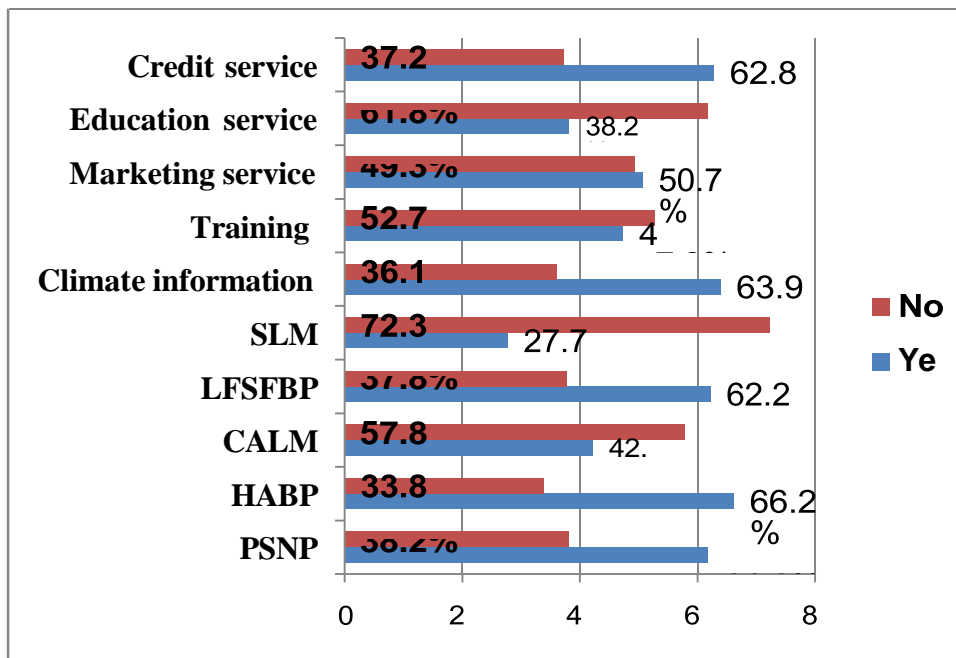


Figure 13: Numbers of respondent’s beneficiary from access of public institutional program in the three *kebeles*

Source: (Households survey, 2024)

According to some of the respondents also said that *“PSNP Payments to both public works and direct support beneficiaries can be made in cash or in kind. If the payment is in cash, a household receives 30 birr per month per person; and if the payment is in food, a household receives 15 kgs of grain plus pulses and oil per month per person”*

The PSNP is evaluated to have several benefits by building essential community assets and helping households building their assets, it builds their resilience to climate variability and weather extremes. The result of KIIs revealed that Household Asset Building Programme (HABP) provides micro-credit, agricultural extension, and business advice to help PSNP recipients to improve their asset. About 66.2% of respondents received support from Household Asset Building Programme while 33.8% of respondents not received support from HABP. About 42.2%, 62.2% and 27.7% of respondents received support from CALM, LFSFBP and SLM while 57.8%, 37.8% and 72.3% respondents not received support respectively. From FGD confirms that majority of farmers received climate information through DA. Accordingly, 63.9% of respondents received climate information through kebele DA while 36.1% of respondents received through media FM. Beside of these 47.3% of respondents received training on good agricultural practice while 52.7% didn't received training. Agricultural cooperatives can stand on behalf of small farmers and transact out the business in a cost effective manner and create ability to supply the required agricultural inputs to farmers (Suleman, 2009). The percentage of respondents who received support from credit service, education service and marketing service were 62.8%, 38.2% and 50.7% while 37.2% , 61.8% and 49.3% did not received support respectively.

According to some of the respondents said that *“we are contact with development agent (DA) more than four times in month this makes create awareness for us about climate change”*. Male respondent from *Melka Gemachu*. The result from FGD also confirms the above result. From FGD participant in *Ifa Oromiya kebele* said the following *‘we are regularly meeting with DA share information regarding to climate change’*. *Melka gemachu Kebele residents stated that, they benefited from agricultural training and demonstration programs, road maintenance support, similarly as like others they were provided with, supply of inputs like improved varieties, Dap and Urea, medication for human disease and money loaning programs and linkage to market.*

4.4.3. Activity of Local Civic Institution to Climate Change Adaptation

According to UNFCCC database on adaptation shows that most local civil society organizations involved in climate change adaptation tend to be informal institutions (Agrawal et al., 2008). Pertaining to civic institution is encourages farmers to form groups which are based on Characteristics such as trust, hard work and financial base. These groups serve as the channel through which farmers are offered support in the form of subsidized farming inputs. Similarly, the cooperatives which are the civic institutions are working together with the smallholders by selecting their own chairman and other staff in the *Kebele*. Accordingly, from the survey results civic institution was the main target areas and focus points of the institutions support the farmers in four major areas of activities in the study areas. These are namely, by provisions of agricultural inputs, animal husbandry, poultry and saving and credit service. The result of the study in Figure 14 showed that the majority of sample households 50% of respondents were received support by provisions of agricultural inputs, about 25% of respondents were received support by provisions of animal husbandry while 18% and 7% of respondents were received support by provisions poultry and saving and credit service respectively.

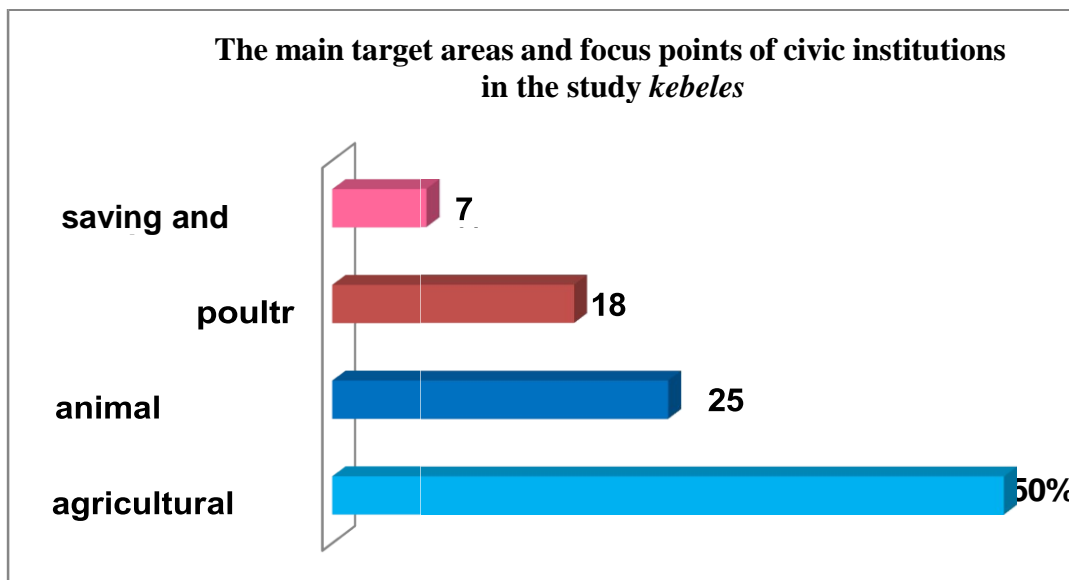


Figure 14. The main target areas and focus points of civic institutions in the study *kebeles*
Source: (Households survey, 2024)

Furthermore, the study identified the institutional areas of activities. As such cooperative organizations like Abdi Boru cooperative, Malka Gemachu multi-purpose cooperative, Waltaha Guddina cooperative were supported the farmers by provisions of agricultural inputs such as improved seed variety, fertilizer and pest side, According to the information obtained from the individual, KII and group discussions, farm inputs that were distributed by the farmers cooperatives union are fertilizer (DAP and UREA) and improved seed, Maize (pioneer, Bh-540 & BH-1 660) every year. Farm input service is one of the main activities of *kebele* farmers cooperatives union. According to some of the respondents said that “ *we didn’t get improved seed as we want from our cooperatives union*” Male respondent from Melka Gemachu. The result revealed that majority of respondents get farm inputs from farmers’ cooperatives union.

While Gemmachu red meat, Finxa bas red meat and Jiru Siresa (dairy cooperative) were supported the farmers by provisions of animal husbandry, particularly, by provision of fattening oxen, goats and sheeps for profits. Chaya tokkumma poultry, Bilisumma poultry were also supported the farmers by provisions of poultry. Iddir and Equib were other traditional local welfare service institutions that are found in the areas. Ekub and Rural Saving Cooperative Organization (RUSACO) were supported the farmers by provisions of saving and credit service. According to some of the respondents said that “ *they were provided with agricultural tools to support their farming activities; they were also provided with sheep and ox for resale after fattening as a form of livelihood diversification*” While other also said that “*Respondents who were beneficiaries of the Melka Gemachu Kebele similarly stated that, they were provided with Agricultural tools, counseling, sheep and fattening oxen, improved varieties, DAP and Urea, medication for human disease, humanitarian services and money loaning programs*”.

On the other hand, social networks are another crucial attribute that effect households’ susceptibility to the impacts of natural disasters. These play a role in enhancing the capacity of an individual or group to cope with adverse climate change impacts in the short run and to adapt to such effects in the longer term. For instance, *Equib* (local saving group) and *Idir* (burial association) were the major local informal institution in the study areas. Accordingly, *Equib* (local saving group) was local informal financial association where members make equal and regular contributions to common finance. The purpose is to save money and benefit from payment and every member take the collected money through a rotation system. However, if

any member gets difficulty like climate related shocks, family sickness or any other urgent issue, priority is given for them. Idir is defined as "An association made up of a group of persons united by ties of family and friendship, by living in the same district, by jobs, or by belonging to the same ethnic group, and has an object of providing mutual aid and financial assistance in certain circumstances. From FGDs results “*Equib*”, “*Idir*” and “Micro and Small Business Enterprises finance” were the most common social organizations available in the study area. Social networks also include friends, family members, extended family members and neighbours. In general the results of this study agree with the result of the research work by other researchers. Civic institutions are provisions of agricultural tools, inputs, provision of fattening oxen for profits, sugar and oil for cooking, strengthening the capacity of women by providing saving and credit opportunities.

4.4.4. The Effects of access to local institutions on livelihoods of farm households

➤ Human capitals

From the Table 9 below we can understand that those who have access to Idir has an odd ratio = .279. The reference category is those who do not have access to Idir. Therefore, the odd ratios of facing a health problem during the past 12 months are 39 percent (1- .279). This indicated that the probability of facing the health problem for those who do not have access to Idir is 39 percent.

Table 9: The results of logistic regression regarding the effects of access to local institution on health problem

Explanatory variables	B	S.E	Wald	Df	Sig.	Exp (B)
Idir	-1.275	.666	3.668	1	.055	.279
Equib	2.197	.650	11.425	1	.001	8.996
Cooperative office	.513	.308	2.782	1	.095	1.671
Farmers’ cooperative	.824	.291	8.047	1	.005	2.280
Constant	-4.342	.785	30.618	1	.000	.013

Source: (Households survey, 2024)

Those who do not have access to Idir have the odds equal to $(1 - 0.279) = 39$ percent. This shows that the possibility of facing health problem for those who do not have access to Idir is about 39 percent higher as compared to those who have access to it. Having access to cooperative office is statistically significant at 1 percent significance level and has an odds ratio equal to 1.671. This implies that the likelihood of facing health problem for the household heads that do not have access to cooperative office is 62 percent $(1 - 1.671)$ higher compared to those who have access to cooperative office.

The household head that does not have access to farmers' cooperative is 2.280 times more likely to face health problem compared as household head to those who have access to it. The result of binary logistic regression that shows the relationship between access to local institutions and human capital in terms of health problem in the last 12 months.

➤ **Financial capital:**

As it can be seen from table 10, the household head who has access to Agricultural office at the local level is 10.666 times more likely to get credit facilities as compared to those who do not have access to this institution (Significant at 1 percent significance level). The household head that has access to Equb is 2.103 times more likely to get credit facilities as compared to those who do not have access (statistically significant at 1 percent). Beside the household heads that has access to the cooperative office is 2.437 times more likely to get credit services as compared to those who do not have access to this office. Access to health institution and educational office increase the credit facilities by 2.076 and 3.712 compared to those who do not have access to these institutions as shown in Table 10..

Table 10: The results of logistic regression regarding the effects of access to local institution on the probability of access to financial capital

Explanatory variabl	B	S.E	Wald	Df	Sig.	Exp (B)
Agricultural office	2.367	1.055	5.031	1	.025	10.666
Equb	.743	.313	5.636	1	.018	2.103
Cooperative office	.891	.308	8.359	1	.004	2.437
Micro finance	1.060	.322	10.805	1	.001	2.886
Health institution	.730	.358	4.166	1	.041	2.076
Educational office	1.312	.323	16.481	1	.000	3.712
Constant	-8.328	1.432	33.807	1	.000	.000

Source: Field survey, (2024)

Smallholder's farmers need to finance to invest in their livelihood enhancing activities, especially in purchasing improved seeds and chemical fertilizer to boost their productivity and as startup capital for micro-enterprises in their locality. In general, the outcome of binary logistic regression reveals that access to Agricultural office, agriculture development office, cooperative office, health institution and educational office , Equibs and micro finance play significant role in improving the financial capital of farming households at local level.

➤ **Social capital**

Social capital in social capital the social networks were assessed to which household heads belong and added them together for examining the effect of local institutions on them.

Accordingly, table 11 shows the multiple regression result about the effect of local institutions on total number of networks/ associations to which participants belongs.

Table 11: The results of multiple regressions regarding the effects of access to local institutions on the number of social networks of household heads

Explanatory variables	B	S.E	Wald	Df	Sig.	Exp (B)
Equib	2.182	.289	56.878	1	.000	8.862
Cooperative office	.312	.298	1.095	1	.295	1.366
Farmers' cooperative union	-.530	.309	2.950	1	.086	.588
Constant	-3.480	.713	23.847	1	.000	.031

Source: Field survey, (2024)

The table 11 clearly indicates that involvement in Equib, access to cooperative office, access to farmers' cooperative union can significantly determine the number of social networks to which household heads belong in rural areas at 1 percent significance level. For example, involvement in a single Equib increases the number of social network by 8.862 to household heads. Access to cooperative office at local level will increase the number of social networks to household heads by 1.366. While access to farmers' cooperative union at local level will increase the number of social networks to household heads by 58.8%. During KII and focus group discussion, the participants disclosed that most people involvement in Equib. In general, involvement in Equib, farmers' cooperative union and access to cooperative office play significant role in increasing the social capital of households at local level.

4.4.5. Challenges of local institutions and smallholders farmers to climate change adaptation

4.4.5.1. Challenges of institutions face in providing support to farmers

Results obtained from the field indicated that, institutions in the three *Kebele* also faced some form of challenges in the process of offering adaptation support to smallholder farmers. Results of the analysis indicated that, the factors that resulted in challenges to institutions faced in providing support arose from two sources. These are the institutions themselves and the smallholder farmers. The following two sections present results of data analyzed on the two sources of institutional challenges to providing adaptation support.

Internal barriers to institutional support:

Public institutions identify both financial and human resources to be major constraints as funding and employment usually fall within the restrictions of the regional and federal level institutions.

Demand-side barriers that hinder institutional support:

On the demand side barriers, all the institutions in the three *Kebele* have stated character traits as the major barriers.

These included lack of showing to financial commitment to pay for adaptation support and lack of showing commitment to adaptation supports.

The KII pointed out that, there is lack of trust between public institutions and smallholders.

Challenges of smallholder’s farmers face in accessing Institutional Support in the study areas

Results from the study indicated that, about 49% (144) of the sample household head stated that poverty is challenging to accessing institutional support as shown in the Table 12. While 51% (152) of respondents stated that Low Education level of household was facing challenges.

Table 12: issues that affected smallholder in accessing institutional support

Challenges	Responses	Percentage
Poverty	144	49
Low Education	152	51
Total	296	100

Source: Field survey, (2024)

4.4.6. The Linkage between Local Institutions and with Different Rural households to Climate Change Adaptation

4.4.6.1. Linkage between local institutions with other institutions to adapt climate change

With regard to information exchange and communication between the different actors at each level in the climate change and response system through their networks, the *kebele* head has a duty to report to the woreda Administration. The task forces at woreda and zonal levels in turn report to the regional office based on the report of the local communities and finally to the federal agency. In terms of hierarchy and interaction, as the IPCC, 2013 posits, each of the institutions interact horizontally with other institutions involved in climate change activities in the three *Kebele*. This was done through direct engagement they had with each other during annual meetings organized by the Haramaya Woreda Administration Office for civic institutions in operation within the *Kebele* where institutions lay out their plans as to how livelihoods in the district might be improved.

Furthermore, analysis on vertical relationships described by the IPCC (2014) amongst the institutions showed that, they were all in contact with parent institutions of the district. The public institutions for instance are controlled in terms of activities, human resources and financial resources at the Haramaya Woreda levels by the Woreda public service and finance and economic development department.

The farmers' cooperative Union controlled and supported by Haramaya Woreda cooperative office. Similarly, *kebele* DA, health extension and educational office also controlled and contact with their parental institutions of the Haramaya Woreda.

Result from table 13 shows that 25 respondents reported that public institutions, its much of the involvement of seems to focus on the communal pooling such as infrastructure development, disaster preparation and information gathering were the major target areas of public institutions. While the other 32 reported that from civic institutions were focused on storage and diversification. Furthermore, 135 respondents reported that civic institutions and partnerships between civic and public institutions seem to occur more frequently to promote diversification and communal pooling. There are relatively (32) few instances of civic institutions and public institutions promoting diversification and exchange, or for that matter a combination of different adaptation strategies.

Table 13. Association of adaptation practices with institutional arrangements

Variable	Public (N)	Civic (N)	Public and Civic (N)	Total
Storage	11	7	21	39
Diversification	21	14	42	77
Communal pooling	25	9	24	58
Storage and Diversification	10	32	14	56
Storage and exchange	7	11	16	34
Diversification and exchange	9	12	11	32
Total	83	85	128	296

Source: Field survey, (2024)

4.4.6.2. Linkage between Smallholder Farmers and Institutions to adapt climate change

Institutional linkages are critical to adaptation because of the ways in which institutional linkages affect flow of resources and influence amongst themselves and to households and social groups. Households and social groups in a study *kebeles* have different degrees and types of links with the institutions. Some households may participate in the meetings, day-to-day functioning, and decision making of a rural institution. Moreover, institutional access is one of the major linkages of households with the institutions. As stated above it is well recognized that majority of farmers received support from agricultural development office through its DA. Therefore, results indicated that, institutional access is one of the most linkages for farmers. The more institutional access for farmers, the more linkages for farmers.

4. 5. Coping Strategies of Households in the Study Areas

From the survey, seven types of coping strategies practiced by households in the study areas were diversification source of income, engagement on daily labor, sell assets (livestock), social network, soil and water conservation, improved crops and variety and water harvesting as shown in Table 14 below.

Table 14: Types of climate change coping strategies practice by households in the study areas

S/N	Coping Strategies	Frequency	Percentage
1	Diversification source of income	27	9
2	Daily labor	33	11
3	Sell assets (Livestock)	55	19
4	Social network	48	16
5	Soil and water conservation	32	11
6	Improved crops and variety	77	26
7	Water harvesting	24	8
	Total	296	100

Source: (Household Survey, 2024)

4.5.1. Diversification source of income

Economic coping strategy mainly consists of diversification of livelihood activities, saving and engagement of members of the family in income generating activities. For instance, husband work agricultural farm land and selling their cash crops called chat while wife also selling livestock product like milk in the market. Accordingly, a few 9% of respondents in the study areas were engaged in two jobs to earn meaningful income. To minimize the effect of climate change, diversifying livelihood strategies through income generating activities within and outside agriculture is required. This is highlighted by Jordan et al. (2013) where important off farm diversification minimizes the impact of climate change. Alternative sources of income reported by respondents the strategies they used including firewood sell, working on other people's farms that are located in safer areas and petty trades were common in the study areas. According to some of the respondents said that: *"we have diversified source of income from on-farm and off-farm activities these contribute for us to decreases the impact of climate change"* Male respondent from Melka Gemachu.

Moreover, diversification source of income enable the households to save money. However, Savings is only done for food and rarely for other needs. The higher diversification source of income and livelihoods decreases the vulnerability of households to the impact of climate change. This result is agrees with the research conducted by Litoroh (2020) in kenya which revealed that occupational diversity leading to multiple income sources increases capacity to cope with the effects of climate change. Adoption of income or economic diversification by the farmers might relief stress caused by the climate change (Makoti & Waswa, 2015).

4.5.2. Engagement on daily labor

Regarding to engagement on daily labor, 11% of respondents reported that during drought season households were engaged in daily labor to cope with impact of climate change. Most of the focus group discussion in the study areas reported that even though it is characterized by very low income return, they engaged on informal trades as means of withstanding drought crisis. In this case women take the lion share in generating income for their family member using washing clothes in the urban areas. It has been also reported that there were family members who engaged in daily labor including the head of the house as the climate change coping strategy. Similarly, male are working on other people's farms, local name called (kuli) and participating other work activity near in the town.

In order to earn income, households took part in farming, small scale businesses, construction activities and others. Moreover, the result of the interviews conducted with Haramaya Woreda expert is almost similar with what have been identified by the FGD. Furthermore, from field observation also pointed out that some of the people living near to the town were participating in daily labor as strategy for minimizing climate change crisis. The observations made by the discussion in this study contradicts with the findings in Northern part of Kenya by Opiyo et al. (2015) that sated harvesting of wild fruits for food, honey production, basket making, and handicraft products crafted from the palm tree as climate change coping strategies.

4.5.3. Sell Assets

In terms of sell assets (livestock), about 19% of respondents reported that during climate change households were sold their livestock to buy foods. While, livestock farming is one of the main sources of livelihood for households in the study areas.

Climate change resulted in a decline in livestock health, leading to low livestock production and loss of livestock in extreme cases. Respondents mentioned that unproductive livestock do not fetch profitable sales; hence they undergo a loss, compared to the input cost. To prevent this, households have to sell their livestock early enough before they are too unproductive to be sold at the market. Since the supply is higher than the demand, the farmers often incur a loss. According to some of the respondents: “During climate change, *we sell most of the livestock so as to get money for food, instead of letting the animal die of starvation*” Male respondent from Ifa oromiya. The result of the interview held with expert of Disaster Prevention and Preparedness of Haramaya woreda showed that it was a common practice to observe while most households were selling their output right after harvest season and also sell their livestock before drought season. The findings of the study revealed that households were selling their livestock before and during drought and buy food to cope with effect of drought.

4.5.4. Social Networks

Social networks are another crucial attribute that effect households’ susceptibility to the impacts of natural disasters. These play a role in enhancing the capacity of an individual or group to cope with adverse drought impacts in the short run and to adapt to such effects in the longer term. Social networks include friends, family members, extended family members and neighbours. Accordingly, from the survey 16% of households were supported from their relatives. The help from these people may be in the form of food crops and financial. According to some of the respondents said that *we have brother in the town who worked off farm activity during drought years, my brother help us* Female respondent from Awmera.

4.5.5. Soil and water conservation

From the survey, about 11% of respondents were used soil and water conservation in order to increase their soil fertility. According to the result of key informant interviews and focus group discussion, in order to avoid culture of dependency, the provision of drought coping strategies were connected with development activities like soil and water conservation works. In this way beneficiaries think that they are provided with food rations because of the work they accomplished. In this processes however, about 5% of the beneficiaries are expected to receive the climate change coping methods without participating in any developmental activities.

These groups of the societies are children, pregnant women, old aged individuals and physically disabled individuals. The underlying concept is that these groups of communities cannot fully take part in the physical development activities.

4.5.6. Improved crops and variety

In terms of improved crops and variety, 26% of respondents were used drought-resistant crops. This is one of the strategies employed by most households, and it could be as a result of frequent extension services offered in the area, as well farmers' experiences of the highest yielding and resistant crop varieties. The drought-resistant crops mentioned by respondents include sorghum and maize. According to some of the respondents: *We start planting early and grow more crops so we can have a reserve for use during the dry season.* While other respondents also said *“We plant crop varieties that mature early, so that we can have food when drought strikes again,”* Male respondent from Melka Gemachu. The findings of the study is similar with the results of Masekende and Shoko (2014), which revealed that climate change coping strategies generally include multiple cropping, planting of drought-tolerant cultivars and other diversifications.

4.5.7. Water harvesting

Pertaining to rain water harvesting, the prolonged drought resulted in scarcity of water in the study rural *kebeles*. Respondents had to walk for long distance in search of water for domestic and livestock use because nearby water sources had dried up. Households have formed welfare groups where they collectively dig wells or water pans. About 8% of respondents were used rain water harvesting during rainy season.



Plate 2. Rain water harvesting in the study areas

Source: (Field Survey, 2023)

According to some of the respondents: *“We have formed groups to construct a well and water pans to store water during the rainy season, so we can use when it does not rain for a long time.* Male respondent from Awmera. The findings of the study showed that rain water harvesting activity were minimized the impacts of climate change. Above all, this study evaluated farmers’ proactive and reactive climate change coping strategies at household level. Accordingly, collection and saving hay, soil and water conservation practices, and use of rain water harvesting, social networks, diversification of income and livelihoods were the main proactive drought coping strategies identified by farmers. In addition, borrowing loans for running small business, selling of household assets such as livestock, productive safety net programme, food for work and reduction of food consumption both in quantity, and quality were identified as reactive climate change coping strategies in the study area

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the summary of findings, conclusion and recommendations based on the three specific objectives of the study.

5.1. Summary

The main objective of this research was to assess the role of local institution to climate change adaptation in Haramaya Woreda East Hararghe Zone, Oromia regional state, Ethiopia. This study was employed the mixed method research approach using a concurrent triangulation research design was used to collect and analyze both qualitative and quantitative data. In the study, 296 respondents were involved from 10 local institutions. The investigator used systematic random sampling technique to collect data, carefully examined, and investigated the overall the role of local institution to climate change adaptation in Haramaya Woreda. This enabled the investigator to draw conclusions and to make recommendations. The study was conducted in three *kebeles* of Haramaya Woreda it relied on both mixed methods of data collection and analysis. The primary data were collected by using data gathering tools such as FGD, key informant interviews, and observation (household survey). The study also used 30 years of climate data used to analysis trends of rainfall and temperature. Structured and semi-structured questionnaires were prepared for 296 respondents for responding.

5.2. Conclusions

Local institutions play a vital role in enabling households to manage threats posed by uncertainties of climate. The study was pursued to find out the role of institutions in adaptation to climate change in Haramaya Woreda. The impacts of climate change on economic sectors are real and smallholder farming is one of the most vulnerable sectors to climatic change. Consequently, adaptation of smallholder farmers to climate change is needed to ensure the sustainability of their livelihoods and to safeguard food security. Institutions have been identified to play important roles in adaptation. In order to measure the role and of institutions in adaptation to climate change, the study took a sample of 296 smallholder farmers and 10 heads of institutions involved in smallholder agricultural development activity in the three studies *Kebele*. Information was pursued about role of institutions, the challenges institutions and farmers face in giving or receiving support among others and the linkages of them. A result collected from the field was analyzed with SPSS and Microsoft Excel.

The study findings indicated that, the knowledge and perception of climate change in the study area was high as both smallholder farmers and institutions were aware of its impacts which they described to have agricultural and non- agricultural effects. Further the study showed that, institutional support provided to farmers to address the impacts of climate change. In general, accessibility of farming households to formal and informal local institutions have significant contribution for improvements of livelihood assets such as human, financial, natural, social and physical capitals at local level.

5.3. Recommendations

Based on the results discussed above, the study came out with a number of recommendations. These include:

- The Government, private sector and other stakeholders should come together to draw a plan on how to change the production and productivity of smallholder and to aid to adapt climate change.
- The study further recommends that, institutions and political and or government leaders must work together to educate the people on the importance of paying for certain services to ensure that their productivity increases in this period of climatic changes.
- There is the need for a policy by government and institutions to ensure sustainability of interventions towards smallholder adaptation. Institutions which provide adaptation support to smallholder farmers must ensure the sustainability of interventions they introduce to farmers as opposed to what happens in most cases where when a particular project run by an institution is ended, the institutional investment for the intervention also comes to an end. This creates difficulties for smallholder farmers to continue with the particular interventions. The improvement of financial, natural and physical capitals of livelihood assets play remarkable role for promoting the welfare status of farming households at local level. Therefore, the local government bodies should work hard to improve the accessibility of all formal public institutions to meet the service needs of people that can change their livelihood. It is clear that all activities could not be satisfactorily undertaken only by the effort of local public institutions.
- Lastly, the role of informal traditional institutions on building the livelihood assets of farming household heads at local level is notable. Therefore, they should be empowered to enable and rebuild their technical, financial capacity and promote the acceptance of legality to assume greater responsibilities in provision of sustainable social services that build the livelihood assets of local people.

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7. APPENDICES

APPENDICES I Questionnaire to be filled by sample household heads

My name is **Abiyu Teressa Hailemariam** I am writing a thesis entitled “to investigate **Role of Local Institution in Adaptation to Climate Change** in Haramaya woreda East Hararghe Zone,Oromia regional state, Ethiopia..”In partial fulfillment for MA in Climate Change and Disaster Risk Management. The General objective of the study is to investigate **Role of Local Institution in Adaptation to Climate Change** in Haramaya woreda Therefore, your valid contribution by giving accurate information is highly valuable in achieving the objective of this research. The information we will collect from you will serve only for the academic purpose and it will be kept confidential. Thus, please feel free to convey the required information honestly.

Thank you in advanced for your cooperation.

Instruction: Dear enumerator, please circle the number representing respondent’s answer from given alternatives and/or write their answer for the rest questions requiring quantitative and other responses.

Part I: General Information Demographic

1. Gender of the household head? A) Female B) Male
2. Age of the household head (in years)
A. 20 – 24 B. 25 – 34 C. 35 – 44 D. 45 – 49 E. 50 – 54 F. 55– 60 G. 60– 65 H.
Above 65.
3. Marital status A) Single B) Married C) Divorced D) Widowed
4. Educational status A) Unable to read and write B) Primary school (grade 1-8)
C) Secondary school (grade 9-12) D) Tertiary (college, university) E) other (specify)
5. Total family size (Age group (year)?-----

Age group (year)	Male (no)	Female (no)	Total
< 10			
11- 14			
15 – 49			
50– 65			
> 65			
Total			

6. What type Farming system you follow currently?

- A) Crop production only B) Livestock rearing only
 C) Mixed farming D) others (specify).....

7. What kind of agriculture are you practicing?

- A) Rain fed agriculture B) Both rain fed and irrigated agriculture
 C) Irrigated agriculture D) other, specify:

8. Do you have land? A) Yes B) No

9. If your answer for Q, No. 8, is ‘yes’, how much is the total size of your land? Local units (*‘qoxi’*): In hectare:

10. How many years of farming experience do you have? years

Part II Climate Changes perception in the past 30 Years.

11. What is your perception of climate change/ variability of your *kebele*?

- A) There is climate variability C) The climate has not changed
 B) The climate has totally changed D) I have no idea

12. If your answer to Q No, 11 is ‘the climate has changed/ show variability’, what are the local indicators of the observed climate change?

- A) Unpredictable rain falls C) Recurrent drought D) Hail storms
 B) Increase in temperature E) Decrease in river volume F) others, specify

13. What are the local indicators of the observed climate change regarding with your temperature perspective?

- A) Increased B) Decreased C) No change D) Unpredictable

14. How about rain fall size in your local area?

- A) Increased B) Decreased C) No change D) Unpredictable

15. How about rain fall distribution according to your perspective in your local area?
 A) Irregular B) Regular C) I do not know D) Unpredictable
16. Is there a change in main season rainfall timing shifting in your area? A) Yes B) No
 C. I do not know
17. If your answer is 'Yes', how do you characterize it?
 A) Comes early and goes late C) Comes and goes early
 B) Comes late and goes early
18. If your answer for Q N 17, is comes late and goes early, what changes have you observed in crop production?
 A) Decrease in crop yield C) No change in production
 B) Increase in crop yield D) Decrease of long cycle crops E) Others
19. What are the major challenges that climate change/ variability posed on your livelihood?
 A) Shortage of pasture land C) Loss of livestock
 B) Crop yield reduction D) flooding E) Drought E) Other (specify)
20. Have you ever faced any climate related disaster over the last 30 years? A) Yes B) No
21. If your answer for Question No 20, is 'yes', what type of climate shock is your concern?
 A) Recurrent drought C) Crop pests and diseases
 B) Erratic rain fall & flooding D) Rain fall variability E) Other
22. What do you think is the main cause for the climate change related problem that you specified in Q NO, 21?
 A) Deforestation B) Low fertility of land C) Change in land use and land cover
 D) Absence of sustainable farming system E) other (specify).
23. Which group of the society is most impacted by climate change and variability?
 A) Female headed households B) Male headed households. C) Land less and the poor
 D) Elderly and children E) other specify
24. Based on your answer to question No23, why do you think, you are more vulnerable to the impact of climate change /variability?
 A) Lack of information on climate and weather variability B) Weak social capital
 C) Poverty to adapt the shocks easily D) Poor administration E) other (specify)

25. Dear respondent please fill the following if you are **experienced/practiced** with it.

S.No.	Have you experienced/practiced with the following types of climate change and variability indicators?	Response		How often?(in past 30 years)
		Yes	No	
1	Recurrent Drought			
2	Floods			
3	Off-seasonal rainfall			
4	Delayed on set of rain fall			
5	Early termination of rain fall			
6	Too much rain			
7	Too little rainfall			
8	Higher temperature			
9	Frost (coolness)			
10	High winds			
11	Food insecurity			
12	Human and livestock diseases			
13	Drinking water scarcity			
14	Soil fertility loss			
15	Crop pests			
16	Gully formation			
17	Others (specify)			

Part III Social impact of climate change Information Surveys

1. Did you borrow any money from relatives or friends in the past period? A) Yes B) No
2. Did you lend any money to relatives or friends in the past period? A) Yes B) No
3. What customary self-help arrangements are there to support each other in your villages during the times of climatic extremes?
4. How long does it take you to get to a health facility?
5. Is anybody in your family chronically ill (get sick very often?) A) Yes B) No
6. Has anyone in your household been too sick in the past last 30 year to miss work or school?
A) Yes B) No
7. Where does your family get most of its food?
8. What kind of crops does your household grow?
9. Do you sell the crops your Grow for money to buy other food goods? A) Yes B) No
10. Do your household get sufficient water in the whole year? A) Yes B) No
11. What is the source of water for your household?
 A) Rivers (Stream) B) pounds C) Protected springs
 D) Unprotected springs E) Pipe lines F) Dams

15. In summary, have you observed the following climate change related social impacts in last 30 years?

S.No.	Climate change related impacts	High	Medium	Low
1	Outbreak of human and livestock diseases(malaria, black leg .. etc)			
2	Hygiene related skin diseases (scabies or cito)			
3	Communicable diseases			
4	Reduction in water quality and quantity			
5	Conflicts for resource competition (water, forest product, grazing land...Etc.)			
6	Malnutrition of under <5 years children and lactating, pregnant women			
7	School feeding related with releasing class student			
8	Others			

Part IV Economic Status of the study Area

1. What is your means of livelihood or how do you get your livelihood?

- A) Livestock rearing B) Crop production C) Mixed farming

2. Do you have another source of livelihood other than Agriculture (off farm activity)?

- A) Yes B) No

3. If your answer to Q 2 is 'yes', what could be that activity, please specify

- A) Bee keeping B) Petty trade C) Working as laborer
D) Working hand crafts E) Other, specify

4. How much income you get from your farm during the last one year?.....birr

5. What are the major crops grown by your household last year?

S.No.	Type of crops (cereal crop/cash crop/oil seed)	Quantity produced (Qntl)	Price per quintal (Birr)
1			
2			
3			
4			
5			
6			
7			

6. Do you have livestock (domestic animals)? A) Yes B) No

7. If yes, how many livestock do you own?

S.No.	Animal Type	TLU (Tropical livestock unit)
1	Cows	
2	Oxen	
3	Donkeys	
4	Goat	
5	Sheep	
6	Camels	
7	Chickens	
8	Others (specify)	

10. How Wealth status of households across Agro-ecology?

	Mid land	Low land	Total
Poor			
Medium			
Rich			
Total			

15. In summary, have you observed the following climate change related economic impacts in last 30 years?

S.No.	Climate change related impacts	High	Medium	Low
1	Decline in crop yields			
2	Increase in crop yields			
3	Decline in livestock yields			
4	Increase in livestock production			
5	Decline Livestock productivity			
6	Death of livestock due to shortage of fodder and water			
7	Food shortage /insecurity			
8	Increased weed and pest pressures			
9	Higher risk of crop damage from drought			
10	Infrastructure development			

Part V. What adaptation strategies of local institutions on climate changes impact in the study area?

1. What are local institution in your kebele? (Civic, Public, Private, Market)
 - a) What are formal local institution in your kebele
 - b) What are in formal local institution in your kebeles?
 - 1.1. What is the first concerns the distribution of institutional types (public, private, civic) in facilitating local adaptation.

Types of local institutions			
Types of institutions	yes	no	Total
1. Public			
1.1. Bureaucratic Agencies (FTC, health service centers, schools)			
1.2. Elected local governments (kebale administration, zonimisoma, garemisoma, gurmainsamisoma, parti leaders, hunde, seli)			
2. Private			
2.1. Service Organizations (NGO’S small clinics, pharmacies,)			
2.2. Private Business			
3. civic			
3.1. Membership Organizations (afosh, guza,qubi, ananwalibusu,informal group association, pooling, ribbi,waterdestirbution /malaga)			
3.2. Cooperatives and rural saving and credit cooperative			
Total			

What is the role do local institutions have long term adaptation?

- A) Production System
 - B) Land and water governance
 - C) Social support system
 - D) Household gender and adaptive capacity
 - E) Weather and climate information system
 - F) Drought early warning
 - G) Water Management
 - H) Land management
 - I) Mediating role
2. What are enabling factors that affects local institution? **national/international**
 - a) Information system
 - b) Technology
 - c) Finances
 - d) Leadership

3. What are the factors that affects adaptation strategy for local institution?

- a) Conflict over resource use
- b) Drought (repeated drought)
- c) Encroachment of farm land

4. Is there community adaptation mechanism in your in kebeles?

5. What types of adaptation practices in you kebeles?

- a) Mobility
- b) Divesification
- c) Storages
- d) Communal pooling
- e) Exchange
- f) Herd splitting

Short term Adaptation mechanism	Long term adaptation mechanism	Conceptual and emerging adaptation
<ul style="list-style-type: none"> • Live stock sale • Petty trade • Restricting • consumption and shipping needs • Charcol and fire wood sales 	<ul style="list-style-type: none"> • Mutual support system • Mobility and management • Accumulation • Diversification • Education • Saving and credit • group Storage • Restocking 	<p>Conceptual and adaptation</p> <ul style="list-style-type: none"> a)Mobility b)Diversification <p>Emerging adaptation</p> <ul style="list-style-type: none"> a) Credit and saving b) Business c) Wage labour

5.1. What types of major adaptation strategies applicable on local institutions on climate changes in your kebele?

Sa.no	Adaptation strategies	High	Medium	Low
1	Crop diversification			
2	crop choices			
3	production technologies			
4	Animal breeding			
5	Improved seed variety			
6	Drought tolerant crop			
7	Adjusting crop planting dates			
8	food storage (crops, seeds, forest products)			
9	Pest control			
10	Water harvesting / irrigation			
11	Soil and water conservation(terracing and tree planting			
12	Tree planting and soil fertility management			
13	Compost preparation to increase soil fertility			
14	Off- farm activities			
15	Improved market access			
16	Seeds, animal, and other input purchases.			
17	forestry			
18	Infrastructure development			
19	Information gathering			

8. What are the major characteristics of local institution in your kebele?

9. What are the linkage between local institution and households and between local institution them selves?

a) yes b) no

10. There linkage affects flow of resources and decision making powers among social group?

a) yes b) no

10. There linkage affects their capacity to adapt climate changes?

a) yes b) no

10.1. How different types of local institutions correlate with particular combinations of adaptation practices?

Combinations of Adaptation Practices and local Institutions															
Variable	Public			Civic			Private			Public and civic			Private and civic		
	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L
Storage															
Diversification															
Communal pooling															
Storage and Diversification															
Storage and exchange															
Diversification and exchange															
Other															
Total															

There is any Benefits from Adaptation Practices for Different Types of Local Institutions?

Distribution of Benefits from Adaptation Practices for Different Types of Local Institutions.												
	Individually Oriented benefits from adaptation practices					Collectively oriented benefits from adaptation practices					Total	
	VH	H	M	L	VL	VH	H	M	L	VL		
Local institution functioning in conjunction with an external intervention												
Local institutions without external interventions												
Total												

12.How does the strengths of local Institutions?

12.1. How do local Institutions service delivery and level of community satisfaction on them?

Sa.no	Variables	High	Medium	Law
1	PSNP			
2	HABP			
3	CARE Ethiopia			
4	SLM/RLNP			
5	CALM			
6	LFSFBP			
7	Climate information			
8	Training on good agricultural practice			
9	Marketing service			
10	Natural resource conservation			
11	Provision of selected seed Varity			
12	Provision of agricultural input (fertilizer, pest side, other chemicals)			
13	Education			
14	Credit service /access to credit			

12.2. How do the 3 aspects that make local institutions relevant in climate adaptation?

No	How does the strengths of local Institutions?	High	Medium	Low
1	The structure impacts and vulnerability.			
2	How does the mediate between individual and collective responses to climate impact and there by shape out comes of adaptation?			
3	How doesthe act the means of delivery of external resources to climate adaptation and thus govern access to such resources?			
3.1.	How does Institution mediate resources from extra local institutions?			
3.2.	How does Institutions shape people’s vulnerability to the impacts of climate change?			
	A. How do Decrease farm household sensitivity?			
	B. How do Increased adaptive capacity or resilience?			
	C. How Do Reduced exposure?			
3.3.	How do Institutions shape farm households response to climate impacts?			

4. What are **the challenges** that face local Institutions in our local area?

5. What do you think about thislocal Institutions they have a **good opportunities** in climate adaptation strategies in our local area?

6. Please our respondent, in general what does our **suggestion** about the role of local Institutions adaptation to climate changes in our local area?

Tell. No 09-12-89-30-55

Email - Abiyu Teressa11@gmail.com

Thank you very much for your time and cooperation!

.....

APPENDIX II. Guiding Question for Key Informants in the Study *Kebeles* Name

..... Position/profession Organization _

1. Have you observed any change in climate in the last 30 years?
2. What do you say about the trend of temperature during the past 30 years?
3. Which local indicators do you use to evaluate the temperature trend in the area? (Please support it with example)
4. What do you say about the trend of rainfall during the past 30 years?
5. Which local indicator do you use to evaluate today's rainfall pattern?
6. In terms of the frequency of drought, what trends have you observed?
7. In terms of the frequency of flood, what trends have you observed?
8. What do you think is the cause of climate change?

Tell. No 09-12-89-30-55

Email - Abiyuteressa11@gmail.com

Thank you very much for your time and cooperation

APPENDIX III. Guiding Questions for Focus Group Discussion (FGD)

Address (location) of the village:

Focus group size:

Focus group composition: Male headed households/Women headed households/Youth group,
Kebele leader

1. Have you observed any change in climate during the past 30 years?
2. What is your observation on the trend of temperature condition in your area?
3. What do you say about the trend of rainfall condition in your area?
4. How often is the occurrence of drought in the locality? And what are the probable causes?
5. What are your traditional or local indicators to realize that there is climate change?
6. Are the crops you cultivate now the same as the crops your father or forefathers were growing? If no, reasons for changing the crops?
7. Identify any newly appeared crop infestation and diseases in your locality.
8. What are the impacts of climate change on livelihood of smallholders' farmers?
9. What do you recommend to be done to enhance the fight towards climate change?

Tell. No 09-12-89-30-55

Email - Abiyuteressa11@gmail.com

Thank you very much for your time and cooperation

APPENDIX VI : Checklist for Field's Observation

Address (location) of the village:

Focus group size:

Focus group composition: Male headed households/Women headed households/Youth group,
Kebele leader

1. Have you observed any change in climate during the past 30 years?
2. What is your observation on the trend of temperature condition in your area?
3. What do you say about the trend of rainfall condition in your area?
4. How often is the occurrence of drought in the locality? And what are the probable causes?
5. What are your traditional or local indicators to realize that there is climate change?
6. Are the crops you cultivate now the same as the crops your father or forefathers were growing? If no, reasons for changing the crops?
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8. What are the impacts of climate change on livelihood of smallholders' farmers?
9. What do you recommend to be done to enhance the fight towards climate change?

Tell. No 09-12-89-30-55

Email - Abiyuteressa11@gmail.com

Thank you very much for your time and cooperation

APPENDEX Table

Appendix Table 1: Rainfall data of Haramaya Woreda from 1990 to 2020

Year	J	Feb	M	Apr	M	J	Ju	Au	Sep	Oc	Nov	Dec
1990	1.7	73.1	45.4	137.1	59.6	54.1	80.9	154.7	133.8	53.3	0	7
1991	0	51.7	136.2	73.2	58.6	25.7	109.1	107	120.1	25.8	0	52
1992	3.9	11	18.2	85.2	65.1	68.3	77.5	97.6	107.1	36.6	10.4	4.1
1993	0	5.5	15.8	88.2	45.2	55.2	103	115	90.3	25.2	8.5	0
1994	0	0	0	54.4	77.8	0	154.5	201	55.2	3.5	0	0
1995	0	47	42	43	66.7	55.2	135.8	110.4	154.1	49.2	0	0
1996	0	0	22.6	77.5	38.9	25.3	204.4	189.1	34.5	21.1	0	0
1997	0	0	78.1	124.6	155.9	59.8	148.7	102.7	61.7	203.8	60.4	16.1
1998	86.5	51	33.7	59.9	55.4	24.8	128.5	110.4	175.7	54	21.3	0
1999	0	3.7	68.3	71.3	77.4	30	95.2	238.6	139	135.7	15.6	4.9
2000	0	0	6.3	137.6	95.1	18.9	82.7	141.5	109.4	16.6	104.2	0
2001	0	18.8	56.6	94	146.2	111.3	217.7	54.6	24.9	0	0	0
2002	17.9	0.6	56.3	84.4	47.9	43.3	64.8	165.3	83.4	21.7	0	21.5
2003	3.6	16.4	25.1	142.2	19.2	62.5	106.6	272.4	77.2	0.2	0	40.7
2004	38.2	0	27.4	215.1	39.7	25.3	74.2	116.4	126.7	43.8	33.6	4.5
2005	0.5	2	39.9	119.5	198.3	23.5	68.1	132.2	154.4	17	11.9	0
2006	4	35.9	49.2	191.2	71.4	74.1	119.6	191.4	180.4	111.6	1.6	88.4
2007	0	3.5	25.4	142.7	55.7	61.4	196.5	110.5	136.9	27.1	6.5	0
2008	5.5	0	0.2	26.6	179	106.3	131.3	120.6	170.2	14.1	120.6	0
2009	23.6	5.3	5.7	78.2	90	53.8	163.5	96.5	65.2	139.3	12.4	26.2
2010	2.7	44.1	82.3	123.8	73.1	24.6	144.9	179.6	170.4	5.6	10.8	11
2011	0	0	0	39.7	113.4	57.7	119.5	227	161.8	0	0	0
2012	0	0	0	66.3	51	0	214.8	149.5	105	4.6	0.5	6.7
2013	6	0	159.3	171.6	55.1	15.8	215.4	185.1	142.1	71.4	81.6	0.8
2014	0	0	50.3	85.7	110.6	18.8	133.2	166	150.2	75.9	3.6	0
2015	0	0	32.7	77.4	199.8	86.1	17.3	163.6	53.6	7.9	0	0
2016	0.4	15.5	41.5	154.6	120.8	88.9	159	58.5	183.3	1	24.5	6.7
2017	0	36.5	11.3	51.6	147	29	146.6	117	158	14.7	0	0
2018	0	0	0	0	0	0	0	168.7	81.3	67.5	3.4	0
2019	0	8.4	30.6	25.9	175	83.3	146.8	240.4	138.2	213.5	0	0
2020	0	9.2	31.1	25.7	0	0	151.3	256	170	217	0	0