AN ANALYSIS OF CLIMATE CHANGE RESILIENCE OF VULNERABLE RURAL COMMUNITIES IN MALAWI

by

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DECLARATION

Name: Yusuf Malsellino Mkungula

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An analysis of climate change resilience of vulnerable rural communities in Malawi

I declare that the above thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the thesis to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

Signature:  Date: 25 May 2021

DEDICATION

This study is devoted to my late mum who gave me the true meaning of life despite encountering several challenges in her life.

This work is also dedicated to Violet, my wife for her daily prayers and moral support during the study.

I also dedicate this piece of work to my three children (Hastings, Hellings and Hazel) for their understanding and endurance during my absence at home and loss of fatherly love and family time.

ABSTRACT

Climate change is increasingly becoming a global challenge and countries are feeling its impacts. Malawi is heavily affected by the impacts of climate change because her economy depends on agriculture which is extremely sensitive to climate change. As a result, community-resilient livelihoods are eroded, leading to reduced adaptive capacities, and therefore low resilience levels. The study (an analysis of climate change resilience of vulnerable rural communities in Malawi) was conducted in four districts of Malawi, namely Chikwawa, Karonga, Salima and Zomba. Data was gathered using several methodologies and tools such as structured questionnaires administered to 402 households, 15 focus group discussions (FGD), 15 key informant interviews (KII), and a survey monkey that was administered to a few government staff members at ministerial level. The study revealed that 94.3% of respondents are aware of climate change and are able to differentiate between current weather conditions and the conditions of 30 years ago. At least 83.7% indicated a decline in the quantity of precipitation; 85.7% noticed late onset of precipitation; 88.7% stated that there is early cessation of precipitation; 92.4% said that there is oftentimes poor precipitation distribution; 95.9% showed increased temperatures; 94.9% expressed prevalence of regular strong winds; 90.9% indicated late planting of crops; and 94.7% indicated regular floods in large volumes.

The common disasters related to climate change in study areas are floods, erratic rainfall, droughts, hailstorms, and army worms. When disasters occur, key coping mechanisms include sales of household assets, wage labour, relief and donations, migration to find employment and petty trade. The main adaptation strategies employed by smallholder farmers are conservation agriculture, livestock production for income, irrigated agriculture to supplement rain-fed farming, crop diversification, cultivation of drought-tolerant crops, aquaculture, agroforestry, and planting early maturing varieties. In terms of indicators of resilience, it was reported that households can cope and recover from

shocks. Households can also adapt to change, access clean water and to some extent earn a stable income. The study further revealed that climate change resilience building in Malawi is hampered by inadequate extension services to communities, inadequate understanding of climate resilience principles, the frequent occurrence of natural disasters that affect gains made on adaptation and resilience building, and poor implementation and climate financing.

The overall analysis concludes that the communities are resilient but not to desired/adequate levels. As much as several climate change adaptation efforts are being made, climate change resilience building in Malawi is slow. This entails that communities are not more resilient because their economic security is not adequately diversified. It is pleasing to note that households have adequate access to water supply. Disaster preparedness is also sound and effective, and households are enjoying continued peace and security. Three out of four characteristics of resilience are being met by the households to some extent. In order to ensure effective and enhanced climate change resilience, it is recommended that policy awareness must be ensured by reviewing and implementing policy. Institutional arrangements for climate change must also be supported. Furthermore, irrigation farming for adaptation must be enhanced. In addition, there must be full devolution of powers from central government to district authorities. Other recommendations include reforming livestock production in the face of climate change; improving extension services to smallholder farmers; promoting crop diversification for adaptation; enhancing water harvesting to adapt to drought and water shortage; promoting the use of improved agricultural inputs for adaptation; carrying out future research related to climate change resilience; and ensuring collaboration among stakeholders in resilience building.

Key Terms: climate change, climate change mitigation, climate change adaptation, vulnerability, climate change resilience, adaptation strategies, climate change impacts, natural disasters, community-based adaptation, and ecosystem based adaptation.

OPSOMMING

Klimaatsverandering bied wêreldwyd toenemende uitdagings en lande beleef die uitwerking daarvan eerstehands. Malawi word swaar getref deur die uitwerking van klimaatsverandering omdat die land se ekonomie van landbou afhanklik is en die landboubedryf uiters sensitief vir klimaatsverandering is. Gemeenskappe se veerkragtige vermoë om ’n bestaan te voer word afgetakel. Dit lei tot verminderde aanpassingsvermoëns en dus tot lae vlakke van veerkragtigheid. Hierdie studie (’n ontleding van kwesbare landelike gemeenskappe se veerkragtigheid teen klimaatsverandering in Malawi) is onderneem in vier distrikte in Malawi, naamlik Chikwawa, Karonga, Salima en Zomba. Verskeie metodologieë en hulpmiddels is aangewend, insluitende gestruktureerde vraelyste wat deur 402 huishoudings voltooi is, 15 fokusgroepbesprekings, 15 onderhoude met sleutelinformante, en ’n Survey Monkey-vraelys wat deur regeringsamptenare op ministersvlak ingevul is. Die studie het getoon dat 94.3% van respondente bewus was van klimaatsverandering en kon onderskei tussen heersende weerstoestande en die toestande 30 jaar vantevore. Ten minste 83.7% het aangedui dat reënval afgeneem het; 85.7% het opgemerk dat reënval laat begin; 88.7% het gesê dat reënval vroeër ophou; 92.4% het gesê daar is dikwels swak reënvalverspreiding; 95.9% het gemeld dat temperature styg; 94.9% het gesê dat daar gereeld ’n sterk wind waai; 90.9% het gesê dat gewasse laat geplant word; en 94.7% het melding gemaak van groot oorstromings wat gereeld voorkom.

Die algemene rampe wat met klimaatsverandering in die studiegebiede verband hou is oorstromings, onreëlmatige reënval, droogtes, haelstorms en kommandowurms. Wanneer huishoudings deur rampe getref word, sluit hulle belangrikste hanteringsmeganismes die volgende in: die verkoop van die huishouding se bates; loonarbeid; noodleniging en skenkings; migrasie om werk te kry; en beperkte handelsaktiwiteite. Die aanpassingstrategieë wat kleinboere volg sluit in bewaringslandbou; veeteelt vir ’n inkomste; besproeiingslandbou om landbou wat op reënval

steun aan te vul; gewasdiversifikasie; die verbouing van droogtebestande gewasse; visboerdery; agribosbou; en die verbouing van gewasse wat vinnig ryp word. Betreffende aanduiders van veerkragtigheid is daar gemeld dat huishoudings die skokke kan hanteer en daarvan kan herstel. Huishoudings kan aanpas by verandering; hulle het toegang tot skoon water; en sommige verdien ’n redelik stabiele inkomste. Die studie toon verder dat die ontwikkeling van veerkragtigheid teen klimaatsverandering in Malawi aan bande gelê word deur onvoldoende landbouvoorligtingsdienste aan gemeenskappe; onvoldoende begrip van die beginsels van veerkragtigheid teen klimaatsverandering; natuurrampe wat dikwels voorkom (en aanpassing en veerkragtigheid belemmer); en die swak implementering van finansiering.

Die oorkoepelende ontleding toon dat gemeenskappe wel veerkragtig is, maar nog nie voldoende of gewenste vlakke van veerkragtigheid bereik het nie. Daar word baie pogings aangewend om aan te pas by klimaatsverandering, maar die pas waarteen veerkragtigheid teen klimaatsverandering in Malawi toeneem, is stadig. Gemeenskappe is nie veerkragtig genoeg nie omdat hulle ekonomiese sekuriteit nie voldoende gediversifeer is nie. Dit is gerusstellend dat huishoudings voldoende toegang tot skoon water het. Hulle is ook goed voorbereid op rampe en geniet vrede en sekuriteit. Drie van die vier kenmerke van veerkragtigheid word in ’n mate by die huishoudings bespeur. Die aanbeveling is dat ’n bewustheid van beleid geskep moet word deur dit te hersien en te implementeer om sodoende huishoudings se veerkragtigheid teen klimaatsverandering bevorder en uit te brei. Institusionele inisiatiewe rakende klimaatsverandering moet ook ondersteun word. Voorts moet besproeiingslandbou bevorder word. Daarby moet al die sentrale regering se mag afgewentel word aan distriksowerhede. Verdere aanbevelings word gemaak rakende die hervorming van veeproduksie; verbeterde landbouvoorligtingsdienste aan kleinboere; die bevordering van gewasdiversifikasie; verbeterde water-oespraktyke droogtes en watertekorte die hoof te bied; die

verbetering van landbou-insette vir beter aanpassing; toekomstige navorsing oor veerkragtigheid teen klimaatsverandering; en samewerking tussen diegene wat betrokke is by die ontwikkeling van gemeenskappe se veerkragtigheid.

Sleutelterme: klimaatsverandering, versagting van klimaatsverandering, aanpassing by klimaatsverandering, weerloosheid, veerkragtigheid teen klimaatsverandering, aanpassingstrategieë, uitwerkings van klimaatsverandering, natuurrampe, gemeenskapsgebaseerde aanpassing en ekostelsel-gebaseerde aanpassing.

INGQIKITHI YOCWANINGO

Ukushintsha kwesimo sezulu kuya ngokuya kuba inselele emhlabeni wonke futhi amazwe ayawuzwa umthelela wako. IMalawi ithinteke kakhulu ngokushintsha kwesimo sezulu ngenxa yokuthi umnotho wayo uncike kwezolimo ezizwela kakhulu ngokushintsha kwesimo sezulu. Ngenxa yalokhu, izindlela zokuziphilisa ezikwazi ukumelana nesimo zomphakathi ziyaguguleka, okuholela ekwehleni kwamandla okuguqugugquka, kanjalo namazinga aphansi okumelana nezimo. Ucwaningo (ukuhlaziywa kokumelana nokuguqugugquka kwesimo sezulu emiphakathini yasemaphandleni esengcupheni eMalawi) lwenziwa ezifundeni ezine zaseMalawi, okuyiChikwawa, yiKaronga, yiSalima kanye neZomba. Imininingwane yaqoqwa kusetshenziswa izindlela namathuluzi amaningana afana nohlu lwemibuzo oluhlelekile oluqondiswe emakhaya angama-402, izingxoxo zamaqembu ayi-15 (FGD), izinhlolokhono eziyinhloko eziyi-15 (KII), kanye nenhlolovo yakwa-*survey monkey* eyasatshalaliswa kubasebenzi bakahulumeni abambalwa ezingeni longqongqoshe. Lolu cwaningo luveze ukuthi abantu abangama-94.3% abaphendulile bayalwazi uguquko lwesimo sezulu futhi bayakwazi ukuhlukanisa phakathi kwesimo sezulu samanje kanye nesimo seminyaka engu-30 edlule. Okungenani abangama-83.7% babalule ukwehla kwenani lemvula; Abangama-85.7% baqaphele ukuphuza ukuqala kwemvula; Abangama-88.7% bathi kunokunqamuka ngaphambi kwesikhathi kwemvula; Abangama-92.4% bathi ezikhathini eziningi kuba nemvula engasabalele kahle; abangama-95.9% baveze amazinga okushisa anyukile; abangama-94.9% bazwakalise ukusabalala kwemimoya enamandla; abangama-90.9% babalule ukuphuza ukutshalwa kwezitshalo; kwase kwathi abangama-94.7% babonisa izikhukhula ezivamile ngokwezamba ezinkulu.

Izinhlekelele ezijwayelekile ezihlobene nokushintsha kwesimo sezulu ezindaweni zocwaningo yizikhukhula, izimvula eziguqugugqukayo, isomiso, isichotho kanye nezibungu. Uma kuba khona inhlekelele, izindlela eziqavile zokubhekana nalokhu zifaka kuzo ukudayiswa

kwempahla yasekhaya, ukusebenzela amawejisi, ukusizwa ngemali nokunikelelwa, ukuya kwamanye amazwe ukuyofuna umsebenzi kanye nokuhweba okungathi shu. Amasu aqavile okuzivumelanisa nezimo asetshenziswa abalimi abancane ngezolimo zokulondoloza imvelo, ukufuya imfuyo ukuze bathole inzuzo, ukunisela ngenkasa ukuze kwenezele ukulima okunezimvula, ukuhlukahluka kwezitshalo, ukutshala izitshalo ezikwazi ukumelana nesomiso, ukufuywa kwezilwane zasemanzini, ukutshala amahlathi, kanye nokutshala izinhlobo ezisheshe zivuthwe. Mayelana nezinkomba zokumelana nesimo, kubikwe ukuthi amakhaya ayakwazi ukumelana nesimo nokululama ekushaqekeni. Imindeni ingakwazi futhi ukuzivumelanisa noshintsho, ifinyelele emanzini ahlanzekile futhi ngokwesilinganiso esithile ithole iholo elizinzile. Lolu cwaningo luqhube lwaveza ukuthi ukwakhiwa kokumelana nokuguquguquka kwesimo sezulu eMalawi kukhinyabezwa yizinsiza ezinganele zokudluliswa kwezinsiza emiphakathini, ukungaqondi kahle kwezimiso zokubhekana nesimo sezulu, ukwenzeka njalo kwezinhlekelele zemvelo ezithinta izinzuzo ezitholwayo ekuzivumelaniseni nezimo nokwakhiwa kokukwazi ukumelana nezimo, kanye nokungaqalisi kahle ukusetshenziswa kwako kanye nokuxhaswa ngemali kwezesimo sezulu.

Ukuhlaziya sekukonke kuphetha ngokuthi imiphakathi iyakwazi ukumelana nezimo kodwa hhayi emazingeni afisekayo/anele. Njengoba nje kwenziwa imizamo emininganа yokubhekana nokuguquguquka kwesimo sezulu, ukwakhiwa kwemizamo yokuvumelanisa nokuguquguquka kwesimo sezulu, nokwakhiwa kokukwazi ukumelana nokuguquguquka kwesimo sezulu eMalawi kuhamba kancane. Lokhu kubandakanya ukuthi imiphakathi ayikwazi ukumelana ngenxa yokuthi ezomnotho zayo azihlukanisiwe ngokwanele. Kuyajabulisa ukuqaphela ukuthi imindeni ikwazi ukuthola amanzi anele. Ukulungiselela izinhlekelele nakho kunengqondo futhi kuyasebenza kanti futhi amakhaya ajabulela ukuthula nokulondeka okuqhubekayo. Izici ezintathu kwezine zokukwazi ukumelana ziyahlangatshezwa yimindeni ngokwesilinganiso esithile. Ukuze kuqinisekiswe ukukwazi ukumelana

nokuguqugugquka kwesimo sezulu okusebenzayo nokuthuthukisiwe, kunconywa ukuthi ukuqwashisa ngenqubomgomo kumele kuqinisekiswe ngokubuyekeza nokusebenzisa inqubomgomo. Amalungiselelo ezikhungo zokuguqugugquka kwesimo sezulu nawo kumele asekelwe. Ngaphezu kwalokho, ukulima ngenkasa ukuze kuvumelane nesimo kufanele kuthuthukiswe. Ukwengeza, kumele kube nokudluliswa okugcwele kwamandla kusuka kuhulumeni omkhulu kuya kuziphathimandla zezifunda. Ezinye izincomo zibandakanya ukuguqula ukukhiqizwa kwemfuyo uma kunenkinga yokuguqugugquka kwesimo sezulu; ukwenza ngcono izinsiza zokwandisa abalimi abasafufusa; ukugqugquzela ukuhlukahluka kwezitshalo ukuze zivumelane nesimo; ukuthuthukisa izinhlelo zokuqoqwa kwamanzi emvula ukuze kuvumenaliswe nesomiso nokushoda kwamanzi; ukugqugquzela ukusetshenziswa kwezinsiza zezolimo ezithuthukisiwe ukuze zivumelane nesimo; ukwenza ucwaningo lwangomuso oluhlobene nokumelana nokuguqugugquka kwesimo sezulu; kanye nokuqinisekisa ukusebenzisana phakathi kwababambe iqhaza ekwakheni isimo sokukwazi ukumelana.

Amagama Abalulekile: ukuguquka kwesimo sezulu, ukunqanda ukuguqugugquka kwesimo sezulu, ukuguqugugquka kwesimo sezulu, ukuba sengcupheni, ukumelana nokuguqugugquka kwesimo sezulu, amasu okuzivumelanisa nezimo, imithelela yokuguqugugquka kwesimo sezulu, izinhlekelele zemvelo, ukuzivumelanisa nezimo ezisekelwe emphakathini, nokuzivumelanisa nezimo ezisekelwe ku-ecosystem.

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ACPCs	Area Civil Protection Committees
ADCs	Area Development Committees
AEC	Area Executive Committee
CAAP	Community Adaptation Action Planning
CBO	Community Based Organisation
CBA	Community Based Adaptation
CCA	Climate Change Adaptation
CDSS	Community Day Secondary School
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH4	Methane
CoP	Conference of Parties
CO2	Carbon Dioxide
CCR	Climate Change Resilience
CRED	Centre for Research on Epidemiology of Disasters
CoBRA	Community Based Resilience Analysis
DCCMS	Department of Climate Change and Meteorological Services
DDP	District Development Plans
DEC	District Executive Committee
DFID	Department for International Development
DESC	District Environmental Screening Committee
EBA	Ecosystem Based Adaptation
EEA	European Environmental Agency
EMA	Environmental Management Act
ENSO	El Nino and the Southern Oscillation

EPA	Extension Planning Area
EWGs	Expert Working Groups
FAO	Food and Agriculture organisation of the United Nations
FGD	Focus Group Discussions
GCF	Green Climate Fund
GCM	General Circulation Model
GC-RED	Global Centre on Resilient Ecosystems and Desertification
GDP	Growth Domestic Product
GHG	Greenhouse Gases
GEF	Global Environmental Facility
GVH	Group Village Head
GoM	Government of Malawi
HCFs	Fluorocarbons
ICT	Information, and Communication Technology
IIED	International Institute for Environment and Development
IKS	Indigenous Knowledge Systems
ILRI	International Livestock Research Institutes
IMES	Implementation, Monitoring and Evaluation Strategy
IPCC	Intercontinental Panel on Climate Change
ITK	Indigenous Technical Knowledge
ITCZ	Intertropical Convergence Zone
INDCs	Intended Nationally Determined Contributions
KII	Key Informant Interview
LDCs	Least Developed Countries

MDGs	Millennium Development Goals
MGDS	Malawi Growth and Development Strategy
MVAC	Malawi Vulnerability Assessment Committee
NAPA	National Adaptation Programmes of Action
NAMAs	Nationally Appropriate Mitigation Actions
NCCIP	National Climate Change Investment Plan
NGOs	Non-Governmental Organisations
NRS	National Resilience Plan
NSCCC	National Steering Committee on Climate Change
NSO	National Statistical Office
NTCCC	National Technical Committee on Climate Change
N_2O	Nitrous Oxide
OECD	The Organisation of Economic Co-operation and Development
PDNA	Post Disaster Needs Assessment
PFCs	Perfluorocarbons
REDD+	Reducing Emissions from Deforestation and forest Degradation in developing countries and the role of conservation, sustainable management of forests, and enhancement of forest sinks in developing countries
SEP	Socio-Economic Profile
SLA	Sustainable Livelihood Approach
SIDS	Small Island Developing States
SLF	Sustainable Livelihood Framework
SPSS	Statistical Package for Social Sciences
TA	Traditional Authority
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNISDR	United Nations Office for Disaster Risk Reduction
USAID	United States Agency for International Development
UNFCCC	United Nations Framework Convention on Climate Change
VDCs	Village Development Committees
VCPCs	Village Civil Protection Committees
VNRMCs	Village Natural Resources Management Committees
VSL	Village Savings and Loans
V2R	Vulnerability to Resilience Framework

CHAPTER 1: INTRODUCTION: BACKGROUND TO THE STUDY, PROBLEM STATEMENT AND OBJECTIVES

This thesis is a collection of some of the works on the climate change thematic area. It focused much on climate change adaptation and building community resilience for improving community and national level livelihoods.

An analysis of climate change resilience of vulnerable rural communities in Malawi was conducted by this researcher. This was a critical analysis of different approaches and strategies employed by various communities and stakeholders in Malawi to inform best practices for resilience building for conclusions and recommendations.

1.1. BACKGROUND TO RESEARCH PROBLEM

Climate change is a global occurrence which is bringing several challenges and impacts on socioeconomic development (IPCC, 2007a:123-125). Several livelihood strategies globally have been disrupted thus development gains in vulnerable countries have been compromised because of the effects of climate change. Impacts of climate change are increasing the vulnerability of nations and the citizens globally. Climate change related risks, hazards, and natural disasters will continue to significantly increase due to the variability of the climate (UNFCCC, 2011a:103). This will entail negative impact on national economic development thereby affecting general peoples' livelihoods.

To substantiate the impact of climate change at global level, for example, some communities in Southern Asia are vulnerable and are heavily affected by its impacts that include reduced agricultural productivity, decreased water availability and quality, adverse impacts on aquaculture/fisheries, adverse effects on all sorts of ecological systems and increased prevalence of various diseases such as cholera (IPCC, 2007b:27-31). In general, Southern Asia is feeling the pinch of climate change and occurrence of natural disasters which eventually increases

peoples' vulnerability to the risks and hazards thereby reducing their socio-economic status.

In Africa, many countries have been heavily affected because of the levels of poverty and the fact that the continent relies on the agriculture sector for its development which is very much sensitive to climate change. Agricultural development has not fully contributed to the resilience of countries in Africa because climate change and natural disasters prevail annually thereby resulting in reduced yields hence declining national income and reduced food security (FAO & ILRI, 2008:1-3). Malawi is not exceptional; the country is facing climate change impacts, therefore, making disasters unforeseen in the country. Malawi, which is in Southern Africa, is susceptible to a number of threats/risks, critical ones being floods, droughts, strong winds, hailstorms, earthquakes, pest infestations, and disease epidemics (Mkwambisi & Martin, 2014: 57). All the above hazards are very much linked to climate change and result in the prevalence of natural disasters. The fact is that when these natural disasters occur, they affect peoples' livelihoods and socio-economic development of the country. For example, the 2015 unprecedented floods that occurred in Malawi affected a larger population and the impacts included the death of people and livestock, reduced crop yields, destruction to infrastructure and increased incidences of malaria and cholera (Coulibaly, Mbow, Sileshi, Beedy, Kundhlande, & Musau, 2015: 283-284). This eventually affected peoples' livelihoods because they had no adaptive capacity to the challenges and that their resilience to climate shocks was threatened. The argument is that most of the work being done by government institutions and Non-Governmental Organisations (NGOs) simply aim at the humanitarian response to natural disasters as opposed to activities related to preparedness and recovery. This, therefore, affects the livelihoods of communities because climate change adaptation and resilience building of communities is not guaranteed. This, in turn, makes the communities or the country very vulnerable to stresses, and climate shocks.

The problem of slowed climate change resilience building in Malawi is caused by a number of factors and include the following: lack of alternative livelihoods at household level to reduce impact of climate change; inadequate extension services to communities on climate building strategies; inadequate understanding of climate resilience principles by communities and some development practitioners; occurrence of natural disasters that affect the gains made on climate adaptation and resilience building; and poor policy direction on resilience building. However, with the increased climate action interventions in Malawi that are aiming at adapting to the changing climate, the impacts of climate change are slowly being tackled with the aim of contributing to climate resilience of communities (UNDP, 2017b).

1.2. PROBLEM STATEMENT

The problem to be addressed in this study is lack of evidence and documentation on the extent of climate change resilience building approaches in Malawi even though climate change adaptation programmes are implemented by different stakeholders to reduce impacts of climate change and natural disasters. The consequences or challenges stated in the background above are affecting Malawi, a country bordering Tanzania, Zambia, and Mozambique. According to the Government of Malawi statistics, 15 of 28 districts are experiencing climate-related risks and these include droughts and dry spells, seasonal floods, strong winds, and hailstorms (GoM, 2015a:7-8). These are exacerbating the vulnerability of people to climate change impacts and natural disasters leading to reduced capacity for resilience building.

Several studies and/or assessments have been conducted by development practitioners and scientists at county level but very little is linked to climate change adaptation and building community resilience in relation to climate change and natural disasters (World Bank, 2007:110). While a multitude of development initiatives have been undertaken by different stakeholders in supporting the Malawi Government to minimise the extent of natural disasters, enhance adaptation and build community

resilience, the challenge remains that vulnerable communities are feeling the pinch of effects of climate change and disasters. Resilience building relates to several dimensions and these include future uncertainty, adaptive capacity, hazards and stresses, governance, and livelihoods. Communities need adaptive capacity and the capability to tackle and reduce risks (USAID, 2012b:9-11). Building on this, the study assessed the resilience of vulnerable communities to climate change and natural disasters and its effects to the socioeconomic development of the communities of Chikwawa (Lower Shire) and Zomba Districts in the Southern Region, Salima District in Central Region and Karonga District in the Northern Region of Malawi. This was done by finding evidence of the extent of climate change resilience in these communities by analysing their socio-economic context and livelihoods in relation to climate change. These districts were chosen for this study because they are heavily affected by climate change and natural disasters year in year out despite various support that is provided by stakeholders to address the challenge (GoM, 2015d).

The study explored the good/best practices and strategies employed to enhance adaptation to climate change and build community resilience amidst annual recurrence of natural disasters and climate shocks that include floods, dry spells, droughts, hailstorms, strong winds and stormy rains. The best/good practices and strategies were considered by employing a set of evaluation criteria for determining them as developed by European Union. The best practices were evaluated based on the following:

a. Effectiveness and efficiency of the practice- This looks at how useful and helpful to the communities and the value it brings in relation to their livelihoods.
b. Participatory nature – Participation of many or all stakeholders signifies the importance of that good practice.
c. Relevance – This implies the applicability of the good practice.

d. Theory and evidence based – The practice or strategy should have its theory or evidence to show that it is the best for climate change adaptation and climate resilience building.
e. Equity – The practice or strategy should benefit more stakeholders or communities.
f. Transferability – The practice or strategy must work in several locations and can be implemented in different settings and give similar results/impacts.
g. Sustainability – the practice or strategy must help the present generation while also serving for the future generation.

For the practice/strategy to be considered the good or best practice, it should at least meet the three-minimum set of evaluation criteria as described above (European Union, 2016: 2 – 10).

It was expected that the study would help relevant stakeholders to identify and understand the strategies for adaptation to climate change and building community resilience through the recommendations that have been made. In this regard, the problem to be addressed in this study was lack of evidence and documentation on the extent of climate change resilience building strategies in Malawi even though climate change adaptation programmes are implemented by different stakeholders to reduce impacts of climate change and natural disasters.

1.3. RESEARCH OBJECTIVES

The purpose of the research is to analyse climate change resilience building of rural vulnerable communities in Malawi. The following specific objectives were accomplished:

1.3.1. To establish how climate change is affecting the general resilient livelihoods of communities in the four districts of Karonga Salima, Chikwawa, and Zomba.
1.3.2. To identify climate change adaptation and resilience building strategies employed by communities in these districts.

1.3.3. To establish the extent of climate change adaptation and community climate change resilience building in Malawi.

1.3.4. To identify gaps for future research and action.

1.4. KEY RESEARCH QUESTIONS

In relation to the research objectives, some key questions were devised in a form of a questionnaire and administered to the study respondents. These included but not limited to the following:

- How is climate change affecting the general resilience of communities Karonga, Salima, Chikwawa and Zomba? Respondents here were required to indicate ways of how their general resilience if affected by focusing on trends of climate change, shocks and stresses that affect their livelihood.
- Which strategies or practices are undertaken by communities in these districts in order to achieve climate change adaptation and resilience building? Participants were required to identify and provide strategies or mechanisms that make them adapt to climate change and build their resilience.
- What are the key resilient livelihoods strategies employed by the people in the districts to achieve climate resilience? Respondent were required to provide in detail their strategies for their daily livelihood related to resilience characteristics which include economic security, water supply (access to sufficient and good quality water), disaster preparedness, and peace and security.
- What are the gaps that are existing related to resilience building for future research and action? The research was expected to identify the gaps through the findings of the study for future research and action.

1.5. THE SCOPE OF THE STUDY

The study was conducted in twelve sampled villages in five Traditional Authorities (TA), two villages each except in TA Kyungu which had 4 villages. The Traditional Authorities are Katunga and Maseya of

Chikwawa; Mwambo of Zomba District; Ndindi of Salima district and Kyungu of Karonga District. The targeted districts and Traditional Authorities have different socio-economic statuses. Chikwawa District lies in the Shire Valley along the Shire River which is in the southern Malawi and it flows to Zambezi river in Mozambique. The District is known with some economic and livelihood activities including subsistence farming. Zomba District, on the other hand, lies to the eastern part of Malawi and known for its livelihood activities such as subsistence farming and fish farming in and around Lake Chilwa. Salima and Karonga districts lie along the shores of Lake Malawi in the Central and North of Malawi respectively and have very hot conditions. The districts are known for many economic and livelihood activities including rice cultivation and fishing (detailed information on social economic characteristics of the study districts is provided in Chapter 4). The twelve sampled villages have an average number of households of 500. The study selected these areas and districts because they are representative of many other districts that are prone to climate change shocks and natural disasters. The districts selected are some of the districts that experience climate shocks and natural disasters every year. For instance, Karonga experiences floods and dry spells; Zomba experiences droughts, floods, and stormy rains, Salima experiences droughts, and floods while Chikwawa experiences floods, dry spells, droughts, and crop pest infestation.

The study followed a detailed and extensive process by using structured questionnaires for collection of realistic, reliable, and relevant information. The respondents for this study were identified through the random sampling technique using the Andrew Fischer's formula for sampling (refer to more detailed information in chapter 5). At the end of the sampling process, a total of 402 respondents from all the twelve villages participated in the study (thus an average of 34 respondents per village). The questionnaires were developed and utilised to gather quantitative and qualitative data from household heads as respondents. Individual interviews were conducted with key respondents as the other

set of respondents with the aim of getting qualitative data because of their knowledge and experience in the subject matter.

This study revolved around the key issues and aspects of adaptation to climate change, resilience building related to climate change, financing and effects of climate change shocks, and natural disasters on communities' livelihoods.

Six research assistants were identified and given training for them to support the process of data gathering from sampled respondents during the study. Data was consolidated each day after the collection exercise, and this ensured proper cleaning and analysis.

1.6. LIMITATIONS OF THE STUDY

The researcher envisaged that limitations were not avoidable in this study as such they prevailed during the study thereby affecting the execution of the study. Below is a description of some limitations that affected the study:

- **Geographical placement:** Some areas or districts targeted in this study are in very difficult sites where the terrain is not good thereby making access to those places by light vehicles challenging. Some of the places were almost impassable using these light vehicles. To ensure that respondents from those areas participate in the study, the researcher used a 4x4 vehicle and bicycle taxis to reach to such places.
- **Tools and approaches used in data collection:** Collection of quality and reliable data from the respondents was deemed not to be easy because some methodologies were not very much applicable to some respondents. For example, it proved not easy to collect reliable data since the questionnaires were administered to respondents. Some respondents were uncomfortable to spend some time with the researcher simply because of the study. In order to prevent this case, the researcher ensured that the questionnaire to be administered was designed in a way that it had clear and straight forward questions and explaining the reasons why this study is

conducted in their area (s) for easy understanding of the targeted respondents. In addition to this, Key Informant Interviews (KII) were relied upon in order to generate more precise data as part of triangulation of the data already collected.

- **Respondents and Cultural beliefs:** Some respondents in the community or social groups of people were not able to provide responses or data to the study team as required because of their cultural beliefs, values, and traditional beliefs. For example, some cultures in Malawi believe that providing personal information to strangers is a taboo because they feel the information can be used for other purposes. The study team engaged local leaders and village headmen so that the groups were informed about the purpose of the research, research values and that it respects their culture.
- **Time constraints:** The study was conducted when the communities/farmers were harvesting their crops or when they were busy with other community work. This meant that people were busy in their fields (gardens) in taking care of their agricultural produce and with community work. The study team made sure that the exercise of data collection was carried out in the afternoon of every day and even during the weekend when people were available for interview, but this depended on the situation and the need. The timing or approach of interviewing the respondents when they were harvesting their crops or doing other community work offered some advantages and these were:
    i. There was assurance that community members would be available because they are either within the community doing community work or they are within their gardens harvesting the crops. This is opposed to the other times when people are always idle or during agricultural lean period whereby people move from one place to another looking for basic needs.
    ii. It provided an opportunity for all social groups of people (men and women) to represent households and participate in the study due to their availability. This also gave them motivation

to participate in the study because some of the issues in the study were related to agricultural production and other community work.

1.7. IMPORTANCE OF THE STUDY

This study focused on analysing the vulnerable communities' resilience building in the face of climate change. The study is of great importance because of several reasons, and they include the following:

Many similar studies carried out previously both internationally and in Malawi have looked at policy formulation and execution/implementation. In Malawi, the assessments and studies have not tackled issues of practical strategies of resilience building through the implementation of various projects. This study, therefore, tried to bridge that gap so that clear data and the level/extent of resilience building are identified.

The study is important because it established the linkages between climate change adaptation and resilience and whether this translates into improved community livelihoods and a resilient community.

The study also established key climate change adaptation scenarios and how they are helping to achieve community-based resilience in Malawi. In addition, the study intended to find whether Malawi as a country is benefiting from global climate financing mechanisms and through what channels; and in either case, how does that affect the resilience and livelihood status of the people of Malawi.

Finally, the study made an original contribution to the field of Development Studies by exploring and identifying effective best practices/strategies for building community resilience to climate change of which it is a learning point for development practitioners and other stakeholders for replication. This enriches the development domain with additional knowledge on practical practices for climate change adaptation and resilience building.

1.8. CLARIFICATIONS OF KEY TERMS

The terms highlighted here are those that are appearing and will continue appearing throughout the study and of course, some of them appear once but they are worth reflecting.

Vulnerability

This is an exposure or a circumstance of a community or a society to the loss or damaging effects of any hazard. This entails the extent to which physical infrastructure, humans and economic assets are susceptible to the loss and damage. Primarily, vulnerability is caused by lack of access to basic services; lack of economic opportunities; lack of assets; and social exclusion (OECD, 2014: 22).

Community resilience

This term is related to the general improvement of community livelihoods amidst climate change shocks and stresses. Resilience is achieved when a community or people have the ability and capacity to cope with and absorb, adapt to impact of climatic stresses and the capacity to change a system (IPCC, 2012:192).

Climate change adaptation

This entails that people and/or systems can adjust the way they do things as a response mechanism to either expected or actual stimuli of climate variability and its effects. When the adjustment has been made to suit the current climatic phenomenon, there are several changes in practices, structures, and processes (IPCC, 2007c: 67).

Disaster

A disaster is any disturbance in the society and/or environment that exceeds the capability of that society to cope that disturbance. Examples can include floods, earthquake, and drought (Episcopal Conference of Malawi, 2010:2).

Hazard

This is a chance or probability that shows that any dangerous phenomenon or condition can occur and lead to loss of livelihoods, socio-economic disruption, and environmental damage. People with low capacity to deal with hazards are at highest risk of facing an injury (Episcopal Conference of Malawi, 2010:3).

Risk

It is any possibility or probability of meeting a harm or danger. The lower the capacity, the higher the risk an element is subjected to. The major factors that contribute to the occurrence of the risk include capacity and vulnerability (Episcopal Conference of Malawi, 2010:2).

Contingency planning

Contingency Planning involves the development of one or more scenarios describing the potential emergency that may have to be dealt with and planning for response to each scenario in terms of what would be done, how and by whom (Government of Malawi, 2013b:34).

1.9. OUTLINE OF THE STUDY

The "Analysis of climate change resilience building of vulnerable rural communities in Malawi" study is structured to consist of 7 chapters complemented with a list of references and annexes. The chapters are put in the numerical order described below:

Chapter one provides a general introduction to the study which includes background to the research problem, problem statement, research objectives, scope of the study, limitations of the study, importance of the study and clarification of key terms used in this study.

Chapter two provides a review of climate change related literature for this study of which basic concepts on climate change and vulnerability, climate change adaptation and resilience building are documented. It

looks at key components of climate change adaptation, climate change mitigation, and resilience building. It also details general climate change contexts at global, continental, and country level. It also explores context of climate change, mitigation, adaptation, and resilience and how they are approached in Malawi. Additionally, it provides an account of institutional and governance arrangements for climate change in Malawi to ensure effective programming and management in Malawi.

Chapter three presents theories, models and approaches towards climate change adaptation and resilience. It is providing a description of models and approaches to climate change, mitigation, adaptation, and resilience regarding their processes and how they are used by development practitioners including the vulnerable population. This chapter also describes in detail the theoretical framework used in this study which is known as “From Vulnerability to Resilience (V2R) Theoretical Framework.

Chapter four gives a full description of study districts and areas. The description takes a full account of key aspects of the districts such as administrative structures, local politics, and demography; land tenure and land use systems; physical description, location, geology and hydrology; geography, climate, climate change and soils; the people, language and culture; environment and natural resources; education; and infrastructure and utilities.

Chapter five is about research methodology and highlights the methodology, approaches and processes used in carrying out the study in the four districts. The methodology focused much on research design (organisation and approach); population, sample frame, sampling techniques and sample size; data gathering procedures; data gathering instruments; data analysis strategies; ways to ensure data validity and reliability; testing of data gathering instruments; and ethical considerations, and computer use and internet availability in the study areas.

Chapter six presents an analysis of Climate Change Resilience of Rural Vulnerable Communities. The data that was gathered is discussed in detail in relation to the characteristics and/or themes of resilience following the methodology and data instruments used. The chapter highlights critical analysis of the findings from the four study districts based on the data that was collected.

Chapter 7 describes conclusions, and key findings of the study in the districts of Karonga, Salima, Chikwawa, and Zomba in relation to its themes, objectives, and characteristics of resilience. It also provides suggested recommendations for implementation based on the findings. The description is done with cross-referencing of the key findings as they are presented in Chapter 6 to show linkages of the results and recommendations.

CHAPTER 2: AN OVERVIEW OF CLIMATE CHANGE AND CLIMATE CHANGE RESILIENCE

This chapter gives a highlight of key aspects and concepts on climate change, disasters, adaptation to climate change, and climate change resilience. This provides a general context of climate change and natural disasters at all levels (global, and continental) and their effects on building community resilience. It provides a synopsis of all climate change-related concepts and their relationships, but emphasis is put on Climate Change Adaptation and Climate Change Resilience Building. The chapter, therefore, gives a general context of literature review on climate change.

In simple terms, this chapter provides the backdrop to climate change mitigation, adaptation, and resilience building, and Malawi's approach to climate change which are encapsulated in several models explained in chapter 3. This chapter is focusing much on general literature that is available on climate change and is linked to chapter 3 which is focusing on general models and approaches to mitigation, adaptation, and resilience building.

2.1. INTRODUCTION TO CLIMATE CHANGE

Climate change is a concept that is frequently discussed by different development players as explained by Hannah Reid:

> Climate change has been debated by so many development practitioners and scientists and they all agree that the future Greenhouse Gases Emissions (GHG) will increasingly affect the global atmosphere. This entails that the human induced changes in climate are the major cause for variability (Reid, 2014a).

In relation to this, Taylor states that

In the last one hundred (100) years, the mean atmospheric temperature has risen with 0.75 degrees Celsius and that many development

practitioners and scientists understand that the global warming trend is caused by anthropogenic activities (Taylor, 2014: 235-240).

Global warming is becoming an order of the day globally as evidenced by the rise and changes in temperatures. This is because the greenhouse gases block the excessive heat (formed from the earth surface) that try to escape further into the atmosphere. Climate change, therefore, is a global phenomenon that is and will affect livelihoods of many people in the next decade.

With reference to Intergovernmental Panel on Climate Change (IPCC, 2014a), it is explained that temperatures affect a wide range of factors in agriculture and water resources, which are the most important factors of livelihoods. These factors play a significant effect on weather patterns and atmospheric dynamics. Global warming is increased and enhanced by the uncertainty of the environment which is brought about by the energy position of that environment which is an index for determining that position or status.

IPCC defines climate change as “a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties that persists for an extended period, typically decades or longer and this can be any change whether natural change or as a result of human activity”. Whereas UNFCC defines climate change as “the change in the climate system which is attributed directly or indirectly to human activities that alter the composition of the global atmosphere and which are in addition to natural climate variability observed over the comparable period”.

a. Natural causes

Climate change is caused naturally because of exchanges among the sea, atmospheric environment, changes in the orbit of the earth, fluctuations in the sun’s energy, volcanic outbursts, and natural concentration of atmospheric or greenhouse gases (GHGs) in the atmospheric environment. Natural greenhouse gases are what keep the earth habitable, without which the earth could be 30°C colder.

b. Anthropogenic causes

Simply put, these are human activities. The key anthropogenic stimulus on global climate change is the greenhouse gases (GHG) emissions and the GHGs include methane and carbon dioxide. Humanoid actions have resulted in the burning of fossil fuels and land use for agriculture production. Excess release of Greenhouse Gases into the atmosphere due to human activities is making the earth's atmosphere warmer than its natural state and this leads to global warming. Under normal conditions the sun rays hit the earth, and some are reflected into space. Industrialisation, fossil fuel burning, and some agricultural practices upsurge in emission of Greenhouse Gases in the atmosphere making a barrier for sunrays thicker. Massive clearing of forests has also contributed to fuelling carbon concentrations in the atmosphere since the plants also act as carbon sinks because they use carbon dioxide as one of their basic elements for the process of photosynthesis (Chiotha, Mphepo, Tsirizeni, & Phalira, 2013: 18-21).

Climate change has resulted in aggravated serious natural disasters. This is a big risk that affects the planet's future life as it has resulted in more extreme weather-related events like flooding and drought across the world. This has a direct effect on foodstuff production and poor countries and communities are vulnerable hence have limited ability to adapt to climate change hence depend highly on capitals like community water and food materials which are sensitive to climate.

2.2. GLOBAL PERSPECTIVE OF CLIMATE CHANGE AND INTERNATIONAL RESPONSE TO CLIMATE CHANGE

As explained above, global warming is becoming the order of the day globally as evidenced by the fact that the earth's atmosphere is becoming warmer due to rise and changes in temperatures. This is because the ozone layer is depleted by the greenhouse gases that try to escape further. Climate change, therefore, is a global phenomenon that is, and will affect livelihoods of many people in the next decades. As explained by Wendy Taylor (2014: 235-236) in her book titled "Development Studies", many scientists have agreed that some changes

that are occurring in weather and climate patterns are due to climate change brought about by man's activities. Global warming, therefore, is linked to climate change, which is a result of temperature changes, changes in rainfall patterns, changes in water vapour, and other climate variables. There is, therefore, overwhelming scientific evidence that climate change has taken place remarkably in the last century than any other before it (IPCC, 2014a: 1138 - 1140). The possible effects of climate change are numerous and varied and they include the following:

- warmer seas expand and sea level increase.
- ice melt down and ice tops in Arctic and Antarctica respectively and Greenland Sea level rise.
- low lying coasts and islands such as The Maldives may be submerged.
- occurrence of cyclones in Bangladesh and droughts in Somalia can become more severe.
- people will become displaced from their homelands.
- food production will be affected such as growing wheat in Russia.
- various species may be unable to adapt and will migrate or die.
- diseases such as malaria could spread, and rainforests such as Amazon could suffer as rainfall patterns change.

When these effects occur, the peoples' livelihoods and their socio-economic status is also heavily affected because all the sectors of development are equally affected. For example, the agriculture sector acts as a key livelihoods' source of the global population since 2.5 billion people worldwide depend on agriculture (FAO, 2016:1-12). As such agricultural production at the global level will be affected because it is more susceptible to climate change. It is an undeniable fact that climate change is connected to natural disasters because it triggers changes in the environment hence creating hazards and risks (Henderson, Reinert, Dekhtyar, & Midgal, 2017).

Over the last 20 years, approximately 218 million people each year were affected by disasters worldwide (CRED, 2015:9-10). These disasters

cause extensive damage to life, infrastructure, and livelihoods within a short period. The examples of natural disasters that occur worldwide include floods, drought, tsunami, hurricanes, and cyclones. The impact of a catastrophe relies on the scale of the event as well as on the development of the area that it affects. Natural disasters bring about negative impacts of the environment and ecosystem and they include but not limited to deaths of people, people fleeing their homes and suffer stress, damage of infrastructure (houses, roads, schools, and bridges), washing away of crops and death of livestock.

Realising the impacts of disasters across the world, in March 2015, 168 Governments, including Malawi, adopted a Sendai Framework (UNFCCC, 2015a). This is a plan aiming at accomplishing significant reduction of risks to disasters; losses to lives; businesses; livelihoods; health; physical, socio-cultural, and ecological capitals of people; societies and nations. The framework was agreed upon and adopted during the Third World Conference on Disaster Risk Reduction. It replaces the Hyogo Framework for Action (2005 – 2015) that had a focus on building resilience of Nations and for Communities. The overall objective of the framework is to check and decrease disaster risks through implementation of inclusive measures that reduce exposure to hazards and vulnerability to disasters for increased preparedness and recovery that will in turn lead to strengthening resilience.

The continent of Asia is larger than any other continent on this mother earth. It has four climatic zones, and these are boreal, temperate, and tropical, Semi-Arid, and Arid. It encounters both socio-economic and environmental related problems which are linked to the protection of its natural resources (UNFCCC, 2013). The UNFCCC further says that the continent is greatly subjected to climatic hazards and risks. Examples of the hazards include the 2005 Pakistan earthquake or tremor, and the Indian 2004 Ocean Tidal wave (tsunami). This entails that evidence of periodic occurrence of extreme weather events is there and that the frequency and intensity in the locality is increasing. The negative impacts of these kinds of catastrophes include susceptibility to pests and

diseases, reduction of household income, hunger and malnutrition, and loss of livelihoods thereby affecting human well-being. It is understood that climate change will enhance the magnitude of environmental and development challenges in Asia, and this will affect agriculture productivity and food self-sufficiency, availability of water resources, biodiversity, and human well-being conditions.

Melting of glaciers on the Himalaya is caused by global warming and this results in increased flooding, and mud slide erosion. Consequently, global warming could result in disappearance of glaciers and rise in snowline. This may cause grave effects on the people of Asia who depend on the seven major rivers of which their source of water is the Himalaya mountain and is mostly affected by periodic monsoon systems (Christensen & Kunikicharlan, 2015). It is, therefore, a fact that over 1 billion people in Asia could meet the challenges of water shortage resulting in environmental degradation, and droughts not later than 2050s (IPCC, 2015:206). The major effects of climate change on health in the Asian continent will include an increase in epidemics such as dengue, vector borne diseases and malaria. Malnutrition and diarrhoea are also posing a threat in the world particularly in the south eastern Asia. Countries mostly affected in this part of the continent include Myanmar, Nepal, Bangladesh, India, and Bhutan. Ailments and deaths are anticipated to be on a high level because of increased floods and droughts, cholera, and diarrhoea (IPPC, 2015: 241-242).

There is an expectation that the increase of heat waves and humidity during hot season will increase the mortality and morbidity of people particularly to those poor people or communities who reside in the tropical and temperate zones (Al-Houri, Al-Omari, & Saleh, 2014). Humidity is the amount of water vapour concentration in the air. This means that if there are higher temperatures, the air can hold more water vapour hence inducing clouds formation. So, the changes in humidity in terms of its occurrence are referred to frequencies and duration (Environmental Protection Agency, 2018). Recently, more pressure has been exerted on the natural ecosystems to provide increased need and

demand for livelihood resources for peoples' well-being (IPCC, 2014c). The future distribution and productivity of forests throughout this continent will be affected by climate change. For example, north-east China may be dispossessed of conifer forests.

The fisheries sector is not spared of climate change in the Asian continent, both freshwater in seas are heavily affected. It is understood that fisheries in higher or upland areas is likely to be affected negatively by reduced oxygen availability which is as result of surface air temperature rise. FAO (2015) indicates that the timing and quality of rainfall in the plains have impacted on fish migration from rivers to flood plains to achieve dispersion, breeding, and growth. Aquaculture production in Asia has improved over the years because of effective management. And in their recent work on climate change impact in Asia, it is believed that these aspects have already started being felt whereby fish are drifting to flood plains (FAO, 2014). This is because the timing and quality of rainfall have changed of late thereby affecting the reproduction and growth of fish. The change and variations in the quantity of water and temperatures have the potential of affecting fish breeding habits, and grounds thereby reducing fish population. This, in turn, affects the livelihoods of the population that depend on water and fish resources in that region. This means that their household income is reduced because they cannot get sufficient fish for sale, and again, their fish consumption is reduced leading to malnutrition.

In general, climate change in Asia has affected several sectors of development and its major impacts are on the following:

- temperatures.
- precipitation, snow, and ice.
- and extreme weather events like El Nino, drought, rainfall, wind cyclones, landslides, severe floods, and heat waves.
- water resources (increased stress to hundreds of million people and increased amount and gravity of glacial melt-related floods).

- agriculture production and food self-sufficiency (decreased crop yield, land degradation and desertification).
- terrestrial ecosystem (extinction of species because of synergic impacts of climate change).
- health (widespread illness and death due to diarrhoeal ailments).
- shoreline zones (occurrence of shoreline or coastal backlog or inundation, tropical cyclones, and these affect fisheries and that the infrastructure threatens wetlands and mangroves).

The Latin America continent is also affected by climate change. This continent has more biotic and natural diversity and several bionetworks, climatic zones, features, and land use arrays. UNFCCC explains that the sectors and zones like water, agriculture and health sectors, the Andean glaciers, and the Amazon region are vulnerable to climate change. The area is encountering climatic changes with incidence and magnitude of intense weather events, especially those connected to the ENSO portent. UNFCCC further explores the fact that heavy rains and resultant flooding, including those connected to tropical cyclones have led to thousands of demises and numerous losses on the economy, and societal disturbance in the continent over the current years. “An example is that in the year 1998, Hurricane Mitch triggered ten thousand demises and numerous destructions to infrastructure, of which Nicaragua and Honduras were the worst affected countries. The north-eastern part of Brazil and other countries are exceptionally affected by drought and its related impacts on the economy thereby making these countries more vulnerable to natural disasters” (Inter-American Development Bank, 2017).

Glacial seasonal discharge are the source of water supply and hydro-electric energy for the people of Bolivia, Chile, Ecuador, and Peru along the Andean Cordillera. However, as the glaciers disappear and as it is predicted to disappear in the next 15 years due to impacts of climate change, flows will tail off dramatically leading to serious water stresses, reduction in hydropower generation, greater risks of drought and floods,

and serious environmental degradation (UNEP, 2014). The projections are that dry and semi-arid zones will get even low precipitation under climate change resulting in degradation of land for agriculture thereby impacting on food self-sufficiency. This entails that yields from agriculture are anticipated to decline by the end of 21st century across Latin America.

The Amazon Basin is a habitat of about 40% of the global residual tropical forest and comprises one of the world's opulent mixtures of biodiversity. This contains numerous thousands of types of vegetations, over a million species of insects, more than even hundred species of fish, one thousand species of birds and over three hundred species of mammals. The dwindling of tropical forest regions, particularly in the tropical forests, shall possibly bring about the loss of numerous species. It is evident that over the years, tropical forests have faced extinction of many species (Scholze, Kaminski, Knorr, Blessing, Vossbeck, Grant, & Scipal, 2017). So, as climate change continue to prevail in this region, many species of fish, insects, and others will become more extinct thereby contributing to biodiversity loss that will, in turn, impact on peoples' livelihoods and well-being. It is predicted that by 2050, with a rise of 2 Degrees Celsius outward temperatures, there shall be severe loss of species across the central part of Brazil, Mexico and in arid zones of Argentina, Bolivia, and Chile (Thom et al, 2017).

Some extreme weather events that include rainfall, windstorms, and cyclones with their related storm flows, heat waves, and rise in sea levels are making some low-lying coastal areas to become vulnerable to climate change. These low-lying coastal areas include Mexico, Guyana, Uruguay, Columbia, Costa Rica, Ecuador, Belize, Argentina, and cities of Recife, Buenos Aires, and Rio de Janeiro. Warmer sea water is also affecting the fisheries sector in Latin America resulting in a reduction of fish stocks in the region.

Changes in climate are impacting on the people of Latin America and the impacts are on temperature; precipitation, snow, and ice; extreme

weather events; water; agriculture and food security systems; health; terrestrial ecosystems; and coastal zones.

Climate change has also adversely affected Small Island Developing States (SIDS). SIDS consists of 51 nations and zones covering the Pacific, the Caribbean Sea, Indian and Atlantic Oceans. Large atmospheric interactions that include El Nino, trade winds, and monsoons stimulate the climate of these states. Important resources such as water, agricultural land, and biodiversity are already under stress or pressure from sea level rise. The problems are exacerbated by the population increase and the unmaintainable utilisation of accessible natural capitals or assets. Cyclones and tropical storms bring about storm flows, coral bleaching, accumulation and flooding of land, and shoreline and soil loss with resultant damages of high cost to socio-economic and cultural infrastructure. This in the end affects specific county economic status (Springer Nature America, 2014). For instance, the Pacific islands region, hurricanes accounted for 76% of the recounted catastrophes or adversities between 1950 and 2004, of which the mean expenses associated with damage brought about by a hurricane stood at US$ 75 million in 2004 (World Bank, 2014a).

It is understood that climate change effects in these nations across all the sectors are linked to their socio-economic environment or situation thereby making them susceptible to climate change impacts (Fawcett, 2017). Small and fast rising population, aloofness, proneness to natural adversities, extreme dependability on transnational trade, susceptibility to global development, and a low disposal of resources are some of the vulnerabilities in this region. The water access in these states shall probably be aggravated by upcoming climate change. It is being projected that 10% decline in mean precipitation by 2050 could create a 20% drop in the scope of freshwater lens on the Tarawa Atoll, Kiribati, and lessen the viscosity of the freshwater lens on isles by up to 29%. Freshwater provisions are also endangered by saline invasion because of storm surges, and sea level increase, and storm surges and sea level

rise endanger freshwater provision, and these are brought about by climate change (Mimura, 2013).

Forest cover and biodiversity resources are largely affected by extreme weather events chiefly as responses to adaptation on SIDS which are anticipated to be sluggish and impacts of storms may be increasing. This is because terrestrial biodiversity is highly affected by climate change regularly by integrating with many different stimuli (IPCC, 2014b). Temperature changes are certain that they will principally affect the elevation of these states, and biotic forays are projected to push many species, as well as numerous pervasive birds to disappearance. Climate change affects temperatures, precipitation, and extreme weather events in the Small Island Developing States, and these do affect sectors of water, agriculture and food security, health, earthly ecosystems, and coastlines (IPCC, 2014b).

In Europe, the climate is also fluctuating, generally discernible in the increase of annual temperatures and variations in rainfall patterns. The IPCC has established settings or scenarios for predictions of global climate change up to 2100, with a similar work carried out for Europe. All models show warming throughout the European continent, and in all times of the year and that increased GHG emissions will bring about further lasting changes in all components of the climate system (Kundzewicz, Masson-Delmotte, Cubasch, Skea, and Kleiber, 2015). Yearly atmospheric temperatures in this continent are predicted to increase to between 0.1°C and 0.4°C per a span of 10 years and these are increasing GHG emissions (EEA, 2017a). The excess heat is anticipated to occur across the southern Europe, and countries to be affected include north eastern part of Europe, Spain, Italy, Greece, in Western Russia and Finland. The minimum increases shall prevail across the Atlantic shoreline. Cyclical patterns show that the inland of eastern Europe will heat more swiftly, between 0.15 and 0.6°C in 10 years during winter. The projected array of excess heat follows an evident south - north inclination in the summer. For example, southern Europe heating at a scale of between 0.2°C and 0.6°C per decade, and

northern Europe warming between 0.08°C and 0.3°C every 10 years. The rate and intensity of heat waves are projected to increase across the continent, causing a larger threat of summer drought especially in the south and central parts of Europe. The models show that there shall be extensive and general rises in yearly rainfall of between 1% and 2% in the next decade in the northern Europe, whereas reductions are anticipated over the southern part of Europe up to an extreme of 1% in every ten years. The minor and equivocal variations are anticipated in countries of the central Europe and these are Hungary, Germany, and France (EEA, 2017a).

The agrarian and farming practices across the continent are possibly to be impacted to some degree, by the forecast changes and variations in climate in the upcoming years. This is because of the following reasons: increase in concentrations of carbon dioxide; rising temperatures and changes in rainfall affect production; value and composition of the soil; and the profusion and the spread of pests and infections/disorders. Farming systems in the southern Europe shall be the highly susceptible to climate change because of increasing temperatures combined with reductions in both winter and summer precipitation in regions already facing shortage of water (EEA, 2017b). Water stress in Europe is increasing due to climate changes leading to reduced quality of freshwater sources and groundwater (IPCC, 2014b). Additionally, conditions of droughts and dry spells change the organisation of the soils for agriculture, making the soil solid and impermeable or impassable to crop or plant roots thereby aggravating the impacts of droughts. The reactions to water shortage may yield several conflicting antagonistic sequences, with substantial consequences for biodiversity. Substantial damages in biodiversity have been recognised and recorded on an explanation of dam construction and the alteration of widespread farmland to irrigated fields. It is understood that as we approach mid-21st century, there will be huge extinction of habitat due to bioenergy crop production and climate change is anticipated to be the cause (EEA, 2015a). Climatic changes can boost propagation or spread of agricultural

related pests and diseases/infections. Hotter climates offer extra conducive environments for pests and insects by permitting them to finish a larger number of cycles of reproduction. The latent effects of climate change on woodlands and forestry is also possibly to be largely affected both positively and negatively by the predicted changes and variations of climate in Europe in the upcoming years. The net primary production efficiency of forests in boreal zones is anticipated to increase because of rising temperatures, carbon dioxide absorptions and intensities of nitrogen accumulation. However, inadequate water resources in central and southern Europe will cause converse impact and bring about reductions in provincial production efficiency. In big regions of west and central Europe, rises in temperature could bring about the substitute of natural conifers with many modest deciduous trees. The effects of climate change on land use sector of European continent are anticipated to differ in degree and to also vary through interplanetary (EEA, 2015b).

One of the good impacts of climate change in some parts of the continent could be on agriculture productivity. For instance, increased carbon dioxide concentrations may incite photosynthesis process in plants for biomass manufacturing in some crops. The reaction is greatly minimal in crops such as maize, even though higher temperatures may increase production of the crops. Increased carbon dioxide also decreases stomatal opening and thickness on plants' leaves, and this brings about a decline in transpiration.

Generally, the summarised key effects of climate change globally are as follows:

- **Warmer seas expand and sea level rises:** These do cause flooding that affects low lying areas.
- **Ice melting and ice caps in Arctic and Antarctica respectively and Greenland Sea level rise**: This too causes seasonal floods that affect the low-lying areas and results in several damages on humans and infrastructure.

- **Low lying coasts and islands such as The Maldives may be submerged:** This can cause a lot of havoc to the inhabitants of the region and affect the biodiversity.
- **Occurrence of cyclones in Bangladesh:** The Cyclones also affect infrastructure thereby affecting general livelihoods of communities.
- **Droughts can become more severe globally:** These droughts bring about a number of effects such as water scarcity/stress due to lowered water tables, rainfall is unreliable resulting in reduction of crop yield hence food self-insufficiency that results in hunger and malnutrition which eventually leads to death. Drought also causes a decline in livestock production due to the fact that there is always the inadequate production of feed for livestock.
- **People become displaced from their homelands:** Livelihoods are affected because they leave everything at home and start life all over wherever they migrate to.
- **Food production is affected such as growing wheat in Russia:** This is because of water stress and increased temperatures that are not favourable to some crops.
- **Species may be unable to adapt and will migrate or die:** This disturbs ecosystems and biodiversity thereby affecting peoples' livelihoods.
- **The prevalence of illnesses like malaria and cholera:** Increased incidences of diseases make people not work effectively, as a result, they don't accelerate socio-economic development because they are often times trying to do away with diseases.
- **Rainforests such as Amazon could suffer as rainfall patterns change:** This is the major rainforest in the world and as climatic weather events become more intense, its ecosystem and biodiversity may be disturbed thereby affecting the lives of various types of species.

In response to climate change and its impacts, the international community came up with a global agenda of ensuring that Climate

change impacts are addressed particularly focusing on Climate Change Adaptation. The United Nations Framework Convention on Climate Change (UNFCCC) is at the centre stage and provides a forum for coordination and addressing all climate change related issues. IPCC is the UN authoritative voice on climate science and produces periodic assessments of the climate system globally. A number of agreements, treaties and policies have been entered into by member countries as a commitment to combating climate change.

One of the agreements as a way of responding to the impacts of Climate Change is the Green Climate Fund (GCF). This was established by the UNFCCC in the year 2010 and it is the operating entity of the financial mechanism for climate change of the UNFCCC. This is a kind of a ground-breaking in the level of assistance it offers to least developed countries for climate change adaptation (Green Climate Fund, 2015). This fund allows for all adaptation and mitigation related projects to be implemented in developing countries related to food and water scarcity, capacities for natural disaster preparedness and response and general livelihoods improvement. The major role of the fund is to enable advancement of standard change to the development that is low in emissions and climate resilient by considering the requirements of nations that are vulnerable to impacts and effects of climate change. The fund also aims at providing same sums of grants or financial support to actions that address mitigation and adaptation while being directed by resolution principles and establishments or requirements. It also has an additional role of ensuring that the Paris Agreement on Climate Change that was reached in Paris, France in the year 2015 is assisting the overall objective of keeping climate change below 2 degrees Celsius. The GCF has been dubbed as the largest and fastest growing climate fund.

Actions aiming at addressing climate change requires shared responsibility or action from all the nations which also include public and private or non-state actors. All the developed economies agreed to collectively mobilise substantial finances that can support least developed countries in tackling urgent requirements of developing

countries. The GCF put much emphasis on the needs of society that are extremely susceptible to the effects of climate change. The special attention and priority are given to African countries, the developing countries, and the Small Island Developing States (SIDS). The fund's financial assets (financial resources) are provided in the form of guarantees, loans, equity, and grants to ensure timely, effective, and efficient response to climate change effects. According to the GCF, it is indicated that the fund ensures that there is a strategy of unlocking private finance by helping both public and private sectors in climate change, fostering ownership of recipient countries through development of own country climate change investments, and promoting a 50:50 balance of allocation of resources between mitigation and adaptation programmes. This fund has supported several countries worldwide since its inception in 2010 and has enabled the developing countries to swiftly plan and implement mitigation and adaptation programmes. The developing countries that accessed the funds have made tremendous progress on climate change because they have made huge investments that would not have been possible to venture into had it been there was not such access of investment funds. This has, therefore, contributed significantly to the global response to the effects and impacts of climate change.

The other global funding mechanism that was set up to support addressing climate change is the Global Environmental Facility (GEF). This was established on the eve of the 1992 Rio Earth Summit to help tackle the global urgent environmental problems. It is an intercontinental grouping of 183 nations, transnational or global organisations, and private sector, and tackles worldwide ecological problems or challenges. Many countries are supported globally with financial resources to address environmental challenges in areas of climate change adaptation, safe disposal of hazardous chemicals, GHG emissions reduction, sustainable land management, integrated water resources management, sustainable management of forests, sustainable seascape and landscape, and protected areas.

The GEF acts as a financial instrument for several treaties and agreements that is making financial resources accessible to developing countries and those countries whose economic status is in transition so that they achieve the goals of the global agreements and treaties. Financial grants and financial resources are given to government agencies, private sectors companies, research institutions, civil society organisations among others who are eligible for this fund.

There are many other different funding mechanisms that have been established of late by the transnational community with the purpose of making vulnerable and least developed countries to access funds for climate related projects' implementation so that they reduce emissions and negative impacts of climate change in order to achieve climate resilience for resilient nations.

In addition, as a response to climate change and sustainable development, the United Nations came up with Sustainable Development Goals (SDGs) also called Global Goals. These Sustainable Development Goals (SDGs) were developed during the United Nations Conference on Sustainable Development in Rio de Janeiro in 2015 (UNDP, 2017c). They replaced the Millennium Development Goals (MDGs) that begun efforts of addressing the dishonour of poverty in the year 2000 and their time frame expired in 2015. These Global Goals coincided with another important treaty agreed in 2015 at the COP21 Paris Climate Conference know as Paris Climate Agreement. The purpose for adopting the SDGs is for the collective action to end poverty, protecting the planet and ensuring that the world's population enjoys peace and prosperity by the year 2030.

These SDGs are 17 in total and they include 1. No poverty; 2. Zero hunger; 3. Good health and well-being; 4. Quality education; 5. Gender equality; 6. Clean water and sanitation; 7. Affordable and clean energy; 8. Decent work and economic growth; 9. Industry, innovation, and infrastructure; 10. Reduced inequalities; 11. Sustainable cities and communities; 12. Responsible consumption and production; 13. Climate

action; 14. Life below water; 15. Life on land; 16. Peace, Justice and Strong Institution; and 17. Partnerships for the Goals. The SDGs are all interlinked, and this means that they recognise the fact that any action done in one of them will affect the results or outcome of the other SDGs and that the development must balance socio-economic and environmental sustainability. The SDGs have a pledge of “Leaving No one Behind” and this compels UN member states to have commitment for accelerating implementation of the same especially for those that are already behind for resilience building (United Nations, 2019).

This study focuses on and is linked to Sustainable Development Goal Number 13 which is “Climate Action” and aims at taking urgent actions to combat climate change and its impacts. The actions are skewed towards climate change adaptation and climate change resilience of vulnerable communities so that they become resilient. In addition, the actions for this SDG must support vulnerable communities to fully improve their resilient livelihoods so that they contribute to the other SDGs. The interventions should also be aligned to efforts that can incorporate sustainable natural resources management, human security, and Disaster Risk Reduction aspects.

It is important to bear in mind that availability of financial resources alone cannot help in managing climate change adaptation, mitigation, and climate change resilience but there must be a combination of factors. These should include human resources with knowledge, information, capacity, and skills in climate change; natural capital or assets; and political will of recipient countries or organisations in addressing climate change. What matters most is the presence of effective climate change coordination structures for climate change management in every country. Any response to climate change at all levels must be guided by the legal frameworks and the required mechanisms for accomplishing the desired objectives. The response to climate change globally and nationally needs concerted efforts, innovation, and dynamic strategies that can address climate change problems for realising sustainable socio-economic development hence climate change resilience.

2.3. CLIMATE CHANGE IN AFRICA

Africa is getting warmer than the world and it is scary to understand that it is expected that this development or trend will prolong (IPCC, 2013: 7-12). In addition, this trend will be of high magnitude in the Sub-Saharan Africa regions. Over a period, climate scientists have described the Africa continent as a hot spot for climate change disasters. This means that Africa is very prone to climate change and its related disasters. United Nations Framework Convention on Climate Change (UNFCCC) alludes to the fact that the African continent is already facing a burden of climate-related strains and anxieties and it is exceedingly susceptible to the effects and impacts of the change in climate.

The African continent is prone to climate change because of many reasons and some of them include the following: First, many countries in Africa are susceptible to droughts due to their geographical position and the population is vulnerable to droughts. This is also supported by World Bank (2010:5-6) which reports that droughts lead to migration of people from one place to another and this takes away labour from agriculture production. Second, climate change in Africa aggravates the challenge of water shortages resulting in agricultural production. The water table does not recharge thus there is no availability of water for both home use and crop cultivation. For instance, the communities that are self-sufficient and rely on food gardens for their livelihood face food insecurity because of this challenge (FAO, 2008). Third, the economy of Africa heavily depends on sectors believed to be more sensitive to climate and they include forestry, agriculture, and fisheries. In relation to this, the agriculture production season is reduced as a result yields are as low as 50% and will continue to decline (Guillaumont & Simonet, 2011). Fourth, most people in Africa are very poor as compared to other continents and this makes people highly susceptible to climate change due to inadequate adaptive capacity to climate shocks/ stresses. Over the years, this has eventually led to a reduction of agriculture production to about 50% thereby affecting nutrition and food security of many African countries (IPCC, 2013:101).

Natural disasters in Africa have also taken their toll. Over the years, disasters have been happening in some countries in Africa. For example, countries like Ghana, Mozambique, and Nigeria have been experiencing disasters like floods, droughts, dry spells, and stormy rains. These disasters have disrupted the livelihoods of the people in various ways such as damaging infrastructure, reducing household assets for peoples' livelihoods and reducing crop yields (UNDP, 2017a).

It is obvious that several aspects/factors lead to and aggravate the impacts of current climate change in the African continent and will have negative effects on the continent's ability to adapt to change and variations to climate. The factors include low literacy levels and lack of skills, poverty levels, inadequate infrastructure, lack of technology and information, weak institutions, low primary education standards and levels, poor health care, poor access to various important resources, low organizational capabilities, and disputes. The overexploitation of land resources including forests, population growth, desertification and land degradation pose additional threats (UNDP, 2013a). In the Sahara and Sahel, dust and sandstorms have negative effects on infrastructure, agriculture, and health.

It is projected that the African continent will experience increased water shortage and stresses with a succeeding possible increase of water related disputes as almost all the fifty river basins in Africa are transboundary. The water shortage has particularly affected southern African countries of which agricultural production and generation of hydroelectric power are based (Conway et al, 2015). An example of water dispute or conflict is in eastern and northern Africa where a conflict is emerging between Uganda and Egypt over the River Nile. River Nile is the largest and longest river in Africa, if not world over and its source is in Uganda, but it pours its water into the Mediterranean Sea through Egypt. So, it seems countries have now realized the importance of the Nile river that is used for irrigation, hydropower generation, fishing among other economic benefits. There is an understanding that Egypt is benefiting a lot from the Nile river, yet the source is not in their country

as such there are new developments as regards to utilisation of this water resource. The countries are negotiating to come up with some sort of a Memorandum of Understanding for sustainably utilising this water resource. The Agricultural production depends mostly on precipitation for irrigation activities and will be harshly negotiated in many African countries, mainly for smallholder agriculturalists and in Sub-Saharan Africa. In general, there will be a decrease in subsistence crops more particularly on cereal crops. For instance, National Communications report that the types of crops to experience a reduction in production include maize, sorghum, millet, and groundnuts in Ghana; Sudan, Ethiopia, Eritrea, and Zambia; Sudan; and Gambia respectively. Although there is currently a big share of the total additional people at a threat of famine because of climate change, Africa may still well credit for the predominance and majority of the 2080s. Climate change in Africa has affected the manner in which crops develop and produce hence crop cultivation is becoming risky resulting in insufficient food provisions (Yegbeney, Yegbeney, & Yabi, 2017).

Climate change in Africa has also brought about climate-related diseases which include trachoma, diarrhea, conjunctivitis, and scabies that are a result of drought situations that change and impact on the water quality (Serdeczny et al, 2015). Lengthy exposure to high temperatures can bring about heat stroke, heat exhaustion, fainting, heat cramps, and death (Smith et al, 2014). Climatic changes such as increasing temperatures are altering the topographical spreading of vectors of illnesses which are drifting to different new areas and greater elevations. For example, drifting of malaria mosquitoes that cause malaria to upper elevation will uncover big quantities of formerly unexposed populations to diseases in the sparsely inhabited highlands of the east of Africa (UNESCO, 2013:29). This means that diseases that were not prevalent in one area may be prevalent because of the changing climate.

Climate change in Africa is adding more strain and anxiety to the already vulnerable and endangered habitats, natural ecosystems and almost all species in Africa, and is possibly prompting relocation of species and this results in the decline of habitats. It is worth noting that up to fifty percent of the continent's entire biodiversity is at risk because of the reduction in the habitation and other anthropogenic-induced burdens and stresses (World Bank, 2017). These man-made burdens include land use change due to agricultural expansion and subsequent damage of habitat, poaching, civil war and conflicts, high rates of land use conversion, population growth, and the introduction of exotic species.

Climate change is also causing sea level rise in the continent and this has potential to bring about major impacts on Africa's coastal zones including the existing damaged coral mounds on the eastern shore. The National Communications show that shoreline infrastructure is 30 percent of the continent's shoreline nations, including the Gulf of Guinea, Senegal, Gambia, Egypt and laterally the East-Southern African shoreline, is at a danger of incomplete or whole backlog or accumulation because of fast-tracked oceanic level upsurge. For example, in Tanzania, a sea level upsurge or increase of 50 cm would inundate more than 2000 square kilometers of land with a cost of about US$51 million. Overall, the annual cost of adaptation across Africa will be in the range of US$7 billion and US$15 billion by the end of 2020 (UNEP, 2013).

As indicated earlier, the African continent is adversely affected by climate change because of its vulnerability to it. IPCC assessment reports are periodic reports that are produced annually to contribute to global climate change perspective by analysing policies, strategies, and progress of programmes implementation on climate change. These reports have comprehensively described, on a regular basis, the vulnerability levels for Africa (IPCC, 2013b) and as a result the impacts of climate change are adverse. Detailed impacts and vulnerabilities to climate change in Africa are indicated in Annex 1 on page 339. There have been temperature rises, changes in annual precipitation, and extreme events and these have impacted on key sectors of

development. The sectors that have been adversely affected by climate change in Africa are agriculture, water, health, fisheries, livestock, forestry, energy, irrigation, and mining.

2.4. CLIMATE CHANGE MITIGATION

Climate change is a reality, and it will continue to bring adverse impacts, and its predicted negative impacts pose a threat to most of the social and economic gains already attained by humanity. At its annual conferences on climate change, the United Nations Framework Convention on Climate Change has been calling member states to undertake mitigation measures to decrease Greenhouse Gas emissions. The latest request is in the fifteenth Conference of Parties (CoP15) Paris Agreement which seeks to make sure that countries/parties must assume speedy decrease in emissions in agreement with the greatest readily obtainable and existing science discipline (UNFCCC, 2015b).

There is an increase in the level of greenhouse gases in the atmosphere, making the planet's temperature to increase. Carbon dioxide (CO_2) as one of the Greenhouse Gases has steadily risen in concentration, over the past century largely due to human induced activities (anthropogenic) and these include burning of fossil fuels, excessive utilisation of wood fuel, etc. Emissions have a significant impact on the world around us. This is called a greenhouse gas effect. "The radiations or emissions of greenhouse gases such as carbon dioxide ($CO_{2)}$, nitrous oxide (N_2O), methane (CH4) are warming the planet, affecting the earth's climate" (Lemma, 2016). Fossil fuels release CO_2 and this increases atmospheric concentrations hence global warming. There are also other man-made Greenhouse Gases (GHGs) which are known as fluorocarbons (HCFs) and perfluorocarbons (PFCs). Some documentation and publications also suggest that anthropogenic activities cause high concentrations of Greenhouse Gases and the related changes in climate. Global warming is simply the net effect of anthropogenic activities that have been taking place since 1950. Resultantly, the global average temperatures have increased since the middle of 20th century and are understood to be

observed over time because of increased emissions of greenhouse gases. The increase in GHGs has brought about an increase in the quantity of heat in the atmosphere as the heat that is supposed to ordinarily be emitted back to universe is locked in and trapped and concentrate in the atmosphere. The increases in heat has resulted in the greenhouse effect and eventually resulting in changes of the earth's climate.

The atmospheric greenhouse gases have increased, causing the temperatures on earth's atmosphere to increase. For instance, carbon dioxide has steadily increased in concentration over the past century because of anthropogenic activities (use of fossil fuels, excessive use of fuelwood etc.). According to United Nations Framework Convention on Climate Change (UNFCCC, 2007), "Mitigation is any anthropogenic activity that can either decrease the sources of greenhouse gas emissions or boost their sinks (sequestration or restoration)". "In other words, these are strategies to decrease emissions of greenhouse gases".

Internationally, many agreements were made to ensure that mitigation is achieved. The most known international agreement among the member states is a Kyoto Protocol which has recently been replaced by the Sendai Framework (2015) which is focusing on building the resilience of nations and for communities through employing measures that would reduce disaster risks (UNISDR, 2015). The Kyoto Protocol plan aimed at accomplishing a significant reduction of risks to disasters and provides two strategies for ensuring mitigation among member states. The first is the Clean Development Mechanism (CDM) that permits a nation that have a commitment on limiting emissions under the Protocol to execute projects for reducing emissions in developing countries. Such types of projects do earn saleable certified emission reduction (CER) credits that are weighed for meeting Kyoto targets. The second one is the REDD+ Programme and this is about efforts aimed at decreasing emissions from deforestation and foster conservation and enhancement of forest stocks (UNFCCC, 2018: 2). All countries which are party to these agreements

including Malawi should ensure that they implement projects related to mitigation.

It is clearly projected that more efforts to decrease emissions of greenhouse gases (GHGs) beyond those employed now, emission growth at global level are anticipated to prolong and boosted by economic and global population growth and actions. It is really a fact that one of the major emitters of Greenhouse Gases is agriculture and that various strategies can be employed to mitigate emissions of greenhouse gases from the atmosphere and restore them in carbon sinks or basins.

In reference to IPCC, “mitigation against climate change includes all interventions or activities that are planned for reducing climate change impacts and effects”. The sector of agriculture has the possibility of carrying out several mitigative activities. As such, some of the mitigation strategies that can be considered for reducing emissions are: managing grazing land for livestock; taking good care of organic soils; crop management practices; water management measures; management of nutrients; residue management measures; agroforestry practices; adjustment in land usage and shelter; livestock production and management (periodic changing of livestock feeding measures by, for example, modifying the structure of feed to reduce nitrogen quantities defected to decrease emissions from nitrous oxide); emissions of methane can be decreased by increasing the temperature for storing manure; and by decreasing emissions of ammonia and methane through manure production and application (IPCC, 2014c). It is, therefore, important to understand that once effects and impacts of climate change are mitigated against, people’s adaptive capacity to climate change will improve because the impact they used to have as a result of climate change would have lessened or declined. This provides an opportunity for them to increase their resilience.

It is vital to note that forests and forest cover are also significant in reducing emissions of greenhouse gases as they contribute substantially by providing the carbon sink. Various approaches can be utilised to

upsurge the carbon sink of forests and woodlands. Forests can play a significant role in increasing global carbon sequestration if afforestation and reforestation are effectively managed (Sheikh, Skinder, Pandit, & Ganai, 2014). The biggest carbon impacts are possibly accomplished by changes in management to increase the present sinks. Examples could include considering length of rotation, increasing thinning practices and continuous forest cover shifting. Preventing deforestation also ensures that carbon sinks are maintained and prevents quick emissions of CO_2 when a forest is deforested. Planting of trees increases the carbon sink. It is understood that new forests primarily sequester carbon very slowly as such it takes a long period for realising any result in terms of a difference in the carbon sink(s).

Climate Change Mitigation requires those concerned like development practitioners, other stakeholders, and communities to take a responsibility on effective planning and implementation of mitigation related strategies. For example, at international level, new plans, strategies, policies, and other important conventions are developed within the international framework for execution of forestry and agriculture management practices that increase sequestration of carbon in the soils and biomass. Sequestration of soils is simply the management of the soil carbon balance (FAO – IPCC Report, 2017: 15-16). The global agenda recognises the fact that climate change mitigation is achieved through facilitating the increase of forest cover since it acts as carbon sinks where carbon is trapped. This is therefore, one of the most reliable and alluring or attractive approaches of averting anthropogenic degradation of natural ecosystems and are cost effective and environmentally secure. Nevertheless, it is very imperative to take into consideration that mitigating climate change requires collective approaches and efforts and that periodic monitoring on how a society, or a country is doing must be carried out. This ensures effective planning and execution of climate change mitigation actions and programmes.

The contexts of climate change mitigation measures and strategies vary in all countries world over centred on the climate change specific context

of the countries (UNFCCC, 2012:40). Some of the factors to consider are the following: first is the ecological and environmental set up of the country. This means that if the particular country is heavily environmentally degraded and the forest cover is not excessive, then effective, and sustainable mitigation strategies and actions should be employed to ensure effective climate change mitigation. Second is the economic status of the nation which determines how effective and efficient the mitigative actions are implemented. This talks about financial resources available for climate change management. This also determines the level of contributions to mitigation measures to global actions regardless of whether the country is a net emitter of Greenhouse gases or not. The third factor is the human capital or assets. This focuses on the knowledge, information, and skills on general climate change for proper designing, execution, evaluation and reporting of climate change actions. For the country to mitigate against climate change effectively and efficiently, she should have experts and technocrats in climate change who would support all the processes indicated above. It is important to understand that knowledge is power and everything in life is possible when people are knowledgeable and have skills to do something.

2.5. CLIMATE CHANGE ADAPTATION

2.5.1. Definition of Climate Change Adaptation (CCA)

Looking at the nature of climate change globally now, adaptation is both a matter of need and equity as its impacts drop inexplicably on the people who have least ability to persevere them (Chiotha et al, 2013:13) Climate change adaptation is one of the most important pathways to building climate resilience (Chiotha et al, 2018:52).

It is vital to bear in mind that Climate Change Adaptation is defined by different institutions depending on their context. This is because what is adaptation in one region may not be adaptation in another region. This implies that some strategies for achieving adaptation in one region may not work in another region due to factors such as topography, religion,

cultural beliefs/tradition and etc. For example, in a Christian set-up, pig production (livestock production) is used as a strategy for climate change adaptation because the multiply/reproduce within a short period for household nutrition and income. This strategy is a taboo in a Muslim community and cannot be used as a strategy for adaptation because they believe in their religion which restricts them from rearing pigs let alone eating them. As such it is context specific and is flexible so that people can plan how best to take actions for adapting to climate change. The IPCC (2007c) defines "Climate Change Adaptation as any adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects and impacts". In line with this, adaptation measures for climate change among communities globally have been considered with two broad areas of activities, vulnerability reduction measures and measures that enhance resilience through household/community assets utilisation.

2.5.2. International level frameworks on climate change adaptation

The global society has encouraged countries to focus on climate change adaptation through various international soft laws. For instance, UNFCCC formulated a global agenda for addressing urgent and immediate adaptation actions including disaster risk reduction efforts for socio-economic development. This agenda is known as the 2005 Hyogo Framework of Action. The other international framework is the 2015 Sendai Framework for Disaster Risk Reduction (2015-2030). This aims at providing opportunities for countries to understand disaster risk reduction, strengthen disaster risk governance, investing in risk reduction for resilience, and enhancing disaster preparedness for effective response and to build back better in recovery rehabilitation and reconstruction for adaptation and resilience building.

Through my own experience in climate change sector, I observed that it is vital for countries to explore and develop strategies and initiatives that address climate change into development planning as part of contributing to realisation of these frameworks. In relation to this, the higher sense of urgency and seriousness with which the adaptation

challenge is now approached by the international policy community was confirmed under the Bali Action Plan adopted at the 2007 UNFCCC negotiations. This has, in turn, sparked the need to integrate adaptation measures into all development programmes and policies (Malcomb, Weaver, & Krakowka, 2014:19). It is very crucial to note that different stakeholders may adapt differently to climate change as such countries must plan according to their needs while contributing to these frameworks hence adaptation options must be available.

World Resources Institute report of 2008 estimated that 2 billion of the world's rural poverty-stricken population will be subjected to the risks of climate change (World Resources Institute, 2008: 3-4). The effects of climate change will have major implications for the livelihoods of people especially those from developing countries. Climate change adaptation measures enable susceptible people to cope, adjust and enhance their climate resilience. Climate change adaptation requires concerted efforts in order to achieve the desired situation (EEA, 2016a:16). Climate change adaptation can be implemented along the three pathways and these include coping, incremental, and transformational (EEA, 2016b:28). The three pathways of adaptation are explained in detail in Annex 2 on page 340.

However, impacts and effects of climate change do not follow linear pathways. They are complex since they could affect several sectors, communities, and individuals concurrently. They vary in magnitude and spatial, and temporal in scope, and they bring different degrees of effects and damages. This, therefore, calls for a holistic and systematic approach that would initiate an appropriate set of responses for various scenarios (UNFCC, 2015c: 34).

The Vulnerability and Adaptation Assessment studies at sector level done during the preparation of Initial and Second National Communications have further demonstrated the extent to which these sectors would be affected under given conditions (UNFCC, 2011b). The findings showed that most disasters are climate related. In addition, the

frequency and intensities have been increasing over time. The adaptations differ according to the system in which they prevail, which group of people carries out actions, the climatic event or stimuli, their timing, functions, forms, and effects. In this case, adaptation types are classified according to use and purpose (refer to the classification of adaptation in Annex 3 on page 341). A given extreme climate event may hit a given community, but the impacts at household level would vary a great deal. Adaptation actions rely significantly on the adaptive capacity of the influenced system, region, community, and household to withstand the impacts and threats of climate change. The adaptive capacities of human systems depend on prosperity, technological advancement, education levels, information and knowledge, skilfulness, infrastructure, and access to resources and management abilities and competencies. Adaptation to climate change has the capability to decrease adversarial impacts of climate change, and augment the constructive and favourable impacts, hence facilitating people to continue to live their lives and participate in developmental issues in a stable and predictable manner. Furthermore, impacts of climate change are complex to be addressed at one level (GoM, 2011c). Typical climate change responses will depend on a number of variables such as severity of impacts, sectors affected, readiness, adaptive capacity, spatial and temporal scopes, and available expertise. Gaps will have to be identified and appropriate strategies generated to address the shortfalls.

There are many players from government and non-governmental organisations with their own tools, resources and approaches reaching out to vulnerable communities. Most of these organisations work in silos, they develop and use their own training materials to train their field workers and affected communities. There have been no efforts so far to assess these training materials, draw lessons and best practices, and harmonise them.

2.5.3. Enabling conditions and opportunities for climate change adaptation

IPCC, 2014 identifies enabling conditions and opportunities for climate change adaptation for its effective implementation and achievement. These enabling conditions are as follows:

- **Awareness raising:** This involves undertaking participatory research to come up with reliable information and emerging issues for adaptation actions. It also looks at communicating risks and uncertainties to stakeholders including communities for proper planning and implementation. In addition, it ensures that there is positive stakeholder engagement so that no one is left behind in adaptation work for collective action and efforts.
- **Capacity building:** This requires resources to ensure easy execution of any effective capacity building initiatives. There is need to ensure that human capital as a resource is developed and this include social capital. This is also achieved by emphasising on extension services for agriculture taking into consideration that many least developed countries depend on agriculture for their economies which is most sensitive to climate. Research, data, education, and training are very crucial for capacity building so as to enable communities and development practitioners to have relevant and up to date information, knowledge, and capacity for implementing climate change adaptation actions.
- **Tools:** These are important because they help in carrying out cost-benefit analysis of adaptation plans and actions; actions on vulnerability assessment to identify vulnerability levels for contingency planning; multicriteria analysis for identifying effective sets of criteria for action planning; decision support systems; and conducting early warning systems and risks.
- **Policy:** This involves anything related to policy direction as regards climate change adaptation and looks at integrated resources and

infrastructure planning, spatial planning, and design and planning standards.

- **Learning:** This is achieved by experience with climate vulnerability and disaster risks, learning by doing climate adaptation actions, and monitoring and evaluation of the related actions and interventions.
- **Innovation:** This takes into consideration issues of technological advancement or change, infrastructure efficiencies, and digital or mobile telecommunications.

The process of climate change adaptation is the best approach to deal with the impacts and effects of climate change because it ensures sustainability of various livelihood activities for peoples' well-being (UNFCC, 2006). It is a fact that adaptation also varies from one country to another because of different contexts. What is adaptation in one country may not necessarily be adaptation in another country (IPCC, 2014b). This is because of the following reasons:

- **Differences in geographical locations of the countries:** topography of a country will determine what adaptation interventions to be planned and executed since the occurrence of climate change is of different magnitude.
- **The status of the natural and ecological systems of the country:** The natural ecosystem also considers available options for adaptation. For example, if the ecosystem or environment is heavily degraded, the country may require intensified strategies for its citizens to effectively adapt to climate change since most countries especially Least Developed Countries (LCDs) depends on natural resources for their livelihoods. In addition, the adaptation process will require that development practitioners must develop innovative ideas and actions to ensure effective and sustainable adaptation actions for dealing with climate change.
- **Differences in socio-cultural set-up:** Societies and communities have differences in cultural beliefs and traditions and/or customs and due to these differences in culture and

beliefs, adaptation systems and approaches to climate change also vary. For example, it might be a taboo to do a certain activity for adaptation in the name of culture in a certain society, and yet the same activity could be an important activity for adaptation in another society.

- **Perceptions of life among the society also matters in adaptation:** Different people perceive things differently and this can also affect peoples' adaptation initiatives. If a certain society or community has a negative perception of some approaches to adaptation, those approaches cannot be taken on board as part of their adaptation to climate change. Similarly, if that society has positive perceptions to those approaches or actions, then adaptation is possible to be implemented and accomplished.

All in all, adaptation to climate change requires holistic approach whereby all concerned players are involved right from assessments, planning, implementation, and monitoring of the actions. This contributes to livelihoods improvement hence climate resilience and sustainable development. Climate change adaptation is best implemented using the approaches known as Community-Based Adaptation (CBA) and Ecosystem Based Adaptation (EBA) and they are both described in detail in chapter 3.

2.6. CLIMATE CHANGE RESILIENCE

Resilience is a concept of which its meanings vary among different practitioners, yet common to all is the capability to endure an external disruption and the ability to change and maintain it in the prevalence of an outward disruption, i.e., going past survival. Resilience is the ability of a system, community or society and its elements' parts exposed to hazards to articulate, resist, absorb, accommodate, and recover from the effects of a hazard in a timely and efficient manner including through ensuring the preservation, restoration, and improvement of its essential basic structures and functions (IPCC, 2012). The resilience aspects discussed in this section describe what is required for general resilience

building and this is explained in detail in chapter 3 where the “From Vulnerability to Resilience Conceptual framework” is discussed and how it will be applied in this study.

2.6.1. Foundations for building community resilience

Building climate change resilience is a process that requires a holistic approach if it is to be fully achieved.

Even though many resilience frameworks and tools for building community resilience are now available, no single approach will likely work for all communities and their varied social and economic context (Lerch, 2015:2-3).

Lerch, therefore, suggests that there should be two requirements for building community resilience if it is indeed to be organised at the local level. First is that community members must possess their own responsibility for resilience-building and the ability to decide how it is done. The second is that the process of resilience-building must equitably address both the situation of the community and the broader challenges facing the community. In addition, Lerch (2015: 5-11) classifies and describes the six foundations for community resilience building which he thinks are necessary and important, regardless of where or how resilience-building efforts are taking place, or which challenges are of concern locally. The six foundations are described below:

- **People (Human resource)**: This is one of the important foundations and it looks at the fact that the ability to visualise the future of the community and build its resilience rests with the community members themselves. This means that societies are a creation of anthropological relationships, and what the community is now, and what it will be in future both result from decisions made by people networking, collaborating, and working as a team in that society. It is, therefore, a fact that the goals of community resilience building endeavours are best set by and focused on the needs of the people who make up the community or society.

- **Systems thinking**: This is the second foundation, and it means that it is important to understand the multifaceted, interconnected crises that are now unfolding and what they mean for the concerned communities. Communities are influenced by regional water supplies, national energy policy, and climate change. The communities are clearly integrated sub-systems of a single global socio-ecological system. They are connected to and influenced by external factors such as regional water supplies, national energy policy, and global climate change. These communities are complex systems and the problems or challenges they encounter are also complex, so we cannot approach them as if they are a linear or a straightforward problem.

  A system can be defined as a set of interconnected components that work together within some defined periphery and which are organised to carry out a function or task. Examples of systems include a forest, a community, and a society. Systems thinking, therefore, refers to any kind of thinking by any community or a society in working relationships to achieve climate resilience. Adaptive capacity is defined as the capability of any system to absorb change and disturbance from external forces and adapt or change in response. When the systems thinking, and adaptive capacity are effectively achieved, communities gradually become resilient, and the following things occur:

  a. **Resilience enhances sustainability:** According to Blakely (2016), both resilience and sustainability require that we perceive the world as a multifaceted and dynamic system and claim a basic or essential change in the way people think about how we rely on it. He further stresses a point that building the adaptive capacities to endure and recover quickly from shocks and stresses increases the possibility of sustainable development in the changing ecological and environmental system where the future is not predictable.

b. **Resilience becomes a shared responsibility:** This is about building the resilience that requires partners and stakeholders from all the sectors of development. This means that there are always collective efforts as such governments create the different development frameworks like effective policies, strategies, plans, and infrastructure investments; businesses improve the performance of our economic systems; communities and civic institutions become more organised and flexible, responsive, and robust; and organisations and individuals have the core skills, knowledge and information required to cope and adapt to stresses.

Systems thinking, therefore, helps us understand the sense of complexity hence becoming one of the bases of resilience building science.

- **Adaptability**: This is the third foundation of building resilience of communities and it entails that the ability of a community to adapt to changing events. A community that adjusts to change becomes resilient but due to the fact that communities and the challenges we encounter are dynamic, adaptation is a continuous process. It is important to note that complex systems are resilient in the face of any disturbance or disruption because they have the capacity to adapt to changing circumstances and thanks to system characteristics like modularity, diversity, and openness. The process of adaptability looks at reacting to or countering the change both internal and external, and learning from the experiences.
- **Transformability**: Transformability is the fourth foundation which involves effecting transformative changes and complex challenges which is necessary for achieving resilience. This means that when the world changes around the environment, the communities generally adapt to that change. Transformation is the key aspect of the overall resilience, and in other circumstances, it may be very essential for part or whole system to transform for the achievement

of greater system of resilience (Olssons, Galaz and Boonstra, 2014). It is worth noting that resilience building is transformational when attributes of a community that require basic and essential change are tackled. Resilience building and transformation depends on three attributes and they include getting to accept that they need transformation (attaining to recognise), with the capacity for the change that is transformational in nature and devising options for the desired transformational change.

- **Sustainability**: Resilience of a community must serve our community, current generation, other societies, and the upcoming populations and the environments and systems that everyone depend on. The process of sustainability helps us understand the need for resilience building. This gives us a guide to say we will need all the natural resources, ecosystems, biodiversity, and other resources to last forever so that all generation to come can benefit from transformational resilience. Sustainability and resilience are two different aspects that complement one another.
- **Courage**: The need to have courage among communities and development practitioners to confront challenges and taking full responsibility for collective future. Resilience may be a complex concept because it takes a long time to be achieved but with right strategies and human capital, it can easily be realised. People require motivation and emotional strength to take challenging actions for resilience building. Communities should have courage and commitment so that they create enough space for effective planning, act on the plans and be decisive on what they want to achieve.

2.6.2. How to build community resilience?

According to the Global Centre on Resilient Ecosystems and Desertification (GC-RED, 2015), there are simple ways of building community resilience and one could consider the following:

- Resilience building can be discussed for communities and ecosystems.
- communities can build their resilience by improving adaptive capacity and decreasing their susceptibility.
- resilience building in communities is being able to plan by taking intentional steps to stimulate the course of a change.
- a community that is resilient will be able to foresee changes and opportunities and be able to respond to it and plan for it proactively.
- and existing structures can help communities become more resilient to climate change by incorporating climate change into their decision-making methods or structures.

However, looking at these suggested ways of building community resilience, they are difficult and complex to achieve because they require critical thinking, analysis, and effective planning. In addition, communities may not have the capacity to implement these ways of building their own resilience due to different levels of literacy and one's commitment towards it (GC-RED, 2015:23-24). GC-RED further explains that literacy determines the effective comprehension of climate change hence there is need to improve the adaptive capacity of all stakeholders and communities. This, therefore, requires resources and collective efforts from both development practitioners and communities themselves for effective application.

2.6.3. Resilience principles

Blakeley (2016:14) in his SOLGM Building Community Resilience Report, identifies several resilience principles for communities and development practitioners to bear in mind to survive, respond to and adapt to climate stresses and shocks. The principles are described below, and examples are given under each principle on how these principles are guarded and implemented jealously by different communities and stakeholders.

Robustness: This must be done in a way that ensures enough data is collected, to bring confidence to decision-making processes. You must

also ensure that data is informed by multiple sources. This ensures that there are well-conceived, constructed, and managed systems. An example is where a community in Tanzania was able to establish a management system for climate change adaptation through the development of plans and strategies. These helped communities to make decisions regarding implementation of day-to-day activities for climate change resilience building (USAID, 2012a: 11-16).

Scale: Are we partnering with enough civil society groups and other actors at various levels of society and governance to strengthen and support our case for needed policy changes? In this case, it includes both scale and robustness factors. For example, local level development structures in Malawi (Area Development Committees and Area Civil Protection Committees) are working together with civil society organisations and development practitioners to ensure wide scale realisation and achievement of climate change resilience projects and programmes (UNDP, 2014b: 92).

Redundancy: The local government or development partner can step in and work with communities to finish their planning, as well as to coordinate their plan better with that of the existing stakeholders. In other words, it implies that spare capacity purposively created to accommodate disruption. An example is provided of the Lower Manhattan Dryline, urban flood protection infrastructure in New York (Blakely, 2016:20). A devastating Hurricane Sandy occurred in 2012, as a result, a major resilience issue of vulnerability of New York to coastal flooding was exposed by the hurricane itself. To tackle this resilience issue or exposure, The Dryline (an urban flood protection infrastructure in Lower Manhattan Island) project was designed and got a federal funding of USD 176 million. This included a 12 km infrastructural floodwater barrier that comprises of shutters that close in times of emergency, and big areas of public space with parks, sittings, pavilions, shelters for bicycles and skateboard ramps. This demonstrates a situation where spare capacity was purposively generated/created to contain a disruption.

Rapidity: e.g., how are disaster response committees able to prepare and then mobilize relief goods ensuring a hazardous condition do not turn into a disaster. An example is where community members in the lower Shire valley of Malawi are involved in humanitarian works to ensure that annual disasters are well managed and that they build back better. This is done through contingency planning for effective disaster preparedness so that communities recover from impacts of disasters (UNDP, 2018: 22). Through contingency planning, development practitioners and humanitarian organisations are able to provide financial support for mobilisation of relief items during disasters.

Flexibility: How have we adopted new insights. In other words, this entails whether communities and stakeholders are willing and can adopt new alternative/different strategies as a response to emerging issues related to climate change resilience. An example of Island Bay tsunami risk awareness in Wellington, New Zealand. The Wellington Region Emergency Management Office's Community Resilience team works with diverse societies to inspire local communities to develop new solutions. The Island Bay Community realised their tsunami risk and came up with an idea/solution to raise awareness to the public by painting a blue line across the main road to show where the tsunami safe area begins. The Seatoun school seriously took heed that it is within an area that is at risk of tsunamis as such they decided to construct an accessway for evacuation in case of any tsunami (Blakely, 2016: 20). This implies that flexibility of stakeholders helps in coming up with locally made solutions and innovations for resilience building as evidenced by the fact that the Wellington project managed to receive a global award for public awareness from the International Association for Emergency Management in 2012.

Self-organizing: e.g., how communities work together to organize themselves to form a one to one or group implementation system for sharing experiences and skills in adaptation and resilience building. An example here is planning for resilience concept undertaken by communities in Burkina Faso. All stakeholders together with vulnerable

communities carry out capacity needs assessment on annual basis to identify skills and knowledge to be utilised in case of an eventuality (USAID, 2012a: 10). This helps the communities to share responsibilities on how to implement and coordinate climate resilience programmes.

In a community where these principles are guarded and implemented jealously, their adaptive capacity is improved, hence improving their livelihoods resulting in transformed well-being leading to climate resilience. The principles described above draw on systems thinking as described in section 2.6.1 and they also draw on adaptive capacity of people.

2.6.4. Climate resilience capacities

Climate resilience as applied to ecosystems or systems thinking and natural environment is composed of three major important traits or features (Simard et al, 2017:12). The features include:

a. The quantity of change in the system can go through and still maintain same control on purpose and shape and formation.
b. The extent to which the system can reorganise itself.
c. The capability to develop and improve the capacity for learning and adaptation.

Resilience is regarded as a challenging concept more especially when it is related to social systems (Duit, Galaz, and Eckerberg, 2010:363 – 368). It is challenging to prevent conflicts with basic concepts/models in social science domains like right to self-determination, power, and democracy when application of model of resilience to query governance and politics. This is because even if some similarities can be recognised/classified, communities and bionetworks are also basically diverse in several ways (Duit, Galaz, & Eckerberg, 2010: 365).

Bene et al (2012) pages 20 to 23, suggest that for climate resilience to be successful, there is need to incorporate three key elements which are also known as three resilience capacities. These include Absorptive capacity, adaptive capacity, and Transformative capacity. The

Organisation for Economic Cooperation and Development (OECD, 2014) agrees with Bene et al (2012) that for resilience to be achieved there is need to manage the three capacities as a ladder to resilient livelihoods and general transformational development. Figure 2.1 below indicates how OECD described the three resilience capacities.

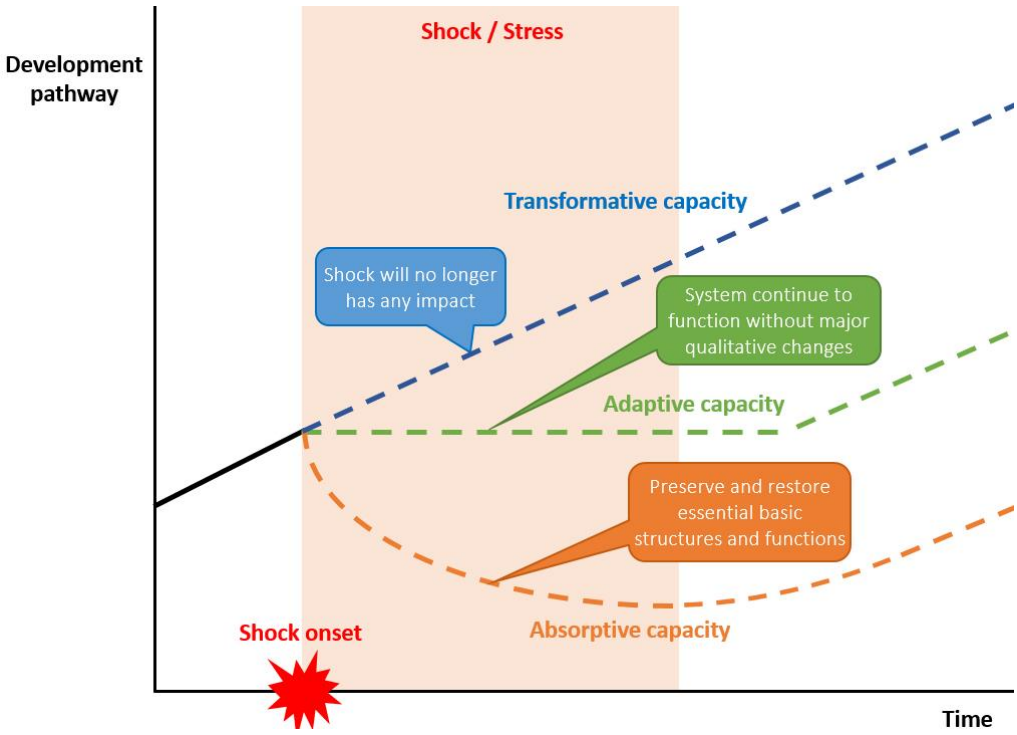

Figure 2.1: Resilience Capacities (OECD, 2014:28)

Based on the figure on resilience capacities above, it is indicated that each type of capacity has specific characteristics and are described below.

- **Absorptive Capacity:** This helps to create persistence and results in stability of people, societies, and systems (Bene et al, 2012). This is the first category of resilience capacity pyramid as one of the stages for achieving climate resilience. This type of a resilience capacity is characterised by several elements and they include hazard insurance; asset ownership; access to informal safety nets; social capital (bonding); households perceived ability

to recover from shocks; cash savings; Disaster risk reduction; households are able to accommodate, endure, continue to function, cope, recover and re-establish, resist, prepare, prevent, and anticipate in times of shocks and stresses (OECD, 2014). This means that when a shock or stress occur in a community with absorptive capacity, a community or system will preserve and restore essential basic structures and functions.

- **Adaptive Capacity:** This brings about incremental adjustment and results in flexibility (Bene, et al, 2012). This type of resilience capacity has elements such as access to financial services; assets ownership; diversity of livelihoods, social capital (bridging and linking); human capital; access to information; households' aspirations and confidence to adapt. In addition, households can manage, change, build capacity, reorganise, bounce back, protect, and minimise cost in case shocks and stresses strike (OECD, 2014). In other words, when a shock or stress strikes in a community with adaptive capacity, the systems will continue to function without major qualitative changes.
- **Transformative Capacity:** It helps to create responsive transformation and results in positive change (Bene, et al, 2012). This is the highest level of resilience that show that the household or community is transformed and is meeting most of the elements of climate resilience. In this type of capacity, households have access to markets; social capital (bridging and linking); there are availability of formal safety nets; empowerment of women, children, and elderly; good governance. Households in this category can build capacity, manage, change, adjust, modify, transform, reorganise itself, and evolve in times of shocks and stresses (OECD, 2014). This also means that when a shock or stress strikes in a community or society with transformative capacity, the shock will no longer have impact on the systems or the society itself.

A community or system with all the three types of capacities is more likely to be more resilient to climatic shocks and stresses as opposed to the one that has absorptive and/or adaptive capacity only.

2.6.5. Characteristics of a resilient community

Any society or community that is resilient is perceived so when that community can manage to respond and adapt to any climatic shocks or stresses (GC-RED, 2015). GC-RED identifies some key characteristics of a resilient community and these include the following:

- **Economic security:** Diversifying income sources by means of alternative income sources by getting skills and knowledge in an alternative career. Farmers' intercropping becomes more involved in agroforestry, irrigation, and drought-resistant seeds.
- **Water supply:** The whole community would have access to sufficient water of good quality throughout the year. For instance, a community can use water harvesting and storage of water in reservoirs to be resilient to droughts, dry spells, and irregular rains.
- **Disaster preparedness:** Improving community disaster preparedness. For example, development of early warning systems, development of contingency plans and tree planting.
- **Peace and security:** The whole community would enjoy continual peace and security.

In general, Kais, and Islam, (2016: 9-10) explains some additional behaviours of a resilient community over and above the characteristics described above and are as follows:

a. A community can foster the elements that increase community resilience by refining community partners/individuals' capacities. For example, by understanding how to stay with the change and improbability, cherishing variety for reorganisation and revitalisation, blending diverse types of knowledge, and making the opportunity for self-organisation.

b. A community becomes organised which means it can identify problems and challenges and employ effective priorities and actions.
c. A society or community shapes its resilience through collecting methods and ways over a period. It is well informed and skilful in measuring, handling, and monitoring risks. It can acquire latest talents and build on past experiences and practices.
d. A society takes planned action to increase the individual and shared/communal ability of its members and organisations to respond to, and motivate the path of social, and economic change.
e. Adjusts to steady and perpetual changes. It normally does not handle shocks and disruptions only as sporadic/occasional but regards many of them as constant and gradual hazards.
f. A community is multi-scalar: it acts at the individual, community, and regional levels by employing its internally and externally schmoozed resources in tackling and coping to challenges.
g. A resilient community helps its members to circumnavigate to resources as well as to bargain for the resources they want.
h. A community can clearly identify its obstacles (such as pre-disaster vulnerabilities, race, ethnicity, and gender) and facilitators which may include access to community resources, and local community civic institutions or groups.
i. A society is wealthy in community assets, and these include political, social, economic, built, and environmental assets.
j. Capacity to manage its natural capitals or assets, and it realises the value attached to them and has the capability to safeguard, improve and sustain them.

Resilience to climate change demands concerted efforts at all levels so that the population is part and parcel of the process as its pathway. Resilience to climate change is a complex and dynamic process because it requires several innovative strategies for it to be achieved (OECD, 2018). For instance, climate change mitigation and climate change adaptation are the two major approaches that contribute to climate change resilience. So, if mitigation and adaptation approaches

are not adequately and effectively implemented, obviously resilience will not be achieved entirely. It is essential to systematically plan and execute mitigation and adaptation measures for a resilient community or nation.

2.7. CLIMATE CHANGE, MITIGATION, ADAPTATION, AND RESILIENCE APPROACH IN MALAWI

2.7.1. Climate change context in Malawi

Malawi is characterized by a tropical climate, with temperatures that range from 18-19°C in June, July, August, and rise to 22-27°C between September and January. Rainfall is most prevalent during November to February but can continue until April. The timing and intensity of precipitation is induced by the shifting of Inter-Tropical Convergence Zone (ITCZ), elevation, and Indian Ocean Sea Surface Temperatures (GoM, 2010b).

Malawi has three seasons, and these include cool season that runs from the month of May to August; a warm/hot season which is between August and November of the year; and the wet season that spans from November to April every year. In terms of recent climate trends for Malawi, “mean annual temperature has increased by 0.9°C between 1960 and 2006 an average of 0.21°C per decade and that daily temperature interpretations indicate considerably rising tendencies in the occurrence and regularity of warm and hot days and nights in all periods or seasons” (World Bank, 2011: 3). Mean annual rainfall in Malawi is usually normal or above normal, however, there is variability of rainfall patterns due to climate variability. “Long rainfall trends are difficult to identify in Malawi because yearly changeability in precipitation is very extreme” (World Bank, 2011:4). Future projections of climate trends are done by using several climate models for decision makers to plan and these include Global Climate Models (GCM), Regional Climate Models (RCM) and downscaling techniques (Future Climate for Africa, 2017). Global Climate Models are the primary sources of future climate trends. According to World Bank, “average yearly temperature for Malawi is

predicted to rise by 1.1°C to 3.0°C by 2060s and by 1.5°C to 5.0°C by 2090s". The World Bank further states that "all climate patterns/scenarios reliably and constantly forecast rises in the ratio and amount of precipitation that drops in intense occurrences in the yearly mean of up to 19% by 2090s".

Studies by the Department of Climate Change and Meteorological Services of Malawi (GoM, 2014b) and others point out to the fact that Malawi is vulnerable to climate change and extreme weather events. In particular, the analysed data indicate the following trends:

- increased incidence and spread of risk climate occasions such as flooding and prolonged dry spells.
- delayed onset of rainfall
- reduced annual precipitations (in some parts)
- erratic rainfall
- increased temperature trends in most districts.

Furthermore, all scenarios for Malawi agree in showing that minimum temperature will rise more as compared to maximum temperature and rainfall patterns for specific region (Katharine, Dougill, Mkwambisi, Tracy, Stringer, & Chanika, 2014). The country models for Malawi are showing the following projections for the specific regions regarding minimum temperature and rainfall trends:

The Shire Valley

Future temperatures show a rise of 1.4 - 2.8°C during the mid-century and 2.5 - 4.2°C during the late century and changes in rainfall regime are not that clear as there are a lot of variations, however the projection show that during the mid-century, January is projected to be wetter by 8% than normal while most months during summer will be drier by 3-5%. According to the projections, winters will be extremely drier than normal ranging from 25-50% during mid-century and 18-58% during the end century (2080-2100).

Southern Highlands

The projections indicated a temperature increase of above 1.0◦C in mid-century while above 1.5◦C for late century and all models seem to suggest that precipitation will be increasing by 9% during winter and decreasing by 19% during summer over Shire highlands.

Lakeshore areas

The future projections are indicating that the average minimum temperature in the 2050s shall rise by approximately 2°C in average minimum temperature and approximately 3°C in the 2080s. The mean highest temperature is anticipated to increase by 1.4°C in the 2050s and further increase of approximately 2 °C in the 2080s. Projections in precipitation in the 2080s indicate rains decreasing in winter by 15 to 26 % and a further decrease of 39% to 62% in September, October, and May. The projections show a slight increase of around 5 to 10 mm in rainfall amounts in the months spanning December to March.

Central areas

The future projections are indicating that the average minimum temperature in the 2050s will increase by 2.2°C and approximately 4.0°C in the 2080s. The average maximum temperature is anticipated to rise to around 1.5°C in the 2050s and further rise to around 2.6°C in the late century. Winter rains will decrease by 5 to 12 % and a slight increase of 3% in the months spanning December to March.

Northern areas

Future climate projections that have been assessed show that there will be a rise in maximum temperature by 1.8°C in mid-century and 2.8°C in the late century. The mean highest temperature is expected to rise by 1.3°C in the 2050s and increasing further to approximately 2°C in the late century.

Climate projections show the rise in precipitation of 3.5% to 8% to be experienced in the 2050s during the months of January to April by the

2050s and a further increase in the range of 7 and 17% by the 2080s during the months of December to April.

Climate change is already distressing Malawi, which has experienced an immense incidence of dry spells and intense rainfall events over the last two decades. These changes have led to an escalation in the prevalence of floods, droughts, and pests and disease outbreaks with severe economic and social consequences (USAID, 2015:1).

Climate change in Malawi has affected all the sectors of development and they include agriculture and food security, water, health, forestry, fisheries, tourism, and education. This has brought about unprecedented impacts that are affecting general economic livelihoods of the people in Malawi (Pauw, Thurlow, & van Seventer, 2010). Some of the key impacts include low agricultural production leading to food insecurity and malnutrition, increased environmental degradation, scarcity of water resources, depletion of biodiversity and ecosystems, the emergence of new and strange health-related diseases, and reduction of fish production in Malawi's lakes and rivers.

"Disasters disturb Livelihoods of people, endanger people and food self-sufficiency, destroy infrastructure, and impede societal growth and development of the economy" (GoM, 2017a:33-41). Disasters also increase the poverty at a household level and affect the capability of the country's economy to endow in key socio-economic sectors that are vital in poverty reduction (UNDP, 2014b).

Malawi has experienced several disasters in the last decade, the most recent devastating one being the 2015 floods that severely affected the economy of the country. The 2015 floods occurred in January 2015; the Southern half of Malawi experienced normal to above normal rainfall which triggered flooding. According to the Post Disaster Needs Assessment Report, the 2015 Malawi floods impacted on more than 1,101,364 people of which 230,000 were displaced and 106 killed while 172-people were reported missing" (GoM, 2015d:1). The report indicates that the economy of the country was heavily impacted since

the flooding affected the Gross Domestic Product (GDP). Different structures and infrastructures were heavily damaged and these included roads, bridges, irrigation schemes, houses, fisheries-related infrastructure, and dykes. Some of the districts heavily affected by the floods in 2015 included Nsanje, Chikwawa, Karonga, Phalombe, Zomba, Ntcheu, Mangochi, Salima, and Blantyre. This incidence, therefore, affected the livelihoods and resilience of communities because almost all the development sectors were affected, and that the economic loss was estimated at US$35.8 Million which was around 0.6% of the Malawi's Growth Domestic Product (GDP). The need, therefore, to integrate disasters and disaster risk management into multi-sectoral sustainable development planning cannot be overemphasized if socioeconomic gains are going to last long putting poverty at bay. This entails the need to engage all stakeholders in managing disasters by following all the necessary steps of Disaster Risk Management/Reduction Cycle. The cycle has three stages, and they include pre-disaster, disaster response, and Post-disaster, and all these should also depend on contingency planning.

2.7.2. Climate change mitigation approach in Malawi

The Government of Malawi signed and ratified to the United Nations Framework Convention on Climate Change (UNFCCC) in June 1992 and April 1994 respectively. The UNFCCC provided a leeway for the developing countries to put priorities on development and emissions and this provided an opportunity for Malawi to develop different policies and strategies to govern implementation of mitigation measures and/or actions. These policies and strategies include:

- **The Nationally Appropriate Mitigation Actions for Malawi (NAMAs).** These intend to help in reducing the emissions of GHGs and ensuring that carbon sinks are strengthened. The Malawi NAMAs cover five key sectors and their associated proposed project concepts namely, agriculture, forestry, energy, transport, Industrial processes, and waste management. These are also related to

Malawi's Intended Nationally Contributions (INDCs) that are country's intended contributions towards limiting the worldwide heating to 2°C comparative to pre-industrial levels (GoM, 2015b:1-6). The NAMA, in regard to its five key sectors (agriculture, forestry, energy, transport, and waste management) has the following priorities:

i. **Energy:** solar water heaters, biomass gasification, fuel blend with ethanol, efficient biomass stoves, household biogas digesters, energy efficiency and hydro-electric power generation.
ii. **Industrial processes:** Soil-cement stabilized blocks, cement blends (rice or coal ash) and Solvay process for lime making.
iii. **AFOLU (Agriculture, Forestry, and Land Use):** Efficient use of fertilizers and manure management, conservation agriculture, improved livestock feeding systems, improved rice cultivation, sustainable land management, afforestation, and forest regeneration.
iv. **Waste:** Municipal solid waste management, composting, waste to energy (biogas/ incineration) and landfills.

- **National Climate Change Management Policy:** A Policy framework promoting mitigation against climate change by emphasising on actions to the decrease of GHGs gas radiations/emissions and boost carbon sinks by re- planting of trees and use of forest assets and resources sustainably.
- **National Climate Change Investment Plan (NCCIP):** It ensures that the main primary and important thematic areas to tackle climate change impacts are championed aptly and adequately with assets and capitals. It identifies four priority areas in climate change management in Malawi and these are mitigation, adaptation, technology transfer and capacity building.
- **Intended Nationally Determined Contributions (INDC):** INDCs are country's intended contributions towards limiting the worldwide heating to 2°C comparative to pre-industrial heights or levels. The Malawi INDC covers both mitigation and adaptation actions. It identifies various mitigation contributions under the following GHG

emitting sectors: Energy supply, energy utilization, industrial processes, agriculture sector, forestry sector, other land use, and waste.

The capacity to achieve mitigation depends on financial resources and transfer of technology. The financial resources help in terms of effectively and efficiently planning different strategies for carrying out research and actual implementation of mitigation measures. Transfer of technology supports a wider range of stakeholders to have comprehension and capacity to effectively manage GHG for dealing with mitigation. This should bear in mind that socio-economic development and poverty reduction are the first and superseding priorities of least developed countries such as Malawi.

2.7.3. Climate change adaptation approach in Malawi

In Malawi, the NAPA is the strategic document guiding adaptation to climate change. Malawi recently developed the second edition of NAPA (2015) which is in line with the international instrument and is also linked to national policies and strategies which include National Climate Change Management Policy of 2016, Vision 2020, NCCIP, and Malawi Growth and Development Strategy (MGDS). The NAPA identifies key vulnerable sectors that need urgent adaptation and that all stakeholders and Government departments should ensure that climate change adaptation is across those sectors (GoM, 2011a). The sectors include agriculture, health, energy, fisheries, wildlife, water, forestry, and infrastructure development. Cross cutting priorities such as gender and population were also considered for integration during implementation.

The NAPA identifies key priority activities for climate change adaptation for Malawi under each sector. Practically, climate change adaptation can best be done at a local level where practical knowledge and experience can be generated, put into practice, and shared. For example, Malawian communities have discovered that climate change adaptation is a necessity for survival rather than an option (UNDP Malawi, 2017). Some

of the practical interventions by communities may include agroforestry practices, soil improvement using manure, irrigation farming, water harvesting technologies, low tillage, and maintenance of permanent soil cover, planting early maturing crops, cultivating drought-tolerant varieties, and crop diversification.

2.7.4. Policy development frameworks for climate change in Malawi

The country has developed national policies, strategies and sectoral programmes towards climate change management, socio-economic development, and poverty reduction (GoM, 2017a). The following are the national policies, sectoral programmes, and strategies that govern the planning, programming, and implementation of climate change actions in Malawi described in detail below.

National Climate Change Management Policy (NCCMP)

The Policy is a major tool for dealing with climate change in Malawi and it acts as a tool for mainstreaming climate change into any development designing and execution processes by development practitioners and interested parties at national and sub-national levels with the purpose of nurturing the nation's socio-economic growth and then achieving development sustainably.

The overall objective of policy is to provide an empowering guiding principle and lawful framework for an idealistic, organised, and synchronised methodology to handling or dealing with climate change in Malawi. It offers a tactical course for country's primary intentions for climate change actions and draws an organisational context/outline for the usage and execution of adaptation to climate change, mitigating against climate change, technology transmission and strategies for capacity building (GoM, 2016c).

The policy was enacted in June 2016 and is under implementation. The only challenge is that not many stakeholders are aware of this policy because it is not fully disseminated to the public. The process of

translating the policy into major local languages was completed in 2019 but the local people are still not much aware of the policy except those that got some policy information from a few NGOs that are disseminating this policy because no proper mechanism was put in place to share the policy to rural population. A number of priority areas as indicated in the policy are not yet under implementation; this could be because the government has limited political will on climate change as evidenced by the fact that the national budget has always negligible allocation of resources for climate change management. The only advantage is that government departments and agencies are getting funding from development partners for climate change programming and implementation, but the resources are always not sufficient.

Malawi is commended for developing and enacting a stand-alone National Climate Change Management Policy for the first time ever which provides good policy direction as regards to combating climate change in the country. The policy looks at six key priority areas and they include Climate Change Adaptation; Climate Change Mitigation; Capacity building, Education, Training, and Awareness; Research, Technology Development and Transfer, and systematic observation; Climate change Financing; and Cross-cutting issues. In addition, an Implementation, Monitoring an Evaluation Strategy (IMES) for National Climate Change Management Policy was developed for the policy. The aim is to ensure effective implementation, monitoring, and evaluation of climate change related actions based on the stated priority areas.

National Climate Change Investment Plan (NCCIP)

This makes sure that the main primary intentions of activities to tackle climate change and its impacts are assisted appropriately and adequately with assets and capitals. It identifies four priority areas in climate change management in Malawi and mitigation is one of them. The NCCIP was formulated in 2013 and was planned to be a working document for five years (2013 – 2018). It focuses on 4 key priority areas of which the Malawi government would invest her resources for climate change resilience (GoM, 2013a). These include investments in

adaptation, mitigation; research, technology development and transfer; and capacity development. The aim was to ensure that a lot of investments are made towards these thematic areas to achieve sustainable development and climate resilience. Financing for investments in NCCIP was believed to come from the Government, Development Partners, Civil Society Organisations, Carbon emission trading, and the Private Sector.

The NCCIP has tried to contribute to management of climate change by ensuring that financial resources that were available have been allocated in appropriate actions and progress has been made in climate change management in Malawi. However, the resources for investments have been inadequate and intermittent and other sectors like the private sector has not been forthcoming in supporting the cause. In addition, political will to implement this plan has been not sufficient as evidenced by inadequate funding or investments. This has made the plan, which is in its final year of implementation, not to be fully implemented and therefore not able to achieve the intended objectives.

National Adaptation Programmes of Action (NAPA)

The first edition of NAPA was prepared in 2006 to make it possible for Malawi to tackle her crucial, exigent, and direct adaptation requirements brought about by climate change and extreme weather occasions. Particularly, the NAPA seeks to recognise and discover a list of priority actions, preparing priority adaptation choices and alternatives, building capacity for adapting to longer-term climate change, and nurturing communal knowledge and understanding on the need to adapt to the antagonistic impacts of extreme weather occasions for effective actions.

The second edition of NAPA was formulated in 2011 after the first one expired and it was observed that there were still many gaps in adaptation to climate change in the country. Based on some achievements made during the first edition, the second edition was prepared, and it ran for another five-year period between 2011 and 2016. This also contributed to some achievements in adaptation but with the usual challenges of

insufficient funding, inadequate coordination among stakeholders, and lack of political will, gaps still exists even though the NAPA expired in 2016. The Government of Malawi through Ministry of Natural Resources, Energy and Mining assessed the NAPA and produced a report of achievements, challenges, and recommendations for future NAPA interventions.

Nationally Appropriate Mitigation Action (NAMAs)

These intend to help in reducing the emissions of GHGs and ensuring that carbon sinks are strengthened. The Malawi NAMAs cover five key sectors and their associated proposed project concepts namely, agriculture, forestry, energy, transport, industrial processes, and waste management. These are also related to Malawi's Intended Nationally Contributions (INDCs) that are our country's intended contributions towards limiting the worldwide heating to 2°C comparative to pre-industrial levels.

The NAMAs in Malawi were developed in 2015 and the identified priority areas are agriculture, forestry, and land use; energy, waste management; and industrial processes. The Government through the responsible Ministry together with stakeholders has identified key actions or activities to be implemented for climate change mitigation in Malawi. All the players involved in these actions are mobilising resources to ensure that these actions are executed but it is becoming challenging for adequate resources to be available hence slow progress is being made in implementing these NAMAs. The country is yet to fully implement the actions that were developed and planned for mitigation.

National Environmental Action Plan (NEAP)

The NEAP was formulated in 2000 and is a government responsibility to provide the agenda for integrating environment in the overall socio-economic development of the country through broad public involvement. Its specific objectives include to record and examine all key environmental challenges and actions to address them; to encourage sustainable utilisation of natural resources in Malawi; and to develop an

environmental protection and management strategy or plan. The NEAP also offers specific rules and recommendations to actions to be undertaken by local communities with or without government or non-governmental support; actions to be undertaken by government or other agencies; adjust prevailing programmes and projects to sufficiently cover environmental anxieties; and selection of projects for the Environmental Investment Programme (EIP).

During management of the environment, the plan stipulates that all the stakeholders must also observe climate change issues that are very much linked to the environment. This can enable the environment and ecosystem contribute to resilience of the population. The challenge is that this plan is not always referred to by the responsible government departments for dealing with environmental issues.

Environmental Management Act (EMA)

The Environmental Management Act was formulated in 1996 and provides strategies of how environment and climate change related actions can be handled and managed in Malawi. This act has been in force since 1996 and some articles became irrelevant, but it was still a document that was used for governing environmental management in Malawi.

The new revised 2017 Environmental Management Act (EMA) has been developed and has been enacted. The new act emphasises on how climate change interventions can be managed and governed in Malawi as compared to the previous one which does not explicitly provide how issues of climate change can be managed. It also gives a prospect for Government through the responsible ministry to develop rules and regulations that can support the development of National Climate Change Fund for Malawi. The fund can act as a pool of available resources for climate change management in Malawi to tackle problems of inadequate resources.

Malawi Growth and Development Strategy (MGDS) III

This is a national development plan or strategy for Malawi. It replaces the Malawi Growth and Development Strategy (MGDS) II and is the medium-term plan for the country to support the country's long-term development ambitions and objectives. It is planned to cover a period of five years (2017 - 2022). The MGDS III underlines the requirement to endow concurrently in spheres that can catalyse development through the connections they have with the other sectors of the economy. It classifies five main thematic priorities which include Agriculture, Water development and Climate change management; Education and skills development; Transport and ICT infrastructure; Energy, Industry, and tourism development; and Health and population. On climate change, the strategy recognises that climate change has adversative effects/impacts on the agricultural sector, as such several plans are indicated to tackle them through mitigation and adaptation programmes. Adapatation enhances planning for and thwart impacts of climate change, thus lessening susceptibility of soceties or people and natural environments.

This strategy is building on MGDS II achievements and it has been formulated after wide consultations and analysing the gaps that were not addressed in the former strategy. However, these plans are not fully executed until the implementation period expires because of inadequate resources both materially and fiancially since Malawi is a resource constraint nation.

National Resilience Strategy (NRS)

The Government of Malawi through Department of Disaster Management Affairs developed a five-year National Resilience Strategy (NRS) in 2017 which is offering an opportunity on how to implement actions that can help the country in building community resilience for building a resilient nation. This is a five-year strategy (2018 -2022) and its goal of this National Resilience Plan is to support in making Malawi resilient to disasters and disrupt the sequence of food insecurity. The

following precise objectives are implemented for accomplishing this strategy:

i. To advance irrigation farming for food self-sufficiency, nourishment, and export urge.
ii. To encourage catchment protection/safeguard and management.
iii. To lessen impacts of flooding and drought prevalence.
iv. To enhance effective early warning systems.
v. To ensure appropriate coordination and linkages of social support programmes.

The strategy has five elements/components, and these include early warning systems, catchment protection and management, agriculture and food security, social support programmes, and control of floods through dams, dykes, and river training.

2.7.5. Climate change governance and the country's response to climate change

Malawi just like other countries globally is affected by climate change which brings about natural disasters such as droughts, dry spells, stormy rains, pests and disease outbreaks, strong winds, hailstorms, and flooding. Currently, the intensity and frequency of these effects and disasters are on the increase and are impacting on peoples' livelihoods, property, infrastructure, peoples' lives, and the economy at large. In the year 2015, the country experienced devastating floods that affected livelihoods of most vulnerable households. Consequently, there was food insecurity and malnutrition thereby impacting on the lives of the very vulnerable in Malawi. In addition, livestock were washed away, destruction of properties or resources such as buildings, residences, roads, bridges, school structures, health amenities and irrigation schemes. Further, the 2015/2016 agricultural production season was disrupted because of El Nino, a phenomenon that prevailed because of climate change. This occurred from January to March when most of the agricultural crops were at a critical reproduction stage and this resulted

in low production and yields. It is a fact that about 6,870,000 people in Malawi encountered starvation because of food shortage which was a result of El Nino (GoM, 2015c).

The Malawi Government has the political will to combat climate change as evidenced by her commitment to ratifying international conventions and treaties related to climate change management. After ratification of these conventions and treaties, the country is implementing several actions related to climate change management, however, Malawi is not doing well because of lack of resources and inadequate know-how on climate change. Particularly, the country has prioritised mitigation and adaptation to ensure that impacts of climate change are lessened. In this regard, Malawi ratified the UNFCCC and its related conventions and strategies such as the Kyoto Protocol, National Adaptation Programmes of Action (NAPA) just to mention but a few.

Governance structure for climate change management in Malawi

The Malawi Government has an institutional framework that guides proper planning and implementation of climate change projects and programmes in the country. This governance structure ensures that there is effective coordination of climate change interventions among public institutions (departments and agencies), Development Partners, Non-Governmental Organisations (NGOs), the Private Sector and other stakeholders (GoM, 2014d). It also offers a good approach for sharing experiences, information and knowledge in climate related aspects. Figure 2.2 below shows the institutional framework for clmate change governance in Malawi.

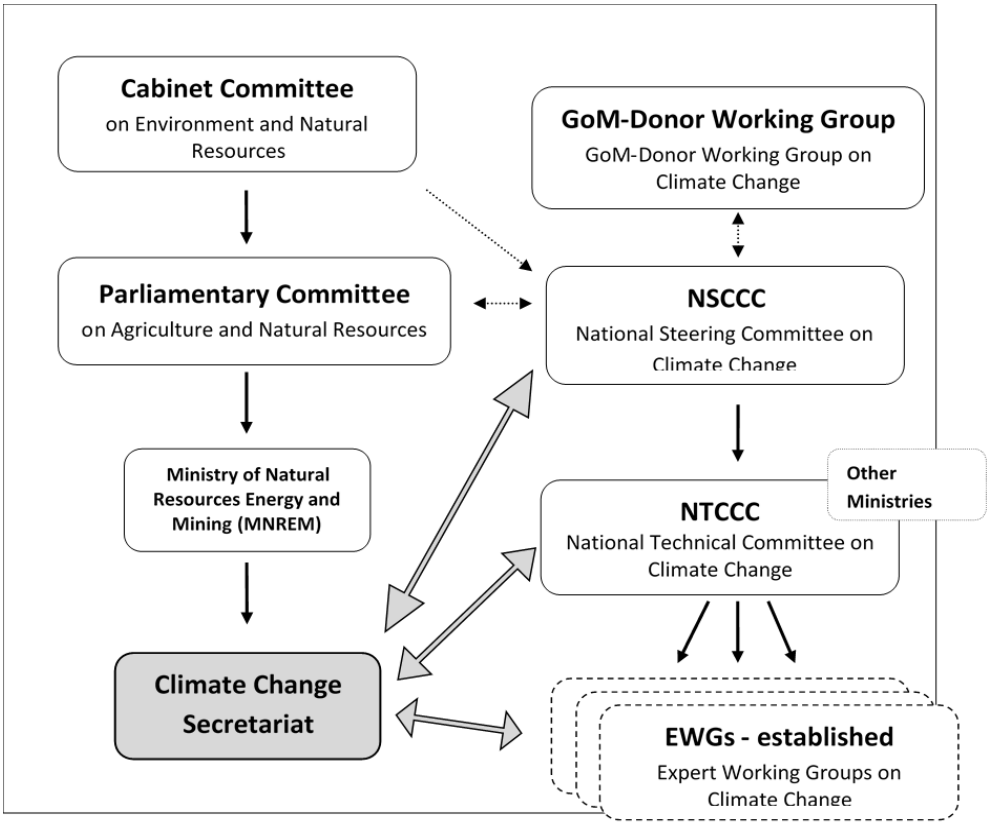

Figure 2.2: Governance Structure of Climate Change in Malawi (GoM, 2014d:34)

The Climate Change Secretariat which is housed in the Environmental Affairs Department under the Ministry of Natural Reourecs, Energy and Mining coordinates all the climate change related programmes in the country. It gets policy dirctions from the Ministry itself, Parliamentary committee on Agricuture and Natural Resources, and Cabinet committee on Environment and Natural Resources.

The Secretariat works and reports on any climate change related issues, to the Government of Malawi-Donor Working Group on Climate Change, National Steering Committee on Climate Change, and National Technical Committee on Climate Change. Expert Working Groups on Climate Change are under the National Technical Committee on Climate Change but they also report directly to the Climate Change Secretriat. The National Steering Committee on Climate Change is mandated to give reguar reports related to policy directions to the Cabinet Committee

on Environment and Natural Resources, and Parliamentary Committee on Agriculture and Natural Resources.

At local authority level (local council), the institutional structure that is used for climate change management is the same to that is used for general project development and management. The local authority/district council has core functions that include: making policy and choices on governance and development of the district; strengthening and advancing local egalitarian organisations and egalitarian involvement; advancing development of infrastructure and economy through District Development Plans (Phiri, 2012). The key decision-making body is currently the District Executive Committee (DEC), which is a professional advice-giving group of representatives that supports the procedure of District Development Planning and execution (see figure 2.3 below) which is headed by the District Commissioner. Members of the DEC comprises leads of the devolved sector executives stated above, Non-Governmental Organisations working in the districts, and Traditional Leaders. The DEC has sectoral sub-committees, for example for environment, forestry, health, agriculture, etc. Organisation and coordination of development planning and execution at the local/community level is carried out by the Village Development Committees (VDC) which is at the Group Village Head (GVH) level, premised on being people-centered, embracing demand driven and bottom-up methodologies, participatory and district centered. Several Village District Development Committees are embodied by the Area Development Committee (ADC) that is additionally supported by the Area Executive Committee (AEC) which consists of professional staff or workers from government sectors and Non-Governmental Organisations that live and work in the various areas within that particular locality. The District Environmental Sub-Committee (DESC) is answerable for ensuring that environmental challenges and climate change are considered and taken care of. It reports to the District Executive Committee (DEC). There are a number of sub-committees that look at climate and disaster related issues at local authority or

District Council level and they include Village Civil Protection Committee (VCPC) which reports to Area Civil Protection Committees (ACPC) and this reports to the District Civil Protection Committee (DCPC). The DCPC reports all matters related to climate change and disasters to the District Executive Committee (DEC) and the District Environment Sub-Committee (DESC). Overall, the District Executive Committee and the District Environment Sub-committee are responsible for synthesizing the environment and climate change related issues and develop plans that are integrated in their development plans for action.

All these committees have chairpersons who are responsible for calling for meetings to deliberate various issues related to development planning. All these committees share information on development issues for development planning both at community and district level. Once reports on issues from committees have been prepared, whether on general development, environment, and climate change aspects, they are submitted to the District Executive Committee (DEC) for consolidation. Thereafter, the District Council uses the information during the development planning process. The key guiding tool for the District Council regarding development is the District Development Plan (DDP) that encompasses strategies for district development programmes across all sectors. The District Development Plans have a lifespan of 5 years and is reviewed by the end of 5 years to develop a successor.

The DDPs are also developed with reference to Social Economic Profile (SEP) for that district. A social economic profile of a district is a detailed analysis and documentation of any district's socio-economic status. Key issue highlighted include population, demography, environment and climate change, vegetation, agriculture, education, health, economic activities, local politics among other aspects. The SEP helps in determining what strategies and plans must be incorporated in the DDPs in relation to the aspects stated above.

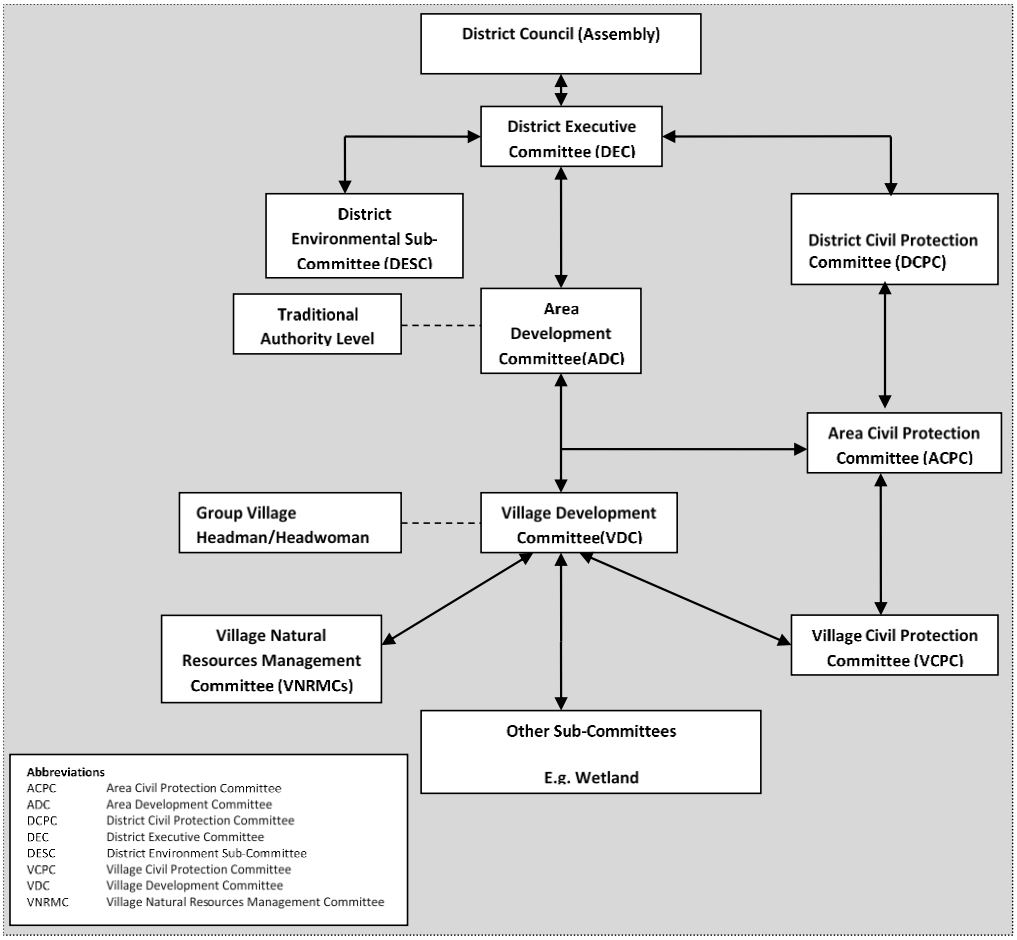

Figure 2.3: Local Institutional Governance structure for Climate Change in Malawi (UNDP, 2014b:92)

The Government of Malawi, NGOs, and other stakeholders have implemented several mitigation and adaptation programmes and projects to address the impacts of climate change. These projects have been small to large and using different implementation approaches. Malawi has designed and implemented over 300 climate change programmes and project activities across the country, most of them in adaptation. These projects range in cost from as small as US$ 1,000 to as much as US$125 million; vary in size from a single intervention project activity targeting a small community, to multi-intervention programmes targeting several communities (GoM, 2018). The scope of projects and programmes is increasing with time so that climate change effects are addressed.

Looking at the challenges of inadequate resources for addressing issues of climate change, the country initiated a process of establishing a National Climate Change Fund in 2017 so that it can act as a pool of resources where all players/stakeholders can access funds for climate actions or projects. It is believed that this is an endowment trust where the funds must be grown for sustainability purposes. The sources of funds are various levies, government subvention, and multilateral and bilateral donors. Malawi is trying her best in dealing with climate change impacts through climate change adaptation and community resilience-building actions.

Generally, climate change programming and implementation in Malawi, as indicated earlier, is coordinated by the Environmental Affairs Department under the Ministry of Natural Resources, Energy and Mining. All efforts towards combating climate change done by Government Departments/Agencies, Private Sector, civil society, and other development practitioners are mandated to abide by the relevant policy frameworks that are in place. It is a requirement for each stakeholder to regularly update the secretariat in terms of the progress that is being made on climate change action in Malawi.

The country adopted several approaches that are regarded as effective in tackling climate change effects in the country (LEAD SEA, 2013) and most of these have been discussed in detail in chapter three. These approaches include Community Based Adaptation (CBA), Community Based Resilience Analysis (CoBRA), Ecosystem Based Adaptation (EBA) and Sustainable Livelihood Framework. All players in the climate change sector must ensure that these approaches are adopted in their programming while observing minimum guidelines for policy implementation.

In conclusion, this chapter has provided a review of general literature on climate change especially focusing on adaptation and resilience building and these are related and linked to chapter three which is describing various models and approaches to adaptation and resilience. This

chapter has also described how Malawi, where the study was conducted, responds to climate change adaptation, mitigation and climate change resilience including governance systems for effective implementation of various climate change programmes.

CHAPTER 3: MODELS, APPROACHES AND CONCEPTUAL FRAMEWORKS TOWARDS CLIMATE CHANGE ADAPTATION AND CLIMATE RESILIENCE

3.1. INTRODUCTION

This chapter details more of climate change models, approaches and conceptual frameworks towards climate change adaptation and climate resilience. It includes an outline and discussion of the approaches used to guide the study and showing how the approaches relate to this study. It also gives a discussion how the researcher understands the approaches and which conceptual framework has been chosen to be used for the study with its rationale. Some of the models that are discussed and are related to this study include Sustainable Livelihoods Framework (SLF), Community-Based Adaptation (CBA), Ecosystem Based Adaptation (EBA), Indigenous Technical Knowledge (ITK) for adaptation, Conceptual model of Climate Change and community resilience, Community Based Resilience Analysis (CoBRA) Tool, and From Vulnerability to Resilience (V2R) Framework. The V2R is discussed in detail in this chapter as a conceptual framework that is applied for carrying out this study. This chapter, therefore, has two sections of which the first section talks about general models and approaches on climate change, and the second section describes the "From Vulnerability for Resilience (V2R) conceptual framework" that is used in this study.

The researcher is providing a critical analysis of these models, approaches, and conceptual frameworks by whether agreeing or not agreeing to the authors of these approaches. Therefore, the discussion in this chapter offer different methodologies of how these key concepts of climate change can be applied for enhanced climate change management and resilience building.

3.2. GENERAL MODELS AND APPROACHES TOWARDS ADAPTATION AND RESILIENCE

While general principles may be applicable to given climate risks, given solutions would not fit all circumstances. The models, approaches and conceptual frameworks analysed here are those linked to promoting resilient livelihoods, enhancing climate change adaptation, and building climate change resilience. The demerits and merits of each approach have been discussed and in the end one approach or framework has been chosen to be applied to this study. The approaches and the frameworks are discussed in the subsequent sections below.

3.2.1. Sustainable Livelihoods Framework (SLF)

This is one of the key Sustainable livelihood approaches to development. The Department for International Development (DFID) developed the Sustainable Livelihood Framework (SLF) in 1999/2000 as an approach in development practice. It is the most widely used approach or framework globally and is incorporated in development cooperation programmes, and it focuses on livelihoods that form a basis for peoples' welfare at all levels. The purpose is to contribute to poverty reduction in developing countries by utilising livelihood assets in any development endeavour. DFID (2000:4) adopted a definition of a livelihood from Chambers Conway which states that:

> A livelihood consists of capabilities, assets, and activities required for a means of living. A livelihood is sustainable when it copes with and recovers from stresses and shocks and maintains or enhances its capabilities and assets both now and in future while not undermining the natural resource base.

DFID indicates several other means of employing or applying livelihoods methods and that even though the livelihood approach application is flexible and adaptable to specific local situations and objectives, it lies beneath several essential principles and values. These values include the following.

- sustainability (preserving the long-term production efficiency of biological and ecological resources or assets and have so many livelihood options).
- macro-micro links (bridging the gaps between these two levels).
- dynamism (continuous learning of changes to mitigate negative impacts in people and institutions to support positive outcomes).
- holistic (understanding collective stakeholders' livelihoods needs with all facets for management).
- building on strengths (recognising peoples' capability and strengths to form a basis for achieving livelihoods by looking at stakeholders' robustness and ability to accomplish goals).
- people centred (emphasis on people as human resources and social capital for executing actions that can contribute to improved livelihoods). Figure 3.1 below is the SLF as described above.

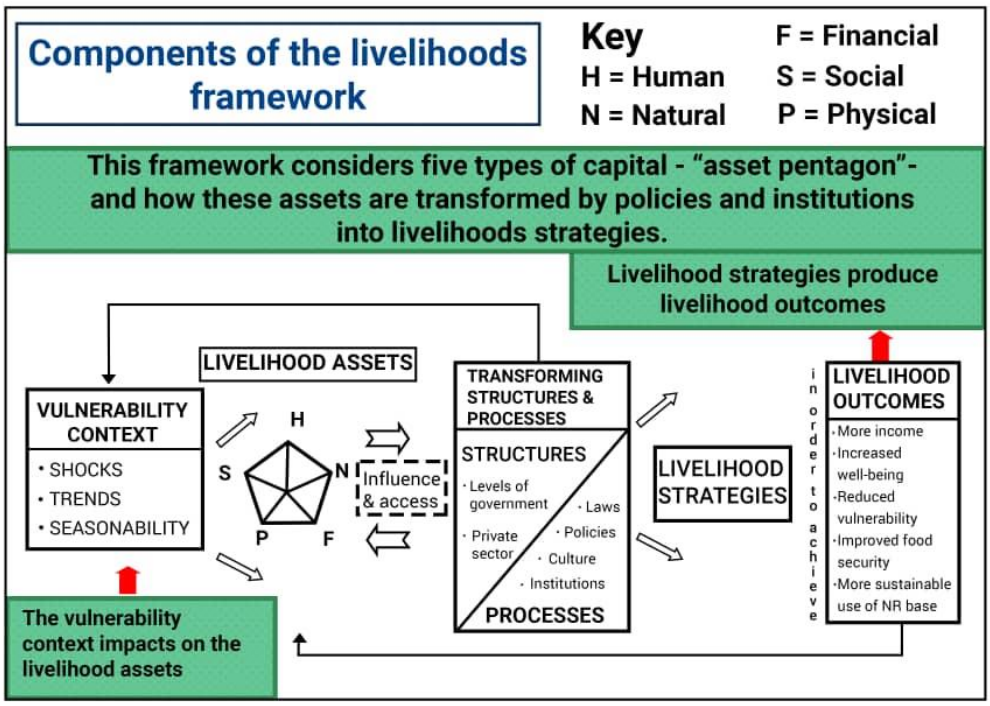

Figure 3.1: Sustainable Livelihoods Framework (DFID, 2000:5).

Figure 3.1. above describes the Sustainable Livelihoods Framework as adopted from Department from International Development (DFID) which is linked to climate change adaptation and climate change resilience.

The framework comprises several components and are outlined below:

- **Vulnerability context:** This component looks at the external environment in which local communities (people) live. The environment is usually influenced by several critical trends that include shocks, stresses, and seasonality. The vulnerability context prevails when people encounter shocks with inadequate capacity to respond effectively (Delaney & Tamas, 2014:68). The framework assesses the vulnerability of the people in terms of poverty levels to discover risks, shocks, uncertainties and hazards for planning and implementation of livelihood action.
- **Livelihood assets:** The livelihoods framework focuses on understanding peoples' assets that are known as capitals. It is very critical to assess and analyse these assets and transform them to good livelihood outcomes and the need to improve human well-being. It is very important to understand that local communities need a set of capitals or assets to accomplish these outcomes. The Sustainable Livelihood Framework discovers the five categories of capitals or assets on which livelihoods are created and these include natural assets, human assets, social assets, financial assets, and physical assets (Bazezew, Bewket, & Nicolau, 2013).
- **Processes, policies, and institutions:** Institutions, policies, and processes function at every level i.e., household, community, national, and international levels. These provide an opportunity for all players in development endeavours to have access to livelihood strategies and decision-making institutions so that there is integration of the capitals for livelihoods improvement.
- **Livelihood strategies:** These are simply actions and choices that development practitioners and the local people undertake for achieving livelihood objectives and outcomes. It is a fact that this is a dynamic process because it involves complex strategies to meet peoples' needs. In addition, processes, institutions, and policies form a basis for livelihood strategies for livelihood improvement. It is also vital to bear in mind that there is always a competition among poor

people such that a livelihood strategy of one household may affect positively or negatively on a strategy of another household within the community.

- **Livelihood outcomes:** These are accomplishments, achievements and/or outputs which are a result of livelihood strategies employed. These livelihood outcomes can include sustainable utilisation of natural resources, improved peoples' food security, decreased vulnerability/susceptibility, increased income, and increased standards of living or well-being.

The SLF approach focuses on the needs of the vulnerable or poor people and is flexible in its design or plan. It also provides openness to changes and this makes it adaptable to various and dynamic local situations. According to Kollmair & Gramper (2002:9), in their paper on the analysis of the strength and limitations of SLA, it is said that:

> The SLA may be utilised as a list or a way of arranging concepts and thoughts or can be used in the method of a livelihood examination to measure in what way do development actions suit the livelihood of the destitute.

The SLF has some weaknesses, and they include the actions aiming at improving the needs of a specific community or group may negatively affect the needs or livelihoods options of others. It is also understood that the examination and assessment of distinguished livelihoods requires a lot of time, human resources, and finances of which most of the initiatives lack these factors.

The Sustainable Livelihood Framework is an approach or framework that is very much in line with climate change management (adaptation and resilience). This is because all the capitals or assets that make up a livelihood are mostly utilised by different stakeholders in mitigating against climate change, adapting to climatic changes, and climate resilience. Therefore, there is a linkage between the Sustainable Livelihood Framework (SLF) and other Climate Change management

methodologies and approaches. In most of the climate change management actions, there is utilisation of the six assets described in this framework with the aim of ensuring that livelihoods options are designed and executed to realise peoples' well-being hence contributing to building communal and societal resilience to climate change. The SLF is integrated in any development programme because it provides several options in the process of the planning, execution, and checking and assessing of what was intended to be accomplished for a specific period. This is, therefore, one of the approaches that helps in coming up with complex and innovative solutions for livelihood improvement.

A clear understanding of livelihoods in any locality or community is very essential to ascertain their susceptibility to climate change and eventually analyse ideal interventions to build adaptive capacity. This is also very true to any climate resilience action and/or approach. The SLF provides an opportunity to understand climate change, the livelihood assets that are elements at risk to the impact of climate change, analyse their susceptibility to effects of climate change, determine factors either processes and/or structures increasing vulnerability of the livelihoods to impacts of climate change, and lastly consider appropriate adaptive livelihood strategies to create and build resilience of community to climate change.

However, despite the framework providing an opportunity for improving resilient livelihoods, it does not offer a leeway for directly enhancing climate change resilience. This is because it only focuses on improving peoples' livelihoods without focusing on how to improve their adaptive capacity. In addition, it doesn't directly offer strategies for addressing impacts of climate change.

3.2.2. Community-Based Adaptation (CBA)

International Institute for Environment and Development (IIED), 2013 developed approaches that address both communities' and ecosystems' specific needs, and these are Community-Based Adaptation (CBA), and Ecosystems Based Adaptation. IIED is promoting CBA and EBA as

approaches that could provide tailored solutions at all levels to ensure susceptible people and/or communities to find and execute applicable and suitable responses to climate change on their own.

It is worth noting that a larger population in the world that is susceptible to effects of climate change have tried to address climate change for several decades and have vast knowledge, and capacity of how to adapt or adjust to these changes. Community-Based Adaptation to climate change emphasises on providing empowerment to utilise their specific information and skills and a process of making decisions to undertake affirmative deeds. CBA involves the designing and delivery accomplishment of solutions that are generated at grassroots level with the purpose of adapting to the effects and impacts of climate variability and change (Reid & Huq, 2014). Examples of the fundamental issues in Community-Based Adaptation are:

- Use local trusted partners (NGOs, CBO, government extension workers) to enter the community.
- Communicating climate change concepts may be a challenge because it may require using innovative approaches such as drama.
- Learn about the local (indigenous) available capacity, skills, knowledge, and practices of how to deal with climate hazards in the past years before introducing new ideas.
- Identified adaptation projects should be mainstreamed into development initiatives for sustainability.
- Encourage action research, network, and sharing of best practices.

Community-Based Adaptation is an approach that looks at several steps from planning to implementation for better climate change adaptation and resilience building.

Why Community-Based Adaptation?

The CBA process or model provides an option to communities to identify innovative actions that can help vulnerable populations or communities to adapt to climate change impacts. It is a basis for identifying diversified

interventions and plans that will be taken on board and executed for climate change adaptation for improved livelihoods. The process provides vital perceptions into community knowledge and practices with climate change that is capable of informing integration of adaptation into development planning (Lisa, Schipper, Ayers, Reid, Huq, & Rahman, 2014). Integrating climate change adaptation into local designing processes provides a formalised channel for ensuring that communities' priorities and plans are aimed at building resilience and give communities the obligation to adapt their plans and budgets to local conditions and climate impacts. CBA plans, therefore, strengthen involvement of communities in development activities and influence in making decisions at local authority.

The process of facilitating the development of Community-Based Adaptation plans demands the application of a climate change perspective to an existing multifaceted and dynamic development process, integrating latest information and knowledge, reasoning, and methods, and working with various diverse players or performers. Designing and/or planning is an important component of CBA because the formulation of a successful intervention relies on its ability to manage climate change impacts, and risks and uncertainty, both of which require forward-looking and informed decision-making.

The basic process of planning involves analysing information, identifying actions and relevant actors, and prioritising and operationalising the selected options. These are critical because they underpin adaptive capacity, and in enabling people to learn and use their knowledge and experiences to manage the risks and uncertainties associated with a changing climate (Dodman & Mitlin, 2013). This approach is also linked to the Community Based Resilience Analysis (CoBRA) Tool that looks at analysing their prevailing condition and primary triggers of susceptibility, design and construct good decisions for their well-being options, and devise strategies for disaster risk reduction strategies. This tool will be described in the subsequent section.

Development Practitioners and frontline extension workers are trained in this process in order to equip them with talents to make sure that their respective actions and strategies are irrepressible to climate change and assist communities in adaptation (CARE International, 2009:5). In relation to this knowledge, all initiatives must place important focus on designing processes within the general community-based methodology, building on prevailing suitable practices in action development-oriented planning by communities. It is important to note that there are two stages of attempts for development planning. First is done at community level, through societal (village or area) adaptation activity designing processes and procedures. Secondly, it is the district council level (local authority), through incorporation of Community-Based Adaptation in planning for development processes at local authority. The designing process at these levels is highly helpful and efficient when it engages the full participation of communities, or project beneficiaries, community-based organisations, local non-governmental organisations, and representatives from government (Extension officers). This process helps in breeding knowledge and developing connections and that relationships can bring about robust concerted and collective initiatives in a short period for increased resilience.

The Community-Based Adaptation (CBA) plans development should follow the general procedure described below:

- **Launching the Community Adaptation Action Planning process:** This involves establishing the Community Adaptation Action Planning (CAAP) team to facilitate the process, consisting of staff from all relevant sectors, departments, and district councils; define the CAAP process; conduct initial background research to identify key issues; carry out stakeholder analysis; and conduct training for CAAP facilitation team. The aim of this process is to identify the purpose, the methodology, and interested parties or other players for the planning.
- **CoBRA Analysis - Situation analysis and stakeholder mapping:** This entails that those responsible do conduct a detailed research to

understand the overall characteristics of community resilience; organise interested parties to help and take part in the planning and in the process link the identified issues to the sectoral needs of the community.

- **Inclusive participation in the assessment of climate change susceptibility and adaptive capacity:** This involves the need to create a shared and collective knowledge of climate change susceptibility and capacity to adapt of various and diverse local organisations and groupings within the society or locality.
- **Development of Community Adaptation Action Plan:** This involves community envisioning; discovering and prioritising suggested plans for adaptation; vetting or investigating practicability and consequences of suggested plans/strategies for adaptation; identifying corresponding interventions; choices on arrangements and management, functions and duties, conclusion, and endorsement of community action plans for implementation.
- **Development of the CBA Plans**

  The development of the CBA plans in the community should be fully participated by the communities themselves and follow a participatory process where communities are asked to own the process and provide their input and their needs in building their resilience and enhancing climate change adaptation.

According to CARE International (2009), the process of developing Community-Based Adaptation plans with the climate lens must follow a logical process so that actions taken are effective and sustainable in nature. Figure 3.2 below indicates key stages in the development planning initiatives for community adaptation. The stages are chronologically followed or implemented because they are dependent on each other. For instance, if one stage is missed, information may not be sufficient for adaptation planning because some aspects are left or are not taken on board in the process. This helps in coming up with important decisions and strategies for development planning.

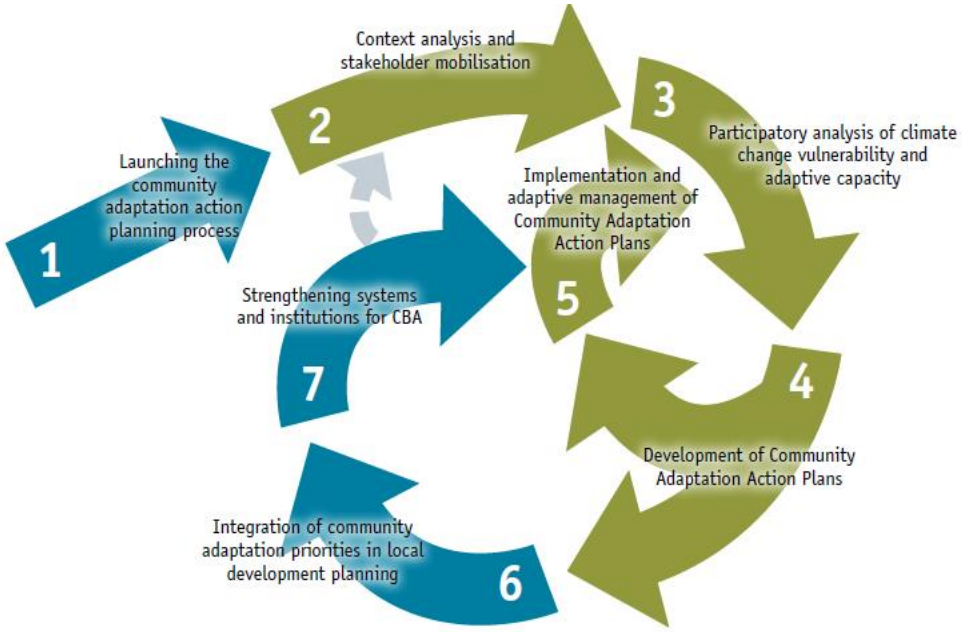

Figure 3.2: The Community Adaptation Action Planning Process (Care International, 2009:23)

Establishment of CAAP facilitation team

The Community Adaptation Action Planning (CAAP) team should comprise staff from relevant Government Departments, District level staff, and NGO partners operating similar programmes in the that particular community or locality. The members of the team should consist of extension workers, project coordinators, and district level sector heads. The team must deliberate at length the purpose of the activity and make proper preparations for consultations with communities and/or project beneficiaries.

Community mobilisation

The CAAP team, through the respective local government authorities or District Councils, should mobilise communities that are expected to participate in the development of the adaptation plans. Communities must be selected from local development structures from all the project impact areas. At each Local Government Authority level, groups of community members should be formed. Members for each group of community participants should range from 25 to 30, and these members

must be selected from Village Development Committees (VDCs), Area Development Committees (ADCs), Village Civil Protection Committees (VCPCs), Area Civil Protection Committees (ACPCs), and Village Natural Resources Management Committees (VNRMCs) and/or any other relevant development structures at a country level (described in detail in Chapter 4). Members of the community should be briefed about the purpose and procedure of the consultative process.

Actual development of CBA plans

The development of the community-based adaptation plans must follow a participatory process thereby enabling the communities to get involved and own the plans. Below is a step-by-step process of how the adaptation plans should be developed at local level:

i. Introduction of the activity to the community

An explanation of the purpose for the exercise is provided to the community by the CAAP team. Communities are then briefed on the importance of conducting an appraisal and analysis of identifying resilience characteristics in that particular community. In addition, communities are informed that following that initial assessment of resilience characteristics and other activities already under implementation, if any, in the locality, there is a need to develop adaptation plans linked to climate related hazards and risks experienced in the project area. It also has to be explained to communities that the development of the adaptation plans would be implemented for adapting to the adverse impacts of climate change, thereby building their own community resilience. Communities are, therefore, asked to actively identify the risks and hazards prevalent in their respective areas, and explain how they affect their livelihood, and lastly identify the respective adaptive strategies and plan for their implementation.

ii. Identification of climate related risks and hazards and their effects on the community

The communities are taken through a process of hazard identification and associated risks that communities experience in their respective areas, and how the hazards affect the communities' day to day lives and their general livelihood. The communities must identify the risks and hazards that are specific to each local authority or district.

iii. Community Adaptation Action Planning (CAAP)

The communities, with the help of the CAAP facilitation team, should develop Action Plans that clearly show what will be done within a specific timeframe, and the resources required, and responsible people. The plans should be based on the risks and hazards identified, that need to be addressed.

iv. Implementation arrangements

Implementation of activities in the action plan can be at two levels. Firstly, some major and critical interventions can be facilitated by the Central Government through coordination and networking at national level. Secondly, the local authorities and district level relevant sectors can practically implement the activities together with the communities themselves. It is vital to bear in mind that provision of capitals for interventions at the local level is frequently determined by local development planning processes and procedures. After successful mobilisation of community structures at local level during the development stage, community adaptation plans will be integrated into the village, area, and district development plans. For successful implementation, there is need to bridge the existing capacity gaps both at central and local levels. Communities can also be related to specialised professionals/officers in government departments, research institutions or non-governmental organisations that have the prerequisite knowledge and understanding, talents and facts/data. Strengthened execution systems and institutions ensure effective implementation of the plans at all levels.

Certain interventions in the design are carried out by community members themselves while others, such as development of infrastructure for irrigation, and water supply, external technical and financial support are required. Other concerns such as right to land holding or tenancy and access to assets, that can affect accomplishment of plans for adaptation might be integrated in community-based organisations, civil society organisations and government institutions for self-reliance, ownership, and sustainable development.

v. Monitoring and Evaluation of CBA Plans

Monitoring and Evaluation is a critical management tool to ensure successful implementation of any development intervention. For sustainable results, these plans and approaches must be monitored, appraised, and accustomed periodically to cater for emerging issues. Besides quarterly monitoring exercises, annual and mid-term reviews should be considered important for reprioritisation of indicators and their targets to intensify their usefulness and efficiency and ably react to climate impacts and effects. Reviews or appraisals must focus on the five main components of effectiveness, relevance, efficiency, impact, and sustainability.

The CBA approach has strengths in the development discourse. First, it contributes to household economic improvements leading to increased economic base, improved social setup and environmental management even in vulnerable communities. Secondly, it helps in improved adaptive capacity of the communities. Thirdly, it makes people plan and make decisions for their well-being. The CBA approach has some weaknesses, and these are: it doesn't recognise, harness, and quantify positive energy that come with peoples' knowledge, information, and skills; It focuses much on community strengths instead of individual capabilities of households since they have different needs; it undermines roles and responsibilities of traditional setups and gender roles and tasks. In addition, my own experience tells me that the approach doesn't provide a holistic mechanism of deriving specific strategies of building climate

resilience. It also relies on other approaches or tools for it to be successful like the CoBRA tool.

3.2.3. Ecosystem Based Adaptation (EBA)

This is also an approach that looks at adaptation to climate change with a focus on ecosystems and biodiversity. The EBA is a process whereby biological diversity and ecological system services are utilised to support the populace adapt to adversarial impacts of climate change (Reid, 2014b). It is important to note that this is not essentially a new approach because most of the people who are most susceptible to climate change are regularly and greatly dependent on bionetworks, and bionetwork amenities for their living and well-being. The bionetworks and the amenities they offer are already significant to several effective and productive plans for climate change adaptation to climate change. Convention of Biological Diversity (2009) defines Ecosystem Based Adaptation as the utilisation of biodiversity and ecosystem services as part of an overall adaptation strategy to support communities or societies to adapt to the adverse effects of climate change. Climate change, and other several anthropogenic pressures and/or burdens are forcing numerous bionetworks to the confines of their adapting ability and capability. Even though most ecosystems are naturally resilient and would bounce back after some time, there is a rising improbability around the ceilings of climate change over which bionetworks or ecosystems are irretrievably modified or distorted and might not perform in the existing condition or position. Nevertheless, we are not in a position to understand that bionetworks are more resistant and resilient to climate change when they are in suitable and better state and non-climate pressures such as habitation destruction, unsustainable harvesting of natural resources, and contamination are reduced. Therefore, human resilience building needs a better knowledge of schemes and techniques, the collaboration among components of systems, and its response twists (Smith & Sterling, 2010:3). This means that strategies to enhance resilience to climate change needs, consequently, not perceive the physical ecosystem or nature as simply the supplier of a collection of

separate and unrestricted resources or amenities originating from several straightforward or throughput schemes and systems. Preferably, we must consider natural food, energy, water, and waste control systems as interlinked and commonly reliant components of physical and natural systems that collectively can help achieve resilience of humans in an extra all-inclusive manner (Reid, 2014b). This results in sustainable utilisation of natural resources by humans hence enhanced resilience and sustainable development. Smith and Sterling (2010) also provide a critique as to whether structures or functions of ecological resilience must be resilient for complete ecosystem adaptation. They narrated that sometimes structures and functions bring negative effects on various ecosystems as a result, they decrease the resilience of ecosystems and their capability to generate services from those ecosystems. It is important, therefore, to understand various ecosystems so that their structures and functions are managed effectively.

When EBA is owned by the communities and subsistence farmers in any area, livelihoods are improved because EBA strategies are locally based and are implemented with commitment (Colls, Ash & Ikkala, 2009). Practices and traditions of EBA might always possibly advantage subsistence households in many respects apart from supporting them to adapt to climate change. For instance, one of the many benefits of EBA is that it helps in guaranteeing that there is a continuous offer of main bionetwork or ecological services over which agriculture relies (Lavorel et al, 2015). Examples of bionetwork amenities include food, nutrition, and water. It is understood that utilisation of EBA practices and tradition i.e., in agriculture, provides a significant prospect for supporting subsistence farmers and/or households to adapt to climate change whilst offering vital living standards and ecological advantages (Vignola et al, 2015). In Central America and southeast Asia, for instance, climate change is threatening several ecosystems thereby resulting into loss of some ecosystem services such as water provision and food availability (IWMI, 2014). Plans and strategies for adaptation that can support, create, and enhance resilience of subsistence households/farmers to

climate change are instantly required in Central America (Harvey et al, 2017). However, data and knowledge on strategies for adaptation that are suitable and applicable for the subsistence households/farmers are scarce and deficient to steer adaptation plans and policy frameworks (Donatti et al, 2017).

As highlighted earlier, no sector is spared from the negative and devastating effects and consequences of climate change, and intense climate events or incidents. As such, least developed countries like Malawi needs adequate number of people with an appropriate level of skills and competences to address climate change adaptation issues. Furthermore, appropriate capacity is low or non-existent resulting in poor implementation and wastage of resources. Thus, the harmonisation of training materials and conducting of training programmes in CBA and EBA would, in a long way, help in increasing the resilience of the community to the adverse impacts of climate change.

It is imperative to consider that much as climate change adaptation plans are the best way to address climate change effects/impacts, it is a requirement to exercise carefulness when planning and implementing these actions/strategies. This is because some plans and actions may lead to maladaptation instead of adaptation and this would bring great consequences because it would exacerbate the already negative effects of climate change. In reference to IPCC, 2014c, the term maladaptation means those interventions, or inactions that can result in compounded susceptibility to climate change, or current and future reduced welfare. Furthermore, the IPCC gives an example of increased cases of harvesting water upstream to cope with unpredictable and intermittent rainfall and this may spoil and decrease opportunities for the people or communities downstream to handle their own risks and hazards. Maladaptation is caused by the following:

- The failure to include the maximum array of risks in the plan of the coastal defensive system (IPCC, 2014c).

- The failure to consider the several collaborations and responses and reactions among systems and sectoral parts resulting in insufficient and imprecise data and knowledge for advancing adaptive reactions, plans and approaches that are not adaptive in nature (Irfanullah, 2013).
- Maladaptation may also prevail when the real probability or possibility of an alternative or technical knowhow (skill) is undeservedly over-emphasised, making it overrated (Irfanullah et al, 2011).

Barnett and O'Neill (2010) recognised and classified five elements of maladaptation and these include increases of GHGs emissions; unduly burden of the most susceptible; have huge opportunity expenses; decrease motivations or inducements and capacity to adjust and set pathways that restrain future options. Barnett and O'Neill further explain that these elements/dimensions are valuable and helpful indicators to the possibility for maladaptation, but their utilisation rely on independent analysis or assessment.

Ecosystem Based Adaptation is an approach that can be implemented together with the Community-Based Adaptation to ensure effective implementation of adaptation measures. This helps communities and stakeholders plan innovatively as to what and when to apply different adaptation actions and approaches. Strengths of EBA include guaranteeing communities of bionetwork services from a number of sectors of development; it helps the society use what is already available for livelihood improvement and resilience building; and helps communities to utilise locally available strategies that makes its implementation easy (IIED, 2011b). EBA has some weaknesses, and they include not providing specific strategies for climate change adaptation and relies on other approaches such as CoBRA and CBA. The researcher, therefore, thinks this approach may not directly and fully help in building community climate resilience because of such gaps unless it is complemented by the other approaches.

3.2.4. Indigenous Knowledge (IK) for adaptation

Indigenous Knowledge (IK) is very important in a community setup because it informs how diverse populations perceive and believe in some of the happenings. The society believes in their own practical experience, knowledge, traditions, and customs and use them to steer development initiatives including issues of mitigating against and adapting to climate change.

UNESCO and Indigenous Corporate Training Inc. (2018:2), defines Indigenous knowledge as:

> Interpretations and/or understandings, talents, beliefs, values, and ideas established and generated by communities with past and lengthy history of interface with their own physical environment. For native populace, indigenous knowledge notifies about essential facets for making decisions for daily living.

Indigenous Knowledge to climate change is an approach/tool used for mitigating against and adapting to climate change because local people can generate solutions to climate change issues. Indigenous Knowledge is locally managed, constantly changing, and it is transmitted orally in the form of dances, folklore, songs, and through imitation and demonstration from one generation to another (Mkomwa et al, 2014). It is very vital as an instrument or approach for adapting to the effects of climate change, mitigating against the same and sustainable development because it provides the basis for resolving challenges facing the local community, particularly the destitute and the susceptible and it symbolises a significant element of the worldwide understanding on development concerns and problems.

During the process of mitigating against and adapting to climate change, the local populace utilises their local knowledge to understand the climate system and devise techniques or strategies how they can tackle climate change. This is because indigenous knowledge is entrenched in a location and set of experiences and it might not be appropriate and transmissible to other areas/location (Ajibade, 2003). For instance, local

communities use special traditional indicators to forecast or predict seasonal weather and climate change and these include animal behaviour (insects and birds), and peculiarity of weather elements (temperature variations in specific months). In addition, some local communities in Malawi and other countries believe the shading of leaves by certain tree species such as *Cordyla african*, Baobab, *Faidherbia albida, Mangifera indica* (Mango) and *ziziphus mauritania* signifies the onset of rains. Similarly, the time of flowering of certain tree types and the increased fruit production by *Adonsonia digitata*, *Mangifera indica*, and *Ziziphus Mauritania* show the onset and prospect of the good amount of rains (Mkomwa et al, 2014). In this regard, local people make decisions and strategies of how to achieve mitigation and adaptation to climate change based on information and knowledge they possess. Accounts of similar traditional knowledge and beliefs have been documented and analysed by LEAD-SEA (2013). It is important to note, however, that there is still a requirement to validate the indigenous knowledge systems to ensure they are effective when integrated with scientific knowledge. This can be utilised in the process of making decisions in issues of mitigating against and adapting to climate change and climate change programming in general.

Indigenous knowledge might ably be utilised in several spheres of climate change and it should be a continuum of processes for mitigation and adaptation. The IK enhances partnerships with local communities on several perspectives such as dependence of the individuals on the whole process, social connectedness within the system or society, and responsibilities of the ecosystem or environment (Bogale & Bikiko, 2017). Factors that are most significant in any society or cultural setup during utilisation of IK for mitigation and adaptation are leadership and culture (forms good basis on which group dynamics are sorted out and managed), networks and relationship (this brings about partnerships and collaborations in sharing information and knowledge) and change ready (the willingness of the local communities and stakeholders to change in relation to mitigation and adaptation). These are important factors

because they do shape the effective direction of climate change mitigation and adaptation actions at local level. If scientifically proven or substantiated, Indigenous Knowledge can be a very important tool for climate change mitigation and adaptation because local people would feel proud of their contribution to the provision of thinking mechanisms in the design and implementation of development initiatives. There is a need to integrate/align IKS with scientific knowledge, which is more than just validation. In a way, they would understand their role on mitigation and adaptation hence owning the process and eventually actively participate in climate change management actions leading to their own resilience.

In my own understanding, this approach helps in enhancing partnerships of climate interventions by bringing in indigenous knowledge for implementation. It also binds the society and its cultural setup due to utilisation of local knowledge. However, the approach may not fully contribute to climate resilience building because its knowledge and information is not scientifically proven and there is always a need to validate it to ensure its effectiveness. In addition, the approach may not be effective on its own since it is dependent on transferability of knowledge of adaptation from one generation to another. Along the way, some important knowledge may be lost.

3.2.5. Conceptual model of climate change and community resilience

This conceptual model looks at matters of climate change, communal resilience and communal assets and capitals, that is used to understand levels of climate change context and community resilience in a community or society. It provides an opportunity to plan climate actions in a manner that can respond to the resilience needs of the vulnerable group of people. The model is also related to the Sustainable Livelihood Framework because the model also focuses on how community capitals are utilised to achieve general community climate resilience based on climate change and resilience dimensions.

The model was developed by McCrea, Walton, & Leonard in 2014 as a theoretical framework for examining and assessing local community well-being and resilience of vulnerable populations. In their understanding, it is believed that for the resilience of the vulnerable populations to be effectively and efficiently built, there is a requirement to assess extent of climate change impacts within a specific community. Once this is done, some elements and factors that can stimulate and facilitate solutions of addressing these impacts are determined and strengthened and these are resilience factors or dimensions. These have to be combined with community capitals that are utilised to achieve community resilience to climate change while addressing the negative climate change dimensions. Figure 3.3 below shows the model that highlights the linkage of different parameters including resilience dimensions, community capitals and climate change dimensions and these have been explained in detail.

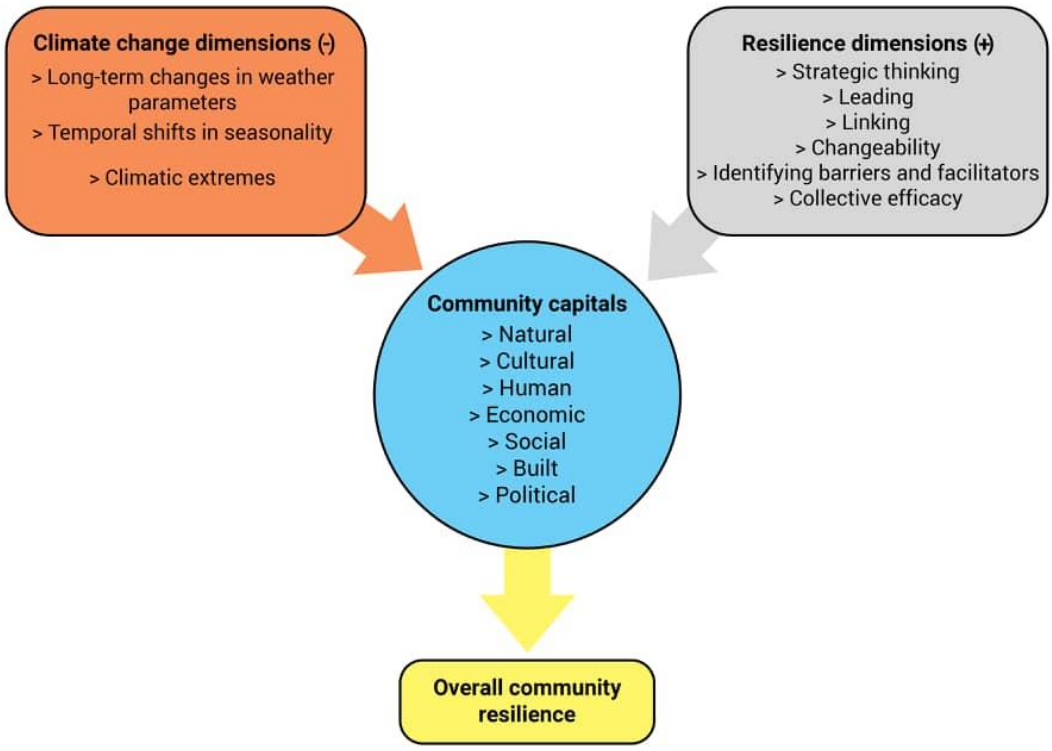

Figure 3.3: A conceptual model for climate change, resilience, and community capitals (McCrea, et al, 2014:83)

Climate change dimensions as indicated in figure 3.3 above refer to negative long-term changes in weather strictures, temporal shifts in seasonality, and climatic extremes. Long term changes in weather strictures are climatic factors that vary from time to time due to climate change which is a result of global warming. These weather parameters include erratic rainfall, sea level increase, and increased temperatures. Temporal shifts in seasonality is a change of seasons for the area due to climate change. This affects the production seasons for each country or community. For example, in a country where a specific season used to start in the month of October, the season may shift to November or December due to climate change. Climatic extremes are abnormal conditions that come due to long term changes in weather parameters due to climate change and they comprise floods, cyclones, hailstorms, droughts, and dry spells. Climate change dimensions pose a threat to community capitals by impacting on the general livelihood within the society.

Resilience dimensions are positive parameters that are identified in a society or community to manage negative climate change dimensions through utilisation of community capitals available in a society. These resilience dimensions include tactical/strategic thinking, leading, linking, changeability, discovering/identifying barriers and facilitators, and collective efficiency. Strategic thinking is a process of analysing the context and come up with practical solutions and once this is done, there is need to identify people who are going to lead the practical solution hence leading (Cambridge University Press, 2014). The linking dimension focuses on transferring the solutions into reality and connect all processes into a system. The resilience dimension of changeability looks at a process of being flexible in dealing with impacts of climate change to come up with several effective solutions leading to climate resilience. The other dimension of this model is the identification of barriers and facilitators. This means that if the solutions are to be effectively managed, there is need to understand the barriers of

community climate resilience, and these are usually related to the climate change dimensions indicated earlier. Once the barriers of resilience have been identified, facilitators must also be identified to spearhead the facilitation of all the processes of resilience dimensions. But what is also important is the collective efficacy or efficiency where everyone concerned can put efforts in dealing with negative climate change dimensions to achieve the resilience. Resilience dimensions provide solutions, ways and/or mechanisms to community capitals to ensure that negative climate change dimensions are effectively and efficiently dealt with or managed.

Community capitals are at the centre of the conceptual model for climate change, community resilience and community capitals. Community capitals as indicated in this model refer to resources of a society that are put together or endowed for mutual and shared well-being of the whole society. The set of community capitals enable the development practitioners and communities to accomplish resilience dimensions. This is because resilience dimensions rely on community capitals to be implemented for community resilience. These community capitals include natural, cultural, human, economic, social, built, and political. Natural capital includes all assets in the environment or ecosystem that supports system thinking for behavioural change. In other words, natural capital is the presence of and sustainable utilisation of natural resources for consumption of human beings. Human capital is the individual's or peoples' intrinsic and personal qualities like skills, knowledge, information, education, health, and experience and these contribute to the capability to earn a living for improved well-being for a strengthened society. Cultural capital talks about norms, beliefs, customs, and values for a community and these strengthen interactions among community members. Economic capital looks at the available sources of finances, wealth, material properties that are usually endowed in different ways for development of various businesses, social and civic enterprises for a better livelihood. Built capital refer to all physical assets or infrastructure that the community has in that locality/country such as energy, transport,

roads and bridges, manufacturing companies, water, shelter, homes, and health facilities. Social capital refers to the level at which social networks thrive in a community though team building and relationship building. Political capital is the capacity of the members of a society or community to have access to power and resources for decision making in ensuring building of their own resilience.

Community capitals are also known as community resources that support communities to enhance their resilience to disruption especially climate change. McCrea, Walton, and Leonard (2014) explain a diagrammatic relationship among climate change dimensions or scopes (climate change impacts), resilience dimensions, and community capitals. This entails that climate change dimensions have general adverse effects on community capitals, and that resilience dimensions have positive impacts on these community capitals.

It must also be understood, therefore, that the disposable or clear impact of the two dimensions (climate change, and resilience dimensions) on communal capital is suggestive of the degree of community resilience to climate change. The theoretical/conceptual model for climate change and community resilience described above is relevant in analysing climate change impacts, community capitals, and resilience dimensions, and helps in developing effective mechanisms and solutions for achieving community climate change resilience. A combination or community capitals and resilience dimensions help in dealing with; the climate change dimensions hence community resilience to climate change.

Despite the conceptual model providing a good grounding for climate change resilience building, it has some limitations that affect the process of building community climate resilience. This approach assumes that communities have all the knowledge and skills for resilience building yet individuals' level of capacity differ. It does not recognise the need for analysing climate change aspects such as shocks, stresses, adaptive capacity, and strategies for addressing impacts of climate change. In

addition, the approach is based on assumptions and is not flexible. Therefore, the researcher thinks this is just one of the conceptual frameworks that can be improved further for climate resilience building.

3.2.6. Community Based Resilience Analysis (CoBRA) Tool

The Community Based Resilience Analysis methodological tool or approach was established and created originally by “the United Nations Development Programme (UNDP) Drylands Development Centre” in 2012 with the objective of complementing systematic/technical design and programming endeavours (UNDP Drylands Development Centre, 2012). This is facilitated by development practitioners and specialists in resilience through provision of opinions and choices from the local populations and building their resilience in the face of severe 2010/11 drought in the Horn of Africa (HoA). To date, CoBRA methodology has successfully been tested and applied in different locations within Kenya, Uganda, Ethiopia, and Malawi (MacOpiyo, 2017). The assessment findings have been incorporated in relevant resilience-related strategies, policy frameworks and projects at various levels in this region.

Community Based Resilience Analysis (CoBRA) is an approach or methodology for assessing community resilience which is participatory and qualitative in nature. Its purpose is to discover and classify specific factors at community level that contribute to households and community resilience that encounter several kinds of stresses and shocks (GC-RED, 2009). This tool does not use any preconceived definitions or indicators of resilience, but rather helps local populations describe and explain them on their own, based on their past experiences by:

- Stating the concept of resilience in plain terms based on local knowledge and experiences.
- Discovering or determining major elements and features that contribute to their resilience of communities in that locality.
- Identifying households that are more (or fully) resilient.

- Agreeing and detailing different categories of actions and activities that the communities themselves believe are effective in building their resilience at best.

In line with the rationale of assessing or determining the resilience and impact of resilience interventions, reference or benchmark data and information should always be founded and ascertained (MacOpiyo, 2017). For this to be done, the CoBRA tool attempts to respond to the four essential questions, and they include:

a. What are the key resilience characteristics at both household and community?
b. Which households in that community can resist, able to cope with shocks and stresses hence more resilient than others?
c. What types of elements are distressing or impacting on peoples' capability to cope?
d. In what way do local communities rank their achievement of the prioritised characteristics in a normal situation and in a disaster or catastrophic situation?

CoBRA Implementation: Phases and Steps

Community Based Resilience Analysis (CoBRA) is implemented following a systematic process and it follows phases and steps. CoBRA process is carried out using several steps as shown in figure 3.4 below:

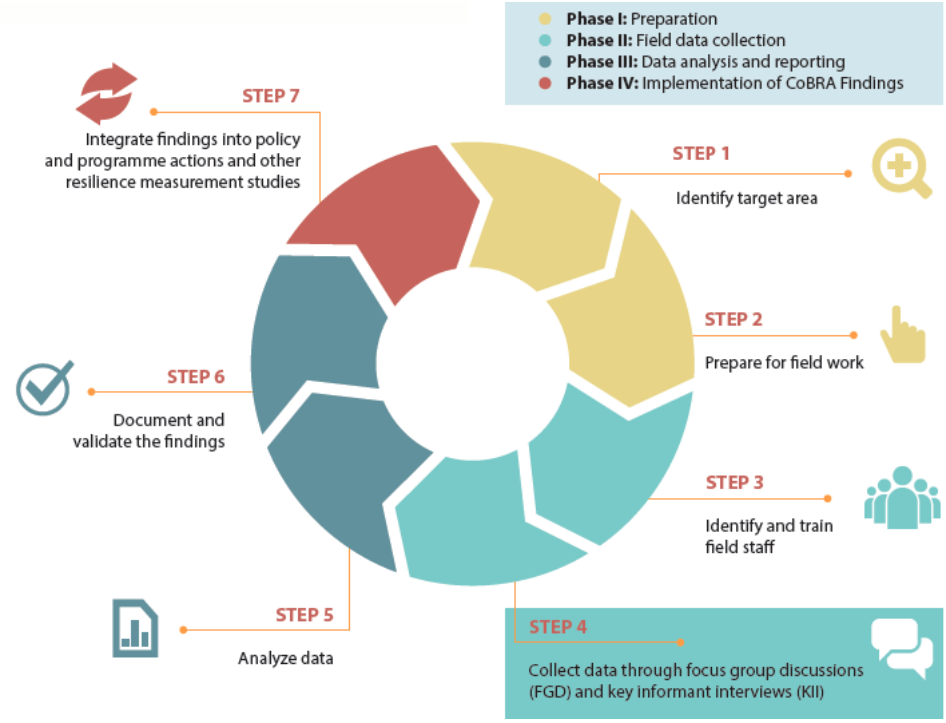

Figure 3.4: CoBRA Phases and Steps (GC-RED, 2013:5)

The phases and steps of the Community Based Resilience Analysis process as explained by GC-RED (2009) include the following:

- **Step 1: Identify target area**

  This involves selecting a community whose resilience would be assessed considering the current perceptions of resilience and geographic coverage of the community.
- **Step 2: Prepare for field work**

  The assessment team or agency to create or produce a plan of assessment in the CoBRA process during field work. This is done by working together and brainstorm of what must be done before and after field exercise and action.
- **Step 3: Identify and train field staff**

  An assessment team of staff should be identified based on their knowledge and experience in working with local communities. They should be trained on a comprehensive CoBRA training to ensure that they are conversant with the approach.

- **Step 4: Data collection**

  Administering Focus Group Discussions (FGDs), Key Informant Interviews (KII) with households deemed resilient. The number of FGDs per livelihood zone is determined by sampling framework while resilient KIIs are done through semi structured interviews with the members of the resilient households. Data collection process follows several steps, and these are indicated in the figure 3.5 below as adopted from GC-RED of the United Nations Development Programme.

FDG Step 1. Agree on the definition of resilience: What does a *resilient* community look like? What are the main hazards or shocks facing the community?

FDG Step 2. Identify resilience characteristics: What does a *resilient* community look like? What are the characteristics of a resilient community?

FDG Step 3. Prioritize resilience characteristics: What are the three most important characteristics of resilience in the community, ranked by importance?

FDG Step 4. Identify the households in the community that have achieved (fully or partially) the resilience characteristics and list their common features and attributes.

FDG Step 5. Identify interventions that have contributed to households resilience: What interventions have helped to enhance households' level of resilience, and what additional/future interventions would help to build resilience further?

KII with nominated resilient households: What factors or characteristics have contributed to your household's resilience? How did your household become resilient? Why do you think your family coped better with shocks and crises affecting the community? What interventions do you think would best build wider resilience in this community?

Figure 3.5: CoBRA data collection process (GC-RED, 2013:10)

- **Step 5: Analysis of data**

  Once qualitative and quantitative data has been collected, it is aggregated and analysed using standard excel spreadsheet. This is to ensure that information is descriptive and quantifiable to effectively document and disseminate real information on resilience context for the community.

- **Step 6: Document and validate the findings**

  Produce a report of the findings, validate them with stakeholders and disseminate to the public and all relevant stakeholders. This ensures that the public and other stakeholders are empowered with information as regards to peoples' resilience in the community. This makes them find means of replicating and scaling up what has worked in that process.

- **Step 7: Integrating findings into policy and programme actions and other resilience measurement studies**

  This is the last and the most important step of the CoBRA process. Once the findings have been validated by the public or relevant stakeholders, the findings of this process can be incorporated into policy and programme actions to ensure replication so that communities' resilience to climate change is built.

Community Based Resilience Analysis (CoBRA) is a tool whose results can be utilized in the following ways:

- **It informs both qualitative and quantitative resilience dimension**

  This provides an opportunity for all players in resilience practice to work with communities and prioritise and discover resilience characteristics and elements which can be utilized as indicators for status of orderly and logical monitoring of resilience progress or advancement.
- **This also informs broad climate change related disaster models and conceptual frameworks**

  It is a fact that some of the prioritised actions for building resilience by communities are off the locator display of climate change related discussions and interventions. This, therefore, gives a lee way for development practitioners to effectively design actions that are connected to climate change, disaster risk reduction and resilience building.
- **It enlightens practices, strategies, and policies**

  Through the CoBRA process, concerned stakeholders and development practitioners learn directly from the communities themselves because this approach or tool is evidence-based since households and communities provide their own opinions during the assessment. In the end, it supplements or harmonises technical approaches and helps in planning for resilience through processes of designing related programmes and polices (strategies).

Community Based Resilience Analysis requires time and availability of some resources for it to be effective and it is a sure way of measuring community resilience to climate change because communities have their voices, opinions, and choices/options for resilience (GC-RED, 2013). Community Based Resilience Analysis (CoBRA) has some strengths in the development discourse, and they include:

- A CoBRA assessment identifies a relatively short list of local drivers of resilience or non-resilience compared to other approaches that try to draw several elements of resilience.
- The approach aims to learn from positive experiences by identifying the households regarded to be already resilient and assessing what those households have or do differently that enabled them to bounce back better from past shocks and stresses. This evidence-based approach significantly improves the stakeholders and communities understanding of what resilience looks like in reality.
- The approach does not attempt to use any predetermined elements or indicators of resilience. The participatory nature of the approach brings communities' perceptions into the discussion. It provides the shocks/stresses affected populations with an opportunity to describe and explain resilience on their own as a community and as individual households based on their practical past experiences.

The CoBRA approach also has limitations or weaknesses, and these are:

- It requires a lot of resources for it to be successfully implemented like financial, and human. This can be a challenge to local population who are already vulnerable and may not actually understand the entire process.
- It is time consuming. It requires a lot of time for it to be fully carried out and this may contribute to the loss of data as a result the true meaning of its findings may be compromised.

- It focuses much on the extent of resilience of households as compared to root causes of households' vulnerability. In other words, it looks at what works well in the community as regards to resilience. It, therefore, leaves some gaps as to how households and the community address issues of vulnerability to become resilient.
- The approach doesn't provide alternatives of how resilience can be built better after resilient households have been identified.

To my understanding, the CoBRA approach or tool must be comprehensive by providing some mechanisms of how to assess the vulnerability of households or communities to climate change. This would help in determining the strategies of building the capacity of communities to build their resilience. This would provide a basis as to how the households that are not resilient can learn from the process itself and from the identified resilient households.

Generally, the researcher agrees with the authors or developers of the approaches discussed above that they contribute to climate change adaptation and building climate resilience. However, all these approaches are not models or theoretical frameworks, but they are approaches and conceptual frameworks. This is because they have no substantive theoretical grounding to justify the same. In addition, there are many gaps in the approaches that must be filled. These have, therefore, been discussed to show their significance in trying to measure climate resilience.

3.2.7. CONCEPTUAL FRAMEWORK

The Resilience concept is a tool that is used to analyse the adaptive capacity of vulnerable communities for achieving sustainability simply because it gives an opportunity of upholding stability amidst any shocks and stresses. This is based on resilience building principles for maintaining bionetwork services (Biggs, Schluter, & Schoon, 2015).

There are several frameworks used by development practitioners when analysing community resilience building and some of them have been

discussed in the preceding sections. For the sake of this research or study, a “From Vulnerability to Resilience (V2R) Framework” is adopted and used fully for this study. This framework has been selected to be applied to this study because it is very much linked to climate resilience building as evidenced by the fact that it looks at all dimensions of resilience. It focuses on the combination of dimensions to achieve resilience and these include disaster preparedness that addresses issues of hazards and stresses, adaptive capacity that tackles future uncertainty, governance and enabling environment, and livelihoods leading to diversity and security. According to United Nations Development Programme Global Centre for Reduction of Emissions and Desertification (GC-RED, 2015), this is an important framework initiated by Practical Action, an international NGO. The UNDP GC- RED further says that the framework shows key areas that affect communities’ or households’ capability to be vulnerable or resilient and interrelationships between them. It continues by saying that the framework aims at guiding planning for development through techniques and approaches that tackle the fundamental elements or issues that trigger the vulnerability (susceptibility).

The framework looks at hazards and stresses and future uncertainties that are brought about by climate change (Pasteur, 2011:8). After these factors have been identified, there is need to employ mechanisms that would help to address them by ensuring strategies that can bring in adaptive capacity and disaster preparedness. Good governance is one of the important elements in this framework because it provides an enabling environment for ensuring that adaptive capacity is built in communities and that hazards and stresses are effectively managed. Once all these are done, there is need to consider livelihoods improvement in terms of how to diversify and secure livelihoods that can address hazards and stresses, future uncertainties, and climate change impacts. When this is effectively planned and implemented, community resilience would be guaranteed. So, in other words, the inter-relationships among disaster preparedness and management, building

adaptive capacity, ensuring good governance, and diversity and secure livelihoods will eventually lead to resilience building. If resilience is built, communities or households will be able to secure sufficient food, adapt to any change, cope, and recover from shocks and stresses and move out of poverty. Building community resilience is perceived as a course that takes communities everlastingly out of vulnerability and poverty, and it is accomplished by enhancing and consolidating community and household livelihoods, disaster preparedness, building adaptive capacity, and ensuring governance environment (Pasteur, 2011:11-13).

The main purpose of the framework is to ensure that policy makers and development practitioners comprehend the factors and processes that influence vulnerability and resilience at both household and community levels. It helps in identifying gaps in key livelihood assets, the functioning of structures and processes of key organisations, and livelihood strategies of susceptible households. The degree and type of community and household responses to shocks and stresses lead either to increased vulnerability or improved adaptive capacity and resilience of the households and communities (Frankenberger et al, 2012).

This “From Vulnerability to Resilience (V2R) Conceptual Framework” is used in this study by assessing and analysing relationships and trends between climate change parameters in the targeted districts and the livelihoods that are helping communities to adapt and build their resilience. The focus will be on the aspects of livelihoods while also focusing on other aspects of community adaptive capacity, and Governance.

In relation to research objectives and the conceptual framework, some key questions will be formulated in the questionnaire and they include the following among others:

- What are the categories of climatic hazards and shocks/stresses that occur in the community? Participants were asked to identify and provide different hazards and shocks that affect their day-to-day life.

- How adaptive are the communities and individual households to climate uncertainty and/or impacts? Respondents here were required to indicate trends of climate change in their locality and how they adapt to those issues.
- Which governance issues are prevalent in the district level structures and level of participation of communities and other stakeholders in resilience building? The participants were asked to identify enabling factors within their locality and how they spearhead adaptive capacity and resilience building.
- What are the types of livelihoods that are employed by communities, development practitioners and stakeholders for survival amidst impact of climate change? Respondents were asked to provide in detail their livelihoods strategies for their daily living.
- What are the key strategies employed by people in the district (s) for climate change adaptation and building community resilience? Participants were required to identify and provide strategies or mechanisms that make adaptation and resilience building possible.
- Which factors or conditions that show that building community resilience is taking place in a district or society? The participants were required to share success factors and conditions for community resilience building.

The “From V2R conceptual framework” below (figure 3.6) indicates the interactions and relationships whether positive or negative in a process of community resilience building to climate change. It systematically outlines the interrelationships and interlinkages of dimensions for achieving climate resilience.

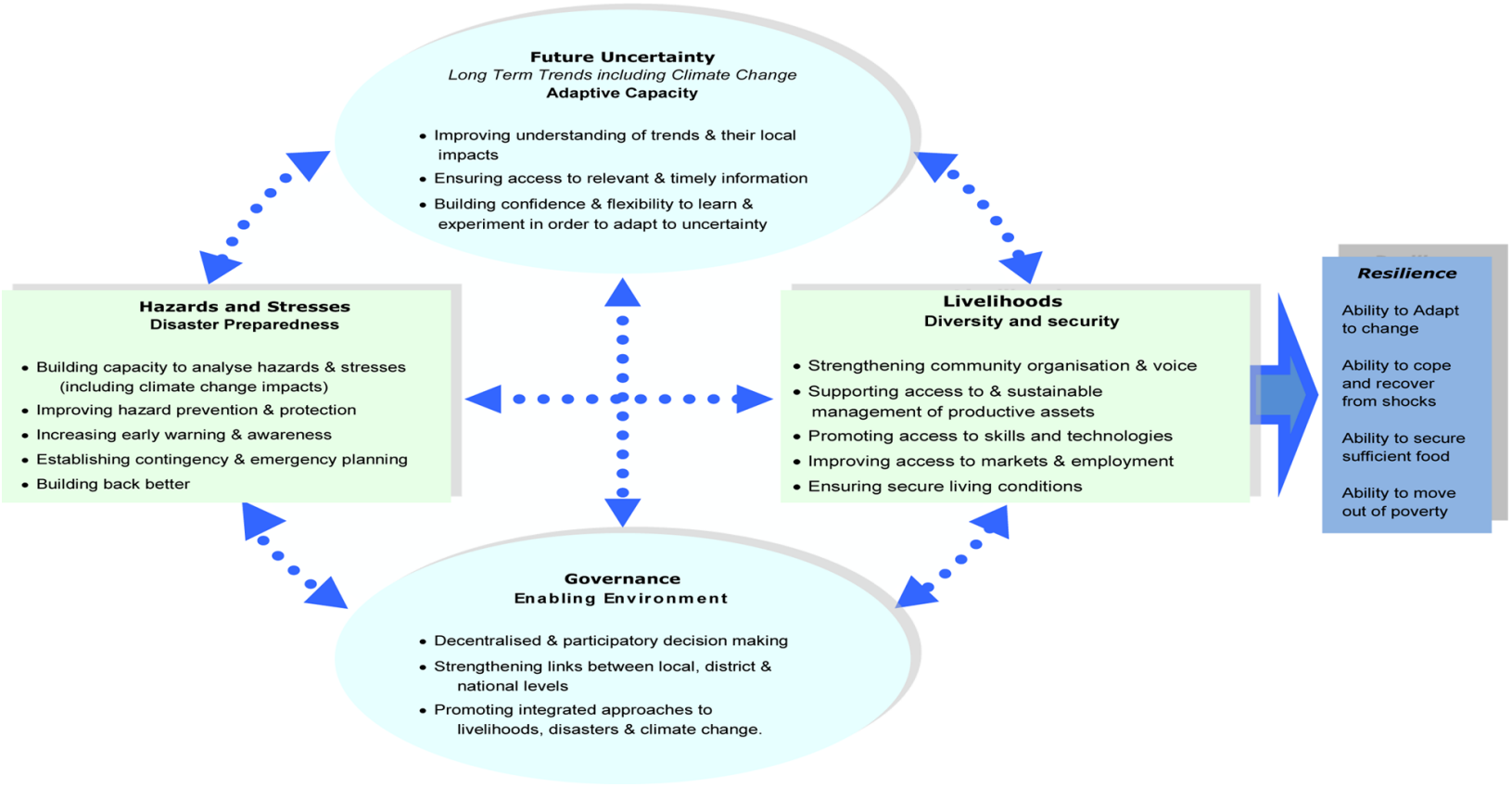

Figure 3.6: From Vulnerability to Resilience (V2R) Theoretical Framework (Pasteur, 2011:12).

It is important, therefore, for one to clearly understand the “From Vulnerability to Resilience (V2R) framework” indicated and described above because it provides interrelationships between and among key factors/areas that affect communities’ capability to become vulnerable or resilient (Fraser et al, 2011:3-6). This is because for one to assess and analyse the context of adaptive capacity and resilience of a community, there is a need to critically comprehend the parameters that either influence vulnerability or enhance resilience. This helps in coming up with good strategies for assessing and analysing the status of community resilience.

For example, for one to understand the framework indicated above, it is very important to also comprehend the hazards, stresses, and climate change long term trends that bring about negative impacts on populace and their well-being and living standards. In addition, there is a need to be aware of strategies that can increase disaster preparedness and adaptive capacities to counter these uncertainties. Once these are in place, issues of an enabling environment through good governance of climate change programmes must also be considered. All these elements must be combined effectively with the aim of diversifying and securing community livelihoods. If the livelihoods are diversified and secured it means community resilience is being accomplished.

This framework, therefore, is applied to this study as indicated earlier with the purpose of determining factors and conditions of resilience. The study tried to ascertain if there are additional conditions and characteristics of resilience as provided by the framework above or whether it is exhaustive in determining these conditions. This has been discussed in chapter 6.

CHAPTER 4: STUDY DISTRICTS AND AREAS

This chapter provides a full description of study districts and areas. The description takes a full account of key aspects of the districts as they relate to resilience building such as Administrative structures, local politics, and demography; land tenure and land use systems; physical description, location, geology, and hydrology; geography, climate, climate change and soils; the people, language, and culture; environment and natural resources; education; and infrastructure and utilities.

This chapter has been organised in a such a way that key aspects and characteristics of the study districts are discussed in detail. Some of the aspects and/or characteristics are discussed per district because they are unique and specific to that district. This implies that the statistics and other information regarding that characteristic is different from one district to another. So, they are presented per district as a way of showing the specific context for each district. Other aspects/characteristics have been discussed covering all the districts or across the districts because they are common to all the districts.

4.1. COUNTRY BACKGROUND

4.1.1. Country location, geography, and climate

Malawi is among the nations located in the southern part of the African continent and is landlocked, meaning she is only surrounded by land (non-coastal). Malawi is in the south-eastern part of Africa and lies on 9°C and 17°C latitudes South and longitudes 33°C and 36°C longitudes East. The country shares boundary with three countries of Zambia to the western part, Tanzania to the northern and north-eastern part and Mozambique to the southern and southwestern part (GoM, 2016a).

The nation's total area is 118,484 square kilometres and is composed of 20% water. Malawi is 840 kilometres in length and its width is between 80 and 161 kilometres. The country reclines alongside the extended Rift Valley in the southern part (IIED, 2004: 5-12).

Malawi has several water bodies that provide sources of water for several uses and these include Lake Malawi that is the third largest of all the lakes in the African continent, and it runs through three districts in the north, two districts in the central region, and one district in the southern region of the country. It runs through Karonga, Rumphi, and Nkhatabay districts in the Northern Malawi, Nkhotakota and Salima districts in central Malawi and Mangochi district in Southern Malawi. The other lakes in Malawi are smaller and they include Malombe, Chilwa, and Chiuta and are situated in the southern region of Malawi (IIED, 2004: 21). Shire River is the largest and longest in Malawi and it drains Lake Malawi through Malombe, another lake in the southern part of the county. It drifts across the largest part of the southern region of Malawi alongside an extension of the Rift Valley through Nsanje district before connecting the Zambezi River in eastern part of Mozambique. Shire River runs through Mangochi, Machinga, Neno, Blantyre, Chikwawa, and Nsanje district of Southern Region. The River is very beneficial to Malawi because of so many economic activities for communities around and along it and for the entire country. The Shire River provides resources for economic activities and these include water for irrigated agriculture; water for hydroelectric power generation of which 98% of Malawi's power is generated from the Shire; fishing activities; and water transport through canoes to some communities (Mulwafu et al, 2002).

The average elevation of the valley base or bottom is about 500 metres above sea level, and the remainder of the country, except the wetland/marsh hollow comprising lake Chilwa, increases sharply to hills/tablelands with an average of more than 1, 200 metres in elevation. In the north, Nyika plateau in the northern region spreads to a highest elevation of 2, 600 metres whereas Mulanje Mountain in the southern region is 3, 002 metres at the peak of Sapitwa of which it is the uppermost or tallest position. Zomba Mountain in the eastern part of southern Malawi, which is also part of Shire highlands is 2,500 metres at the highest point and it separates the Shire Valley from the Mulanje Mountain and the Chilwa depression. The map of Malawi below indicates

the geographical location of the country and its physical features such as lakes and main rivers.

Malawi has two major seasons, and these are the dry season which runs from the month of May to October every year, and the wet/rainy season that runs from November to April every year (GoM, 2014a). The district of Nsanje in the southern region was known as Port Herald during the colonial era reclines in the plains of Shire River and it has an average temperature of 21°C in the month of July, and an average of 29 °C in October but temperatures can go up to 45 degrees Celsius. Dedza district is in the central region of Malawi and lies at 1,632 metres above sea level in the uplands or plateau of the central region and has an average temperature of 14 °C in the month of July and an average temperature of 21 °C in October. In the northern region of Malawi, the Nyika plateau has an elevation of about 2,400 metres above sea level and frostiness and chills are ordinary and customary in the month of July.

Yearly precipitation is greatest across most areas of the northern uplands and the Sapitwa peak on Mount Mulanje which is always about 2,286 mm of rainfall and the lowermost is in the lower Shire which spans from 635mm to 889 mm. Rainfall in the country is influenced by the factors below:

- The Inter Tropical Convergence Zone (ITCZ). This is the main precipitation producing and influencing system from the month of November through April in a year.
- Congo Air Mass is a north-westerly humid air frame or crowd that creates widespread, reliable, and average to intense and torrential rainfall across the country.
- The wintertime Asian cloudburst brings rainfall from the month of November to February.

The temperate typhoon and hollows and dejections that arise in the Mozambican canal across the south-west Indian Ocean further influence rainfall in Malawi. For example, when the typhoon/hurricane stretches

inward from the channel, it leads to widespread and torrential precipitation across most parts and frequently brings about inundation or overflowing in certain areas of the country.

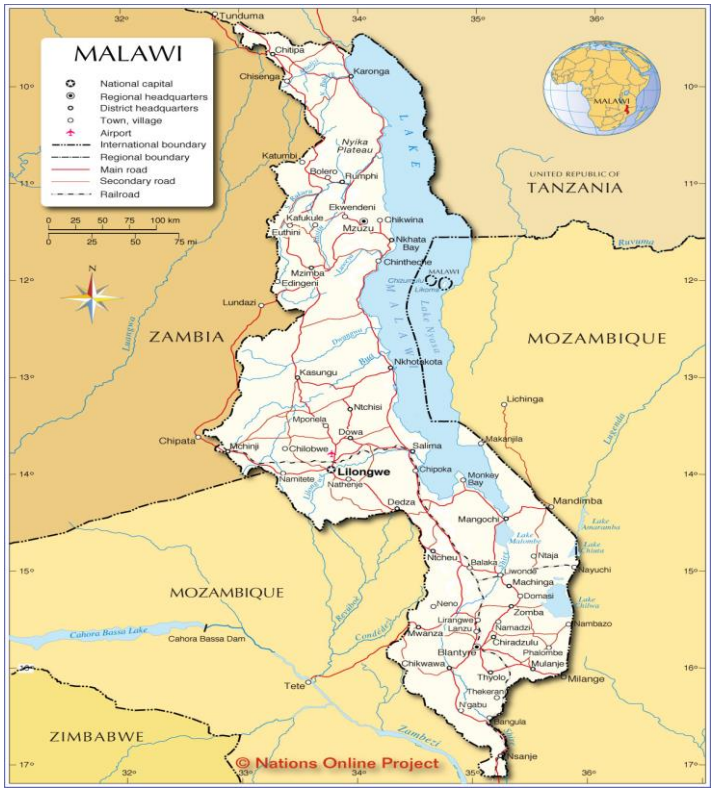

Figure 4.1: Geographical location of Malawi (GoM, 2015d:11)

4.1.2. Vegetation, precipitation distribution and endowment of resources

Malawi has various types of Vegetation and is composed of valuable deciduous forest apparels of the peak of Mount Mulanje, Zomba and Nyika plateaux, while the remainder of the moderate and tropical plateau zones shoulder diversified prairies and are densely forested in locations. The tropical savannah has always fewer trees in the squatter downward the slopes and across most of the southern region and more densely forested bush veldt located along Lake Malawi. The Shire Valley and the eastern slants of Zomba Mountain are outweighed by prickle shrubs, the hot and most dry. Dense forest and reed-beds dominate the Chilwa basin (Chiotha et al, 2013).

Throughout the summertime, rainy season from the month of October to April, the El Nino occurrence is known as a main element for defining rainfall trends in the country. It is a fact the El Nino influences the Inter Tropical Convergence Zone and CABS, the major rainfall-creating system in the region (World Bank, 2018a). La Nina brings about more precipitation that generally causes flooding in Malawi (Katharine et al, 2014). The winter rainfall is commonly relevant apart from on the upwind part of the uplands over which considerable precipitation is expected and obtained which helps crops i.e., wheat and rice particularly in the Northern and Sothern uplands.

Malawi is endowed with woodland reserves and capitals and they cover about 2.6 million hectares of land and 97% of this is covered by local and native plantations while 3 percent is covered with planted/exotic plantations. Additionally, there are exceptional and irreplaceable biodiversity types and bionetworks on Mount Mulanje with certain swamps alongside the Shire River catchment. The water resource is available in lake Malawi, lake Malombe, lake Chilwa, lake Chiuta and the Shire River and together they account for 20% of the nation's territorial area. The total land area appropriate and favourable for rainfed farming for the country is 31% only and 88% of the population are involved in rain fed agriculture (IIED, 2011a:13). The country has abundant biota (flora and fauna) resources, and this performs a key job in improving the social and economic well-being of the population, communities, and the country at large.

The aquaculture sector in Malawi contributes 4% to Gross Domestic Product and over 60% consumption of animal proteins. Aquaculture is one of the main economic activities done by inhabitants along and around the lakes and major rivers of Malawi.

The extractive or mining industry in Malawi is not yet fully exploited because of indecisive tendencies from the authorities. However, the country has various mineral deposits, and they include gold, graphite, coal, ilmenite, mica, monazite, bauxite, asbestos, corundum, and

uranium. An exploration exercise by the Malawi Government has shown that there are large bauxite deposits at Mount Mulanje, large monazite deposit at Kangamkunde in Neno District which is to the northern part of Blantyre and is about 74 kilometres from Blantyre. Large phosphate rock sediments are discovered at Tundulu, large deposits of gold in Ntcheu and Lilongwe, and large deposits of graphite in Lilongwe. The Mining industry is just being developed in the country after exploration activities were done to identify additional mineral deposits such as gold deposits and uranium in additional places. Paladin Africa Limited has been mining uranium in Malawi but stopped due to international market challenges. It is important to note that the mining or extractive industry in Malawi is becoming more formalised in Malawi. However, mining of various minerals is still mostly informal since most of the mining activities are done informally by communities around the areas where the mineral deposits are and are done illegally and unsustainably.

4.1.3. Socio-economic situation for Malawi

About 80% of Malawi's estimated 17.5 million people (National Statistical Office, 2018) dwell in remote parts and farming is the main basis of livelihood for above 80% of entire population of Malawi. Yearly growth value of Malawi's population is 3% and poverty levels are extensive and critical because about 60% of the country's populace lives under the poverty threshold (IMF, 2017b). Regarding poverty levels, Malawi has a 51.5% population on the national poverty line of US$1 per person per day against the global poverty line of US$1.90 (NSO, 2017b). In the 1990s, poverty levels were largely constant while poverty in urban areas escalated.

The country's population is one of the largest and rapidly growing population in the African continent. The fertility of both women and men is very high resulting in rapid population growth and on average, a household in Malawi has 4.4 members. The 18.5 million people was just an estimate as of the year 2016 (NSO, 2017a) but the official total population according to the recent 2018 Population Census is now at 17,500,000 (World Bank, 2018b). The last population census in Malawi

was done in 2008. Figure 4.2 below indicates population progression from the year 2008 to 2016**.**

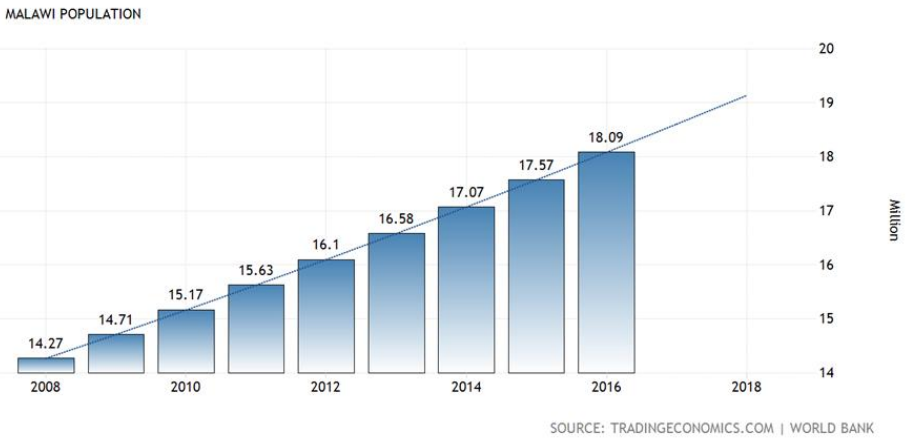

Figure 4.2: Estimated Population for Malawi (2008 – 2016), NSO, 2016:234

The Gini coefficient for Malawi is 0.45 (NSO, 2010) and Malawi is one of the countries with the higher income inequalities of distribution globally. In the same year 2010, South Africa and Botswana had higher Gini Coefficient of 0.65 higher than that of Malawi. Many societal and public indicators are on a lowest side if we compare with other countries in the African continent except South Sudan, Somalia, Eritrea, and Burundi which are worse than Malawi and this is because of continued poverty. It is indicated that out of three children only one completes 5 years of education and that less than 1% accomplishes a desired levels of education (literacy).

As of the year 2016, the lifespan in Malawi rose to 63.22 years. During that time, the lifespan for women was at 65.76 years and for men was at 60.58 years. The country ranked 162 out of 192 countries on lifespan. According to Malawi Demographic and Health Survey (NSO, 2016: 234 - 310) report, the under-five mortality is 63 per 1000 live births and malnutrition rate is 37.1% (NSO, 2017c). Generally, societal, and public indicators and statistics are more severe in remote places than in urban places. The female potency/fertility degree is 6.7, and this is on the

higher side. The maternal mortality rate stands at 439/100,000 live births (NSO, 2017c).

Malawi is divided into 3 managerial regions (South, Centre and North) with twenty-eight local authorities or administrative districts designated for the first time in November 2000. The southern region is the highly urbanised and heavily inhabited with 244 individuals/persons for every square kilometre as compared to a nation-wide mean of 186 individuals for every square kilometre. In terms of population density for major cities, Blantyre is highly populated with 3,328 persons per square kilometre followed by Zomba with 2,511 persons per square kilometre, then Lilongwe with 2,453 inhabitants per square kilometre and the lowest is Mzuzu with 1,516 people per square kilometre (NSO, 2018). The trends in the urban growth show a slow migration of people from remote areas to cities or within regions. The poor people in the country have the following significant features:

- Huge families with a mean of 4.4 members per household of family in remote areas, cities, and towns.
- A third of destitute families in the country are headed by females.
- The AIDS outbreak has brought a quickly increasing number of children without parents and adopted children (orphans) to approximate number of 470 000 that puts further requirements and stresses on the deprived and destitute families. The deteriorating societal/public and commercial situations of Malawi's populace made Malawi unable to accomplish the Millennium Development Goals (MDGs) by 2015. The prevalence of HIV/AIDS in the country is more acute than many other countries in the African continent and has affected all parts of Malawi (NSO, 2015a).

Malawi experienced acute food shortages in 2002 due to drought during the previous growing season, and the overall economic growth dropped to 1.5% in 2001 and it was 1.8% in 2002. As stated previously, in December 2002, yearly price increases of goods and services was at 7.5%. However, interest rates constantly remained astronomical at 30%.

In 1998-2000, the actual exchange rate was devalued by 40% and from January to October 2001 the exchange rate was devalued by 45%. The minimal exchange rate was devalued by 8% in November to October 2002 against the United States dollar because of very declining levels of liquefied coffers for the country. Since then, the currency has not been stable against the United State Dollar.

The sluggish growth of Malawi's economy is not due to its development plan, but a flop in execution of the plans, policy frameworks and strategic frameworks in detail. This led to reduction of economic returns and improvements because of the failure in reducing the threats of market involvement for the country's main economic drivers (World Bank, 2014b). The threats encountered by entrepreneurs, families, traders, and fiscal organisations in Malawi include the following:

- Volatile macroeconomic setting branded by increased prices of goods and services and high and unstable physical interest and exchange rates, that create unstable prices of inputs and outputs.
- Substantial and unstable public meddling or influence by government in essential marketing of some products like fertiliser and maize, and this has destabilised the growth of viable private sector and this need directed subvention.
- Feeble and undependable public amenities with sluggish and unfinished government attempts at refining the main cross-cutting services and functions. Agriculturalists are supported for subsistence farming of crops.
- Downsizing of manufacturing companies.
- Dealers or Traders assumed collusive conduct and started to depend on government deals for almost all their businesses/enterprises.
- Fiscal organisations capitalised their assets in government paper that has a low risk than slightly bankable credits or advances.

The county's agronomic functioning has been deprived of low and sluggish development in the recent years (Kakota et al, 2013). This led to a great adverse impact on the economic status as farming or

agricultural production contributes to approximately 90% of foreign exchange incomes, 64.1% of employment and adds to 28% of Gross Domestic Product. Due to the reduction of yields and tumbling prices, lucrativeness, and profitability for many of the crops has reduced alarmingly. This has disturbed both smallholder farmers who constitute 84% of farming community whose average landholding size is less than a hectare, and medium to large size estate owners or commercial farmers who cultivate cash crops that account for nearly 16% output for Malawi. In 1990s, the country faced a withdrawal by subsistence farmers from crops that are of low value, drought tolerant and low risk which included sweet potatoes, cassava, and burley tobacco. There has been a minimal expansion or growth into high worth/value crops i.e., groundnuts and beans and it is of late when many smallholder farmers are diversifying crops due to the anti-tobacco smoking lobby worldwide which is causing the reduction of tobacco production in the country (Saka et al, 2013: 111 – 146).

The feeble agricultural performances have been caused by elements or factors that form a high-risk environment for smallholder farmers (IMF, 2017) especially the following:

- Malawi's food security or food self-sufficiency does not help even in times of good and plenty harvests. For example, Malawi imported maize in seven of the last ten years.
- Agricultural extension services to all the farmers is weak, and not reliable.
- Arable land is mostly underutilised.
- Exorbitant fertiliser prices due to increased costs of transport and these costs are between 20% and 50% greater than in the nearby or bordering nations.
- The tobacco sub-sector contributes 60% of country's exports but it is suffering reduced yields and undependable markets because of the global anti-smoking lobby.

In Malawi, the formal manufacturing industry/sector is small and has managed to employ only about 5% of the country's five million plus labourers. The industry contributes nearly 13% of Gross Domestic Product. However, this has had no ability to offset for stumpy agricultural productivity.

4.2. DESCRIPTION OF THE STUDY DISTRICTS AND AREAS

The study was conducted in the four districts of Malawi selected across the three regions of Malawi. The districts include Chikwawa of the Lower Shire in the Southern Region, Zomba in the Eastern part of the Southern Region, Salima in Central Region, and Karonga in the Northern tip of Malawi. Generic themes of the districts' description have been clustered and consolidated to make them clear. Figure 4.3 below shows the geographical location of study districts.

Figure 4.3: Geographical location of study districts (GoM, 2015d:11)

4.2.1. Administrative structures, local politics, and demography in Chikwawa, Karonga, Salima, and Zomba Districts

All the District Councils in Malawi comprises an administrative body known as Council secretariat. It consists of elected representatives who are Ward Councillors and Members of Parliament (MPs). Additionally, Traditional Authorities (TAs) and representatives of special interest groups are ex-officio members of the Council in line with Section 5 of the Local Government Act No 42 of 1998. The Chairperson is elected from among the ward councillors and heads the council. The District

Commissioner (DC) is the head of the Council Secretariat. The DC is assigned to oversee all district service provisions and development execution irrespective of the sectors such as agriculture, education, health, public works among others. This makes sure that there is coordination and orderly planning and implementation of development actions in each district. This institutional arrangement offers for community liberties for policy dialogue participation through the Area Development Committee (ADC), Area Executive Committee (AEC) and Village Development Committee (VDC). The Directorate of Planning and Development harmonises all interventions in relation to development designing in executing the District Development Plans and sectoral plans and facilitates information sharing among local governance actors so that activities are not executed in a fragmented manner.

The Councils are mandated to devise and make decisions on governance and development for the local government area, support local democratic institutions and involvement, encourage socio-economic development through District Development Planning, mobilize resources within the local government area for governance and development, appoint, develop, promote, and discipline staff. The District Executive Committee (DEC) is a professional and advisory body of the Council and the committees under it, and it is responsible for the execution of all matters of the District Development Planning System.

The TAs act as overseers of customary land, gate keepers of traditions and culture and supervise development within their jurisdiction, settling disputes for making peace. The TAs and Group Village Headmen supervise the roles of the Village Development Committees (VDCs) and ADCs in their separate area of authority, but the committees are led by ordinary individuals. The committees indicated above are described below:

- **District Executive Committee (DEC):** This consists of all Heads of Departments and Non-Governmental Organisations (NGOs) in the

districts executing its role as the technical advice-giving body to the Council.

- **Area Development Committee (ADCs):** This is a representative of all VDCs within a Traditional Authority and has ten to fifteen members chaired by an elected member and overseen by a chief of the area. The ADCs are mandated to mobilise community resources and they determine development actions in their area.

- **Area Executive Committees (AECs):** Extension facilitators of government departments and NGOs working in Traditional Areas constitutes the Area Executive Committees. It is the professional branch at the area level accountable to ADCs by providing advice on all local development matters.

- **Village Development Committees (VDCs):** This is a representative institution from a group of villages charged with a responsibility of identifying requirements and expediting designing and development in the local community.

Practically, all departments have offices at the district level implementing their corresponding obligations and functions. All activities of departments are directed via the District Executive Committee (DEC) with the District Commissioner coordinating and overseeing the activities.

According to National Statistical Office (NSO) 2018 Population Census, Chikwawa District has a total population of 564,684 (276,890 males and 287,794 females) with a population density of 116 people per square kilometre. The district has 127,198 households with an average household size of 4.4. Chikwawa District has 11 Traditional Authorities namely Chapananga, Kasisi, Katunga, Lundu, Makhuwila, Masache, Maseya, Mulilima, Ndakwera, Ngabu and Ngowe making 11 Area Development Committees.

In 2018, Karonga District had an estimated total population of 365,028 (176,197 males and 188,831 females) with a population density of 107 people per square kilometre. Karonga has five Traditional Authorities,

and they include Kilipula, Mwakaboko, Kungu, Wansambo and Mwirang'ombe. The District has a total of 74,953 households with an average household size of 4.9 (National Statistical Office, 2018).

Salima District has ten Traditional Authorities namely Msosa, Mwanza, Kalonga, Kuluunda, Pemba, Kambwiri, Maganga, Ndindi, Khombedza and Kambalame making 10 Area Development Committees (ADCs). The district has an estimated population of 478,346 (231,930 males and 246,416 females) with a population density of 222. The District has 105,558 households with an average household size of 4.5 (NSO, 2018:16).

Zomba District has 7 Traditional Authorities, and they include Kuntumanji, Malemia, Mkumbira, Mwambo, Chikowi, Mlumbe and M'biza, and four Sub-Traditional Authorities (STAs) namely, Ngwelero, Nkagula, Ntholowa and Nkapita making eleven ADCs in relation to number of TAs. The District has a total population of 746,724 (356,718 males and 390,006 females) with a population density of 316 per square kilometre. The District has 177,679 household with an average household size of 4.2. The district is one of the five most heavily populated in Malawi because of fertile soils, water availability, and the favourable landscape and climate (NSO, 2018:17-21).

4.2.2. Land tenure and land use systems in Chikwawa, Karonga, Salima and Zomba

Generally, the land tenure systems and land use systems are the same across all the districts in Malawi, and the only difference is the extent of usage in each district. The four types of land tenure that exist in Malawi and the four districts (NSO, 2018) under discussion are described below:

Customary Land

Customary land is all land falling within the territory of a known and established Traditional Authority, which has been given to a person or group and utilised under Customary Law. The chiefs have the obligation to allocate land to their subordinates/followers and resolve land disputes.

If any Traditional Chief fails to handle complex land issues, it is transferred to the Office of the District Commissioner. This land is possessed and regulated by Chiefs in trust. They comprise arable dry land, cultivated land, and arable wet land. The primary purpose of this land is for settlement and agricultural activities for the population.

Government Land

This is the type of land obtained and privately possessed by the government and devoted to a particular national use or made available for private utilisation at the preference of the government. Such land is kept for and inhabited by government buildings, schools, hospitals, markets, and other government infrastructure.

Public Land

Public Land is all land possessed in trust and controlled by government or Traditional Authority and candidly utilised or accessible to the community at large. They include escarpments, National Parks, Elephant Marshes, Ranches, Wildlife Reserves, Forest Reserves, and Conserved Land. The major purpose of this land is for preservation of natural resources and wildlife. Additionally, it can be accessible to individuals for housing uses and ecotourism.

Private Land

This is land formally customary land but is wholly possessed, held, or occupied freehold and/or customary land. It entails that land has been allotted completely to a clearly defined community, corporation, institution, clan, family, or individuals. Land under this group comprise private estates and individual farms. They comprise Cattle Ranches, and Leasehold Estates. Private land is used for building of houses and hotels, business uses and small-scale farming for large scale agricultural and industrial purpose. The land is normally under leasehold for 99 years.

4.2.3 Physical description, location, geology, and hydrology for the study districts

Chikwawa District

Chikwawa District is situated in the Southern part of Malawi. It is shares boundaries with four districts, namely, Mwanza to the North, Blantyre to the North East, Thyolo to the East, Nsanje to the South and it also shares an international boundary with Mozambique to the West. The District Headquarters is about 54 kilometres from the city of Blantyre. The district's total area is 4,755 square kilometres and is approximately 15% of southern region area and 5.04% of the country (Chikwawa District Council, 2018). As regards to agriculture, the total land area is 471, 957 hectares and out of this, 20, 118 hectares is dry arable land, and 29,962 hectares is wet arable land. Big estates cover 19,000 hectares while 211, 788 hectares is public land.

Cellar composite rocks of pre-cambrian period, comprising greisses and granulite underlie majority of the hills and uplands of the district. Alluvial rocks of the Karoo system (pebbles, granites, mudstones, and shales) and Mesozoic basalts are located in the highlands of Shire Valley to the Western side, and this is the area that constitutes a fraction of the Great African Rift Valley (Chikwawa District Council, 2011).

Karonga District

Karonga District is situated in the Northern part of Malawi and it shares boundaries with Chitipa District to the West, Rumphi District to the south, and Tanzania to the north and east. The Headquarters of Karonga is located at approximately 50 km south of Tanzanian Border, 226 km north of Mzuzu City, and 585 km north of the capital city, Lilongwe. The district's total land area is 3355 square kilometres representing 3.5% of Malawi's total area of 94276 square kilometres. Karonga is the fifth biggest district in the northern region and is twelfth nationally in relation to total area (Karonga District Council, 2012).

A widespread diversity of various rocks and deposits are discovered in Karonga District. Most of the district is covered by metamorphic rocks of sedimentary and igneous bases recognised together as the Malawi Basement Complex (GoM, 2010a). Many of plentiful rocks are foliated biotite and hornblende, and quartzite create strips within the gneiss in the district. Four major kinds of minerals are prevalent in the district and are Uranium at Kayerekera, about 40 kilometres directly west of the district headquarters along Karonga-Chitipa road; Coal at the Karekera and at Mwaulambo about 20 kilometres north of the headquarters; Lime at Hara in Chilumba area, 70 kilometres south of Karonga, and Mpata area, 16 kilometres alongside the same Karonga-Chitipa road; and Beach sands at Chifyo and in Chilumba zones (Karonga District Council, 2013a).

Karonga town is emptied by a system of natural and artificial drainage channels. The natural channels consist of rivers, streams, and brooks while the artificial channels comprise three big storm channels and tertially gutters and culverts (Karonga District Council, 2013b). There are five main rivers and streams that flow west-east of the planning zone and pouring into Lake Malawi to the east of the district. These rivers are the North Rukuru, Mwangwawila, Phapa, Mpasa and Luwasha streams. Karonga town is susceptible to floods because it is enclosed by these rivers and the Lake Malawi.

Salima District

Salima District is situated in the Central Region of Malawi approximately 103 kilometers eastern part of Lilongwe, the capital city of Malawi. Salima District borders with Dedza to the south, Lilongwe to the west, Dowa to the South west and Nkhotakota to the north while Lake Malawi covers the whole eastern part of the district (Salima District Council, 2011:11). The total land area of the district is 2,196 square kilometers and is equivalent to 219,600 Hectares.

There are certain differences in landform and elevation for the district. The landform varies from the rift valley floor, specifically along the Lake, to mountainous areas as in Traditional Authority Mwanza, northwest of Salima. The rift valley floor has an elevation that varies from 200 to 500 metres above sea level while the highland area has an elevation scale of 500 to 1000 metres above sea level (Salima District Council, 2011a:26). The main rivers in Salima include: Linthipe, Lipimbi, Lilongwe, Lifidzi, Liwadzi, Ngodzi, Chiluwa, Dwele and Chitala.

Zomba District

Zomba District Council is situated in the South-eastern part of the Southern Region of Malawi. It has a total area of 2,580 square kilometres and is 3% of Malawi's total area. It is 296 km from the capital Lilongwe, and 60 km from Blantyre. The District is surrounded by Lake Chilwa to the East, Liwonde Forest Reserve in the Northern part, Namadzi river marks the southern boundary of the District and the Shire Valley to the Western side. The three main features of the District are Lake Chilwa, Shire valley and Zomba Plateau (Zomba District Council, 2017:6).

It shares boundaries with Phalombe and Mulanje Districts to the South, Chiradzulu District to the South-West, Balaka District to the North West, and Machinga District to the North. The District is split into 7 Traditional Authorities (TAs) and they include Mlumbe, Mwambo, Chikowi, Kuntumanji, Malemia, Mkumbira, Mbiza and one Sub-Traditional Authority (STA) Ngwelero (Zomba District Council, 2017:8).

Geologically, the district consists of metamorphic rocks that are drawn from sedimentary and igneous rocks of Precambrian origin. The zones encompass Gemstones that exist in Mpyupyu Mountain and Zomba Plateau, sand appropriate for glass making, and mineral limestone is extracted by Zomba residents on economic basis. The Lake Chilwa area is largely typified by rocky and sandy solid soil that is stratified. The district has some minerals, but they are not yet completely utilised. Nonetheless, only sand, and crude stones are mined for income.

Gemstones exist in Traditional Authority Mulumbe along the Zomba-Malosa Mountain to the Western Part (Zomba District Council, 2017:12).

The District has rivers that act as sources of water for different purposes. The main rivers include Likwenu, Phalombe, Lintipe, Namadzi, Naisi, Mulunguzi, Thondwe, Domasi, Likangala and Shire. All the rivers excluding the Shire and Phalombe begin from Zomba Plateau. The Shire River begin from Lake Malawi while Phalombe River begin from the Mulanje Mountain. All these rivers form the Lake Chilwa catchment which is the only inland drainage lake in Zomba District. It is situated approximately 25 kilometres east of Zomba city.

4.2.4 Geography, climate, and climate change

Chikwawa District

Chikwawa District reclines alongside the lower plane sink of Shire River, which is alongside the Great African Rift Valley typified by wanders or bends. The Thyolo/Chikwawa escarpment reclines in the eastern part of the district and forms the main source of majority of significant and valuable rivers such as Chidzimi, Nyamikalango, Likhubula, Mwanza, Mkombezi, Limphangwi, Nkhate, Livunzu, Nkudzi, Mwamphanzi and Maperera.

A widespread diversity of soils has developed in Chikwawa District that differs from zone to zone based on various kinds of deposits and rocks. The soils are deep-seated, medium to subtle textured, the colour ranges from brown to very dark grey. The soil has a drainage, that differs from high-quality to very poor. Soils in the highlands and hills are primarily reasonably deep, medium textured, well-drained and yellowish brown (FAO, 2010: 10-15). Alkaline and marginally salty soils appear at the bank of swamps, otherwise soils have a marginally acidic to neutral effect. The neutral condition of largely cultivatable soils is low widespread deficits of nitrogen and phosphorous (Chikwawa District Council, 2011).

Chikwawa faces tropical climate and cascades into dry and wet seasons. The wet season commences in November/December and finishes in April/May while the dry season happens from May to October. Temperatures are usually astronomical with a highest of nearly 37.6°C commonly experienced in November and a lowest of 27.6°C in July annually while the mean temperatures are generally over 20°C. Chikwawa District experiences typical undependable and erratic precipitation varying from around 967.6 mm to 170 mm highest and lowest precipitation correspondingly, possibly since it sits on the leeward side of Shire Highlands (Chikwawa District Meteorological Office, 2013). The geography of Chikwawa makes the district a rain shadow area hence rainfall is not oftentimes adequate. In this regard, Chikwawa is prone to climate change and people in the district have been negatively impacted. The district faces climatic challenges such as droughts, floods, waterborne diseases, hailstorms among other challenges (FAO, 2010: 10-15).

Karonga District

The altitude of the district varies from 400 m at the lake coast to 2400 m at the high Nyika Plateau. It is primarily mountainous, specifically west of lake Malawi and most exceptional land types can be alienated into three zones namely:

- **High hills and plateau zones**: This spreads from 100 m to 2000 m above sea level and is typified mainly by the Nyika Plateau. Nyika Plateau is the main supply of the river system in the district and the vital rivers are the Songwe bordering Tanzania and Malawi, Lifilya, North Rukuru, and Chitimba bordering Karonga, and Rumphi Districts and all these rivers run throughout the year. The zone is seceded by the Rift Valley escarpment slopes.

- **Rift Valley escarpment zone:** This zone commences from approximately 600 m above sea level, and it is typified by hills with reasonable to sharp slopes ascending above the Lakeshore plain. The deep-rooted valleys have been cut through the Escarpment zone

by a few rivers that run towards the lake. Karonga District reclines on the Great Rift Valley fault line, making it exposed to earthquakes. Karonga experienced a 6.0 magnitude earthquake along this fault on the 19th of December 2009 (GoM, 2010a).

- **Lakeshore plain zone:** This is moderately flat zone that covers an area of an elevation of between 500 m to approximately 600 m above sea level. The area comprises mainly alluvial plains, valley flood plains and marshes that spread from 4 km to around 20 km wide.

The low-lying areas in the district that are generally exposed to floods are also typified with fertile alluvial soils (GoM, 2010b).

Karonga has a sub-tropical climate with two distinctive seasons, rainy/wet (November to May) and dry (June to October). The average annual temperature of 24°C and the warmest months are October and November, while cooler temperatures can be felt in June and July. The months of October and November bring about north-easterly winds to the district, while winds are south-easterly in April through September. Karonga District faces warm temperatures with average lowest temperatures ranging from 17°C to 23°C and happen between June and July. Average highest temperatures vary from 27°C to 33°C and are recorded between October and November (Karonga District Meteorological Office, 2013). The district being seated on a rift valley is becoming more susceptible to climate change hence leading to climate related disasters in the past years.

Salima District

Salima District has a hot tropical climate with average yearly temperature of 22°C. The maximum temperatures are encountered in October getting to 33°C whilst the minimum temperatures are encountered between May and July getting to 12°C. The district has 3 seasons all the year round and these are: Hot dry season (August- October), Hot wet season (November- April), and Cool dry season (May- July).

The district is presently encountering problems that are clearly connected to climate change. A few areas get flooded annually and this has been credited to climate change due to intense rainfall in a short period of time. In some places like Chipoka, there are lengthy agricultural droughts and these result in reduced crop yields and food self-insufficiency.

Zomba District

The district has a rolling landscape with mountains and valleys. Many rivers originate from Zomba Plateau which forms the ridge splitting the Upper Shire Valley in the western part of the district, to the broad flat plains of Lake Chilwa on the east. The district's elevation changes from 2085 metres above sea level on Zomba Plateau to 627 metres above sea level at Lake Chilwa. The varied topographic features affect a diversity of climatic conditions from cold to warm and rainy to dry weathers in various locations.

Zomba faces a tropical climate with three main seasons such as cold-dry, hot-dry, and hot-wet experienced from April to July, August to October and November to March correspondingly. The warmest months are September, October, and November, with mean temperatures varying between 28°C and 30°C. June and July are the coldest months, with mean temperatures as low as 10°C. The yearly rainfall differs between 600 mm and 1500 mm. On average, February is the wettest month. More rainfall tends to fall on the windward side to the east of Zomba Plateau while areas on the leeward side to the west experience less rainfall throughout the year. Climate change has been revealing itself in Zomba in the form of disasters such as floods, dry spells, droughts, cyclones, heavy rains, hailstorms, and thunderstorms.

4.2.5 The people, language, and culture of study districts

The people, language, and culture of the inhabitants of the districts is described in this section because they affect resilience levels of the community. For example, the people themselves are part of systems

thinking that support planning and implementation of climate resilience interventions. Language is very useful in disseminating information and communicating what is required to be done. Culture also affects resilience of a society because some beliefs derail adaptation efforts. For example, The Yao culture in Zomba and Salima doesn't allow people to rear pigs for meat and income. This means one of the resilient interventions is missed in this culture or society.

Chikwawa District

Two major ethnic groups are present in Chikwawa and they are Sena and Mang'anja. The smaller ethnic groups include the Ngonis and Nyungwes that are commonly found in the northern part of Chapananga zone. The main languages spoken in the district are Chichewa, Chisena and Chinyanja and are spoken by almost all the inhabitants and the rest speak other different languages (Chikwawa District Council, 2006).

The people of the District trail patrilineal system of marriage and in this system, women live at their husband's home and dowry is paid to the parents of the girl/woman. The minority practice matrilineal system of marriage, which is predominant in the North of Chikwawa, and no dowry is paid. Chieftaincy is transferred from one generation to another within the family of the same loyal clan of the patriarchy system of marriage where chieftaincy is passed through male lineage. Matriarchy system chieftaincy is passed through the female lineage (Chikwawa District Council, 2011).

Karonga District

The people of Karonga District mostly fall into two different ethnic groups and these are the Ngonde and the Tumbuka. The main languages spoken are Chitumbuka and Kyangonde. The main religious groups in the district are Christianity (95.5%) and Islam (2%) (NSO, 2008).

The cultural beliefs in Karonga are established in several ways such as traditions and values, performing arts, language and literary arts, visual arts and handcrafts, and indigenous knowledge. For example, many

people in Karonga follow patrilineal system of marriage where a husband pays a dowry (lobola) to the parents of a girl/woman. Heritage of deceased estates and progression to traditional leadership positions usually follow male lineage. Indigenous foods of Karonga are imbalagha (meat or fish boiled with bananas), susa (beef snack) and chambiko (curdled milk). People believe in ancestral spirits and funerals are highly valued. Community members provides money and food. Among the Ngonde, for some funerals, the mourning period may last as long as a full month, and burial of chiefs takes place during the night. Cultural initiatives are profound in Karonga such as traditional dances, drama, and drum-performance. During happy times, people drink traditional beers and engage in traditional dances like malipenga, indigala, ifibwenga and ndolo (Karonga District Council, 2013a).

Salima District

Chewa and Yao are the main tribes in Salima, nevertheless, four other small ethnic groups do exist and include Nyanja, Ngoni, Tumbuka and Tonga. The Yao and the Tonga generally live along Lake Malawi whilst the remaining tribes live extreme inside.

Chichewa and Chiyao are the two main languages spoken in the District. About 86% of the people in Salima speak Chichewa, 10% speak Chiyao, while 2% speak Chinyanja (NSO, 2008). Very few people speak Chitumbuka, Chilomwe, Chinkhonde, Chingoni, Chisena, Chitonga, Chilambya, Chisenga, English, and Portuguese.

Christianity and Islam are the two main religious groups in the District. Nonetheless, most people, irrespective of their religion, still embrace solid beliefs in witchcraft and ancestral spiritual dance locally recognized as *Gule wa Mkulu* which is a traditional dance that is also regarded as religion among the Chewa tribe (NSO, 2018).

Patrilineal and Matrilineal kinds of marriages do exist in Salima District. In the patrilineal system, the woman inhabits at the man's home which is commonly known as *Chitengwa*. In this system, the man pays bridal

fees to the bride's parents as a demonstration of appreciation. In a matrilineal marriage, commonly known as *Chikamwini*, the man inhabits at the woman's home (NSO, 2013). Polygamy is also generally common in the district. Other cultural practices are traditional dances and initiation ceremonies. The prominent initiation ceremonies are *Chikule, Jando, Msondo, Chisamba* and *Gulewamkulu* (Salima District Council, 2011b).

Zomba District

The district is composed of various tribes, cultures, and languages. The dominant ethnic groups are Mang'anja, Yao and Lomwe. There are also the Chewa, Ngoni, Tumbuka and many other minor ethnic groups. Yaos are largely found in the Traditional Authorities Mlumbe, Malemia and Kuntumanji and STA Nkagula. Mang'anja and Lhomwes, on the other hand, are mainly in the areas of TAs Chikowi, Mwambo and Mkumbira.

The main languages for communication in the households are Chinyanja and Chiyao. The other languages include Chilomwe and English depending on the level of education accomplished.

Marriage practice in Zomba is mostly matrilineal, where the husband moves to the wife's house/village. Chieftaincy is transferred from one generation to another with the successor being a nephew or niece customarily coming from one of the deceased chief's sister. Children undergo initiation ceremonies at adolescence known as Jando, Chidototo or Lupanda for boys and Nsondo or Zoma for girls. Such ceremonies cover subjects on morals, adulthood, norms, traditions, and marriage. A diversity of traditional dances is still performed during such initiation ceremonies in the district. Generally, the celebration of cultural ceremonies has been gradually reduced by civilisation and transformation as many people access western countries and cultures (Zomba District Council, 2009).

4.2.6. Environment and natural resources in the study districts

Environment and Natural resources are vital in enhancing climate resilience of communities in respective localities. This is because they are key in providing the needed resources for improving peoples' resilient livelihoods.

Chikwawa District

Chikwawa District experiences a lot of environmental challenges. There are many factors leading to the aggravating environmental condition in the district and they include lack of environmental understanding, weak environmental information system, deficient organisational assistance to environmental management, and weak environmental law.

Accordingly, there is declining forest cover because of energy demand (firewood and charcoal), opening of new gardens and settlements, brick making, rivers drying up which is a direct result of human actions, cultivation along riverbanks, uncontrolled bushfires, curio, and timber making, grazing, and cutting down of trees along river sources. There has also been damage of biodiversity, for example, extinction of some fish, wildlife and tree species because of habitat damage, and poaching (GoM, 2010c).

Approximately 12% of households in remote areas disposes their waste in refuse pits, the remaining 88% utilise the most common ways of refuse disposal like ground crude dumping followed by open ground burning. Wastewater management is a challenge in Chikwawa since there are no suitable locations for disposing wastewater emptied from septic tanks.

Karonga District

The Environmental District Office has a responsibility of coordinating, sensitising, and enforcing programmes for accomplishing environmental conservation. The main environmental challenges in Karonga are deforestation, flooding, droughts, poor drainage system, informal mining activities, overfishing, human and animal conflict, and poor waste management (Karonga District Environmental Office, 2012).

The district has eight forest reserves covering 867.46 square kilometres of the district total land mass and out of these, three of them are gazetted while the rest are recommended forest reserves. The greatest frequently found wildlife species are bushbucks, wild pigs, hare, and snakes. The reserves also offer a potential bee keeping area for the surrounding population. The largest source of fresh water in Karonga is Lake Malawi, and this is fed from rivers and rainfall/precipitation. The other main water sources in the district are Wovwe, Songwe and South Rukuru rivers and Mlare and Chiwondo lagoons. All these water sources in the district are habitation for marine life and are also utilised for transportation, irrigated agriculture, washing and drinking. Karonga District has two hot springs situated at Mkungwe and Ngara.

Salima District

The district has diverse natural resources of economic and cultural significance. The picturesque Lake Malawi, river valleys and plains, attractive islands, and a diversity of native and exotic types create a rich foundation of natural resources. The major environmental challenges in the district are deforestation, depletion of fish, depletion of soil fertility, uncontrolled artisanal mining (quarry stone and sand mining), poor waste management, climate change, and poaching. Both public and private sectors execute local energies to decrease the degradation of the natural resources and the environment.

There are four Forest Reserves in Salima District and are Dedza/Salima Escarpment (320 km^2), Thuma (197 km^2), Senga Hills (1252.39 hectares), and Maleri Forest Reserve (333,221 hectares). Many of these reserves are filled with Miombo woodlands which are habitats to buffaloes and elephants particularly the Thuma Forest Reserve (Salima District Environmental Office, 2011:27). Other games include greater kudu, bushbuck, Sharpe's grysbok, common duiker, klipspringer, baboon, Vervet monkey, leopard, spotted hyena, genet, African civet, honey badger, warthog, bush pig, and porcupine.

Lake Malawi as the largest water source in Malawi, forms the eastern boundary of the district, covering an area of about 1218.13 km². The lake spans 84 km from Traditional Authority Msosa in the north to Traditional Authority Kambalame in the south. Lake Malawi is a freshwater source which entails that it is a good source of water for irrigated agriculture, drinking, fishing among other uses. It is a home to a wide diversity of fish species and other aquatic organisms such as hippopotami, crocodiles, turtles, snails, and other numerous aquatic floras. The district also has numerous rivers and streams especially Linthipe, Lingadzi, Ngodzi, Liwadzi, Lifidzi, Lipimbi, Lilongwe, Dwele, Chiluwa, Lungumadzi and Chitala

There are also significant wetlands in the district with Mpatsanjoka being the highly vital and biggest. Mpatsanjoka Dambo runs from T/A Kuluunda in the north to T/A Maganga in the eastern side of the district, about 4 km from the lake. The seasonally marshy Mpatsanjoka River runs in a curve north of Senga Hill, before pouring into Lake Malawi approximately 25km north of Senga Bay. The area is a habitat of a small populace of hippos, crocodiles, and water monitors (prolific birds' population such as hornbills, kingfishers, weavers, finches, among others). It is also utilised by local people for grazing their livestock.

Solid wastes from Salima Town are collected using a tractor and at times an open seven tonne truck and disposed of at a site that is utilised as a gravel and quarry stone excavation site. The site is off Salima Lakeshore Road along the Ng'ombe Hill, approximately 5 km from Salima Town. The wastes are not classified because of inadequate proper waste collection facilities. Whilst the organic and biodegradable wastes would assist in reclaiming the land at the excavation site, the plastics and the metals disrupt this plan.

Zomba District

Zomba District has one forest reserve called the Zomba/Malosa Forest Reserve with a total area of 8,599 hectares. The reserve is situated in Chingale and Malosa Extension Planning Areas. Forest cover is good in

Chingale unlike in Malosa where forests have diminished because of increase in unlawful forest activities like charcoal burning, encroachment and bush fires. Most trees found in Malosa side are regenerants and the species found in the reserve are commonly indigenous which grow slowly. When completely developed they provide enormous economic returns because of their volume and value. They comprise Khaya anthotheca, Pterocarpus angolensins, Brachystegia species among others.

Aquatic species are dominant in Lake Chilwa, a RAMSAR site (this Wetland is of international importance and was designated as the sole RAMSAR Site (No.869) on 1st November 1997) with diversity of species and in all rivers in Zomba including the small artificial lake/reservoir on Zomba Plateau, the Mulunguzi Dam (Zomba District Council, 2017: 40-45)**.** The rivers create part of the Lake Chilwa catchment area which is used for water transport, irrigation farming, bird hunting and fishing for many inhabitants including the nearby districts and parts of Mozambique. Projections show that approximately 20% of the fish in Malawi come from the Lake Chilwa. The Lake has the history of drying up as was the case in 2012 and 2014 and this adversely impacted livelihoods for the people. Sadly, the lake also dried up in 2018. The Lake and its associated wetland support about 164 bird species, 43 of which are Palaearctic migrant species and 14 are intra-African migrant species. Lake Chilwa wetland has three major vegetation characteristics namely grasslands, swamps, and marshes.

On waste management, over the years, Zomba City Council refuse collection crew has been collecting refuse from residents and institutions in the City and disposing them crudely in the jurisdiction of Zomba District Council along the Zomba-Blantyre road at 4 miles close to a Police roadblock. This is a concern that has been left unattended to for a long time and requires remedy as the tradition calls deals and cost sharing on the environmental concerns that originate from the site and distress the local residents in the neighbourhood of the dumpsite.

Zomba has a rich biodiversity that includes vertebrates, invertebrates, fungi, microorganisms, and plants. The diversity of these is influenced by the topography, soil, and climatic conditions of the district. The biodiversity in the district is encountering numerous threats. These threats include unplanned development; unsustainable utilisation of natural resources, pollution, brick burning, bush fires, cultivation along riverbanks, rapid population growth, invasive alien species, climate change and high poverty levels.

4.2.7. Economic activities of Chikwawa, Karonga, Salima and Zomba

Economic activities offer opportunities to any household in the community to improve availability of food and income. These support the households in having access to basic necessities for their well-being. Food self-sufficiency and increased household income help in enhancing household and community resilience hence household economic security. The economic activities of Chikwawa, Karonga, Salima and Zomba are discussed in detail below.

Agriculture production (farming)

Farming is one of the key economic activities in all the four districts of study (Karonga, Salima, Chikwawa, and Zomba) for peoples' livelihoods. A number of crops are grown mostly at subsistence level and these are maize, rice, millet, sorghum, groundnuts, cassava, tobacco, sorghum, soya, and ground beans. Some crops are not grown in all the districts such as sunflower (Karonga and Nsanje), sesame (Karonga), cotton (Karonga, Salima and Nsanje) and soya (Karonga, Salima and Zomba). Main cash crops for these districts include tobacco, groundnuts, cotton and rice, the rest are predominantly used as staple foods. In terms of livestock, all the districts have farmers who keep different classes of livestock but the common ones across the districts include sheep, goats, cattle, poultry, rabbits, pigs, guinea fowls, ducks, pigeons, and turkey. Livestock production is a source of food, income, manure, and to a

restricted degree draught power particularly in Chikwawa and Karonga Districts (GoM, 2018).

Chikwawa District has a total of 126,201 farming households which consist of 65% and 35% male headed and female headed households respectively (Chikwawa District Council, 2012). There are six Extension Planning Areas (EPAs) and 124 sections, and these EPAs are Mitole, Mbewe, Mikalango, Livunzu, Dolo, and Kalambo. More than 80% of the population are farmers with an average land holding size of arable land of 0.8 hectare per farming household, and 55% of the households have land-holding sizes of less than 1 hectare (Chikwawa District Agriculture Development Office, 2013:36).

The district has a high possibility for irrigation development because of the presence of perennial rivers like the Shire, Mwanza, Mkombezi, Nyakamba, Nkudzi, Livunzu, Limphangwi among others and other small ones and water sources that give free-flowing water all year round. The total area that is potential for irrigated agriculture is 38,000 hectares. The area that is currently under irrigation using these technologies is 2223 hectares supporting 10,979 households (Chikwawa District Agriculture Development Office, 2013:63). Irrigation development in Chikwawa District is facing some challenges and they include insufficient funding, farmers' poor water resource management, deficient agricultural inputs (fertilizer, seed, and pesticides), insufficient resources for maintenance of existing irrigation schemes, and water scarcity.

Karonga District has a total of 334,810 hectares and out of this, 67,100 hectares is arable land favourable for growing crops and it represents 20% of the total land area (Karonga District Agriculture Development Office, 2013). This area is under subsistence agriculture since there are no recorded estates in Karonga. The district is apportioned into six Extension Planning Areas (EPA) that generally cover the boundaries of a Traditional Authority. The district has not entirely used water from Lake Malawi which is on the whole eastern boundary of the district because of underdeveloped irrigation systems. The potential area for irrigation

farming is 12,000 hectares but only 1,543.7 hectares is irrigated benefiting 6,245 farming households representing 12.9% of the potential irrigable area. Agriculture is the main source of food and income for the district hence largely contributing to the district's economy.

Salima District has seven Extension Planning Areas (EPAs) and these are Chipoka, Tembwe, Makande, Chinguluwe, Katelera, Matenje and Chiluwa with 99,729 farm families farming on a total of 107,377 hectares (Salima District Agriculture Development Office, 2011: 4-8). Irrigation is practiced in the district but at a very low rate otherwise most farmers depend on rainfed agriculture.

The agriculture sector in Salima District is functioning with full of problems and constraints and these include unfavorable weather situations in some seasons, land degradation and deforestation resulting in low agricultural productivity, poor coordination between various players in the agriculture sector, and poor prices of agriculture produce.

Zomba District has nine Extension Planning Areas (EPAs) namely Malosa, Nsondole, Thondwe, Chingale, Masaula, Dzaone, Likangala, Mpokwa and Ngwelero and these add up to 241,000 households. Zomba District has a potential area for irrigated agriculture of 60,000 hectares of which 1,602.5 hectares are under development with 15,696 beneficiaries under smallholder farmers and 915.5 hectares under private estates (Zomba District Agriculture Development Office, 2015:28). The district has a total area of 187,731 hectares of which 159,906 hectares is arable land and 27825 hectares is non-arable land. The economy of Zomba District is subjugated by agriculture where smallholder maize production accounts for the major activity while tobacco is grown as the major cash crop.

Fish farming

Fish farming and/or aquaculture is another economic activity that is done by the people of the four study districts and is done in two ways. First is rearing the fish in fishponds and periodically harvest them for income and food (nutrition). Second is the breeding and catches in the natural

water bodies like rivers and lakes. The fish catches from natural waters (Lake Malawi, the Shire River, and other rivers) are mostly dominated by cichlids, cyprinids and clarids (GoM, 2016d). The fisheries industry offers employment opportunities for the people in the study district hence increased income.

Chikwawa District depends on the Shire River and other perennial rivers for fish production and the fishponds that are constructed for aquaculture. There are more than 35 fishponds across the district and the farmers are able to supplement to the fish catches from natural waters. The fish wedge/catch drift indicates a swift reduction in wedges from 1700 tonnes in the year 2008 to 127.8 tonnes in 2015 from the natural water bodies of Chikwawa District (Chikwawa District Fisheries Office, 2015: 13). The fisheries sector encounters problems that endanger the sustainability of fish and these are high population growth and demand for fish, inability to abide by regulations for fish management, among others. Fish is the utmost general and inexpensive source of animal protein in the district and contributes more than 60% of animal protein supply.

Karonga District is along the shores of Lake Malawi, the biggest fish habitat in the country. Fishing related activities are carried out by 5000 people and the small-scale fishing which dominates the fishing occupations and contributes to 60% of animal protein for the Karonga population. The general catches of fish in Karonga are Engraulicypris saedella, copadichromis, Clarias galipinus, Haplochromis, and Burgrus merideonalis. The catches have been changing from 4,780.81 metric tonnes to 6,195.62 tonnes in 2016 and the peak was 2010 and this is because of increased fish production (Karonga District Fisheries Office, 2012:8). The general fish production in the district is complemented by yields from fish farms and ponds. A total of 41 fishponds are used for aquaculture activities in the district. The fisheries sector in the district is facing challenges such as increased climate change affecting fish production, use of unrecommended fishing gear by fishermen, among others.

In Salima District, many subsistence farmers keep their fish in earthen ponds and this kind of income generating strategy commenced in 1990s. It has been a bit prosperous though it has not realized its full potential because of inadequate water and rich soils. Currently, aquaculture has taken its path to complement declining catches from the natural waters of the district. The district has about 100 km of the Lake Malawi coastline. It also has main rivers that comprise of Linthipe, Liwadzi, Ngodzi, Lifidzi, Chiluwa, Chitala, Lipimbi, Lilongwe, Dwele, Lingadzi, Lungumadzi, and Nyungwi. The Fisheries sector performs a main role in reducing poverty and lead to household food security in the district (Salima District Fisheries Office, 2013).

Lake Chilwa is the main source of fish for Zomba District. The Lake Chilwa Wetland has three main vegetation features and are grasslands, swamps, and marshes. The other minor sources of fish are the Lake Chilwa affluent rivers such as Domasi, Likangala, Thondwe, Mulunguzi, Naisi, Namadzi, Sombani and Phalombe. Fisheries offers direct employment to about 700 fish farmers, 670 fishers and 2620 crew members and indirectly to over 10000 people who are involved in building boats, processing fish and marketing (Zomba District Fisheries Office, 2014).

In recent years, low lake levels and overfishing have resulted in dwindling fish production. The slump of 7983.71 metric tons (86.7%) from 2013/2014 to 2017/2018 represents an economic loss of about MWK15.64 billion (USD21.7 million) over a four-year period interpreting to yearly loss of MWK3.91 billion (USD5.43 million). The retrieval period of the fishery is sluggish because of continued drying up of the lake and unsustainable fishing practices signifying that the fishery is currently less resilient to fishing burden and climatic impacts (World Fish Centre, 2018). Aquaculture production in Zomba District is largely done in small earthen ponds. The major species presently farmed are Chilunguni (*Tilapia rendalli)*, Makumba (*Oreochromisshiranus)*, Chambo (*Oreochromiskarongae)* and Mlamba (*Clariasgariepinus*). Fish is one of the highly affordable and extensively accessible sources of animal

proteins and contributes to the nutritional requirements of many people in Zomba and the country at large. According to Chiwaula, Jamu, Chaweza, and Nagoli (2012), approximately 1.5% of fish captured is eaten by fishers, and 98.5% sold to other consumers, traders, and processors.

Forestry activities

In Chikwawa District, forests cover 35% of the district's land area of which 21,000 Hectares (Ha) and 482 Ha is natural woodland, and communal plantations respectively while 158,700 ha is protected area. The whole rural community and a large fraction of town residents greatly rely on forest resources for delivery of a wide range of their needs and requirements for livelihood such as brick burning, family fuel wood, infrastructure construction, curio making, tourist attraction, industrial fuel wood, maintaining ecosystem services and herbs.

Total land for Chikwawa is 491,957 hectares and out of this 10% is forest under customary land, and these are comparatively small to contain the forest resource needs for the increasing population of the district (Chikwawa District Forestry Office, 2014: 7-8). The main natural forest on the customary land in the Chikwawa covers Chikwawa/Thyolo Escarpment (about 21,000 ha.) in the east of the district. This is a most vital natural resource as it fashions a watershed area for a number of vital rivers that pour water into the River Shire. The district has four community plantations that are possessed and controlled by communities themselves and these were established by the Malawi Government.

Karonga District has eight forest reserves covering an area of 867 km^2 or nearly 26% of the district's total land. Many of the forest reserves are invaded in the margin by people living nearby making the areas more vulnerable to soil erosion during rains. Customary land woodlands are on unallocated customary land governed by customary law. The district has a considerable quantity of Village Forest Areas which eases stress for forest products on preserved forests. The four forest reserves

(Karonga South Escarpment, Karonga North Escarpment, Vinthukutu, and Nyika National Park) are gazetted while the remaining four (Kapembe, Nambatata, Kalembo and Musisi) are not. They offer the utmost dependable income generating activities in which people are involved in and they are weaving various products utilising palm leaves, and other non-timber forest products such as baobab fruits, honey, mushroom, and ropes.

The forestry sector in Salima District plays an important role in the livelihood of the people. Most of the people of Salima use fuelwood and charcoal as a source of energy because only a few can access electricity. The forests in Salima are under pressure largely because people rely on charcoal production sold in the city of Lilongwe. The significance of this sector to the district cannot be undervalued because it brings income through sales of charcoal, timber, poles, and other non-timber forest products. The district has village forest areas and some game reserves such as Kuti and Thuma.

Zomba District has numerous forest plantations which provide different gains to the community within the district and surrounding areas. The plantations are into two categories of ownership and are private and public. The utmost outstanding is Zomba Mountain Timber Plantation which is entirely possessed and managed by government and is situated on a Plateau and outer slope and it covers about 5164.24 hectares. The production plantation area is nearly 5084.84 hectares of which approximately 2978.37 hectares of the area is presently bare land (Zomba District Forestry Office, 2015: 12). The Plantation is subjugated by softwood pine, eucalyptus, fine hardwood, and other indigenous tree species. The primary hardwood species are *Eucalyptus grandis, E. saligna and Khayaanthotheca.*

Forestry resources in Zomba are of economic significance but the sector is facing several challenges, which if not tackled with targeted interventions, what is remaining can be utilised or destroyed in a short period of time. Timber and non-timer forest products include poles, fuels,

chewing stick, gum, dye, herbs, shrubs, wine, stem fibres, seed, spices, mushrooms condiments, honey among others.

Mining

Mining is almost absent in Chikwawa District with some small-scale mineral deposits, such as gemstone and blue agate in Traditional Authority Ngabu.

The mining industry is an area of great potential for the economy of Karonga District. Two main kinds of minerals are mined in Karonga, Uranium at Kayelekera, about 40 kilometres straight to the west of the district headquarters along the Karonga to Chitipa Road. Coal is mined at the same Kayelekera, Nkhauti 16 kilometres off the Karonga to Chitipa Road at Mpata, and Mwaaulambo around 20 kilometres north of Karonga (Karonga District Council, 2013a). Uranium is extracted in the shape of uranium oxide also recognised as yellow cake and is sold throughout the world where it is utilised for nuclear power generation. Paladin Africa Ltd is the company carrying out extractive activities for Uranium at Kayelekera and is also conducting feasibility studies in other areas like Chilumba and Silu. The yellow cake is exported to international markets. Coal is extracted in Mwaulambo area and the Mwaulambo coal mine is located 8 kilometres west from the Kakoma School junction on Karonga-Kaporo road (GoM, 2014c). It covers approximately 18 km^2 and the coal yielding structure hollows at 16-25 degrees and is 20 metres thick on average. It encompasses feasible reserves of 50 million tonnes including 0.6 million tonnes of confirmed reserves with a 30.2% slag substance/matter, a 2.2% sulphur substance, and a calorific value of 4,708 kcal/kg (GoM, and Paladin Africa Limited, 2014d). The major customers of coal are cement manufacturing, textile and soap making. Coal has more potential to be used in the tea industry, tobacco industry, and thermal power generation, and room for domestic application (use of coal briquettes).

Mineral deposits found in Zomba District include industrial and semi-precious minerals. The industrial minerals consist of dimension stones,

heavy mineral sands, construction sand, rock aggregate, phosphate, and brick clay. Whilst semi-precious minerals consist of minerals such as aegirine and smoky quartz, the minerals stated are mined by small scale artisan miners. The dimension stones are formed from syenites which are found all over the district and green granites which are found in Thondwe and Chingale. Heavy mineral sands are found around Lake Chilwa while construction sand is extracted from along riverbanks of Likangala, Domasi, and Thondwe and other rivers. Rock aggregate is crushed mostly from syenites along the main roads by small scale rock crushers using manual or rudimentary methods. Mining is done in a form of crude stone quarrying and sand mining specifically in the informal sector. There are, however, prospects for small-scale surface gemstone mining along the western part of Zomba Mountain in Traditional Authority Mlumbe. There is probability that more mineral deposits were identified during the National Aerial Geophysical Survey that the Department of Mines carried out in 2013.

Commerce and industry

The major service and market centres in Chikwawa District are in TAs Chapananga, Ngabu, Lundu, Ndakwera, Kasisi, Katanga, Maseya, and Makhuwira. About 93 % of business communities operating in the district are small-scale retailers such as groceries, bottle store, maize mills, rest house, welding shops, and restaurants**.** The district has large businesses such as 3 cattle ranches, and 1 sugarcane company (Illovo). Local people manage 96% of these business activities and the rest 4% is managed by Burundians and Mozambicans particularly at Nchalo and Ngabu (Chikwawa District Council, 2014). Several other businesses include sale of second-hand clothes, tailoring shops, hair salons, barbershops, video shows, bicycle transport and sale of agricultural products such as rice, maize, and beans. The major trading centres are Dyeratu, Nchalo and Ngabu.

Karonga District shares boundaries with Tanzania and has various commercial activities which vary from wholesale, retail, market activities and hardware. Several businesses that are small, medium, and large-

scale are done in Karonga. They include shops, wholesaler/distributors to retailers, liquor, and market vending. There are five major markets that have their own satellite markets, and they include Songwe, Karonga central, Songwe, Miyombo, Chilumba and Nyungwe. They are fixed markets and support satellite markets that are small and episodic. The district has very few main industrial activities happening, for instance, there is a cotton ginnery at Ngara, a large rice mill at Katili and several small-scale millers of rice and maize. Basket weaving and handicrafts making (mats) are also practised in the district. Cross-border marketing/trading takes place at the Tanzania boarder and the items that are sold in the cross-border trade are household items, clothes, and cooking oil from Tanzania, and sugar, rice, maize, and beer from Malawi. Karonga District has several banking facilities of which people who are into businesses keep their money and access loans for their businesses.

The commerce sector in Salima District comprises trading, service, manufacturing, and agro-based activities. This sector has high possibility of reducing poverty because it generates income for the livelihood of people. Main trading activities include hawking, farm produce selling, secondhand clothes, fish mongering, wholesale, retail, hardware, grocery, bottle stores, butchery, sugar vending, tailoring, welding, hair dressing, hospitality, car repairing, battery charging, tea rooms, shoe making and repairing, radio repairing, barber shops, transport, laundry, milling, bakery, carpentry, and joinery, knitting, shoe making, timber sawing, pottery, tinsmith, basket making, oil refinery and fruit processing. The district has some banks that offer credit and banking facilities such as Standard Bank, Malawi Rural Finance Company, and National Bank of Malawi.

The enterprise structure for Zomba District can be classified into three divisions namely commerce, light manufacturing, and services. The commerce sector is about trade and retail and it comprises markets, formal and informal trade, transport, and telecommunications. The services sector consists of transport, utilities, hotel and tourism, financial and professional services, and business support while the industry

sector is mainly about light manufacturing in agro-processing, forestry products, fisheries, and small-scale mining and quarrying. There are 49 principal trading centres in Zomba District and 77% of all the registered enterprises in the district are concentrated in these centres (Zomba District Council, 2015: 21). Most of the trading centres do not have fixed market structures. The presence of large companies in the district is negligible in terms of employment and revenue since only 1% of the total number of enterprises in the district constitutes that category while the rest are essentially small and medium (Zomba District Council, 2015:24). The large-scale companies functioning in the district are public enterprises such as Agricultural Development and Marketing Cooperation, Electricity Supply Commission of Malawi, and Southern Region Water Board, and significant private enterprises include Southern Bottlers, Telecom Networks Malawi, Airtel Malawi and Sunbird Hotels Limited among others.

Labour and employment

Labour and employment differ based on locality and can be classified into skilled and unskilled, formal, and informal, self-employed, seasonal, and piece work (ganyu). Skilled labour consists of people whose labour is needed in various professions in reputable organisations, and they include managerial, clerical, and other jobs. Unskilled labour on the other hand consists of people whose labour is required in various established organizations but does not require very special skills such as cane cutters. Wage scales across the districts vary between the public and private sector, the private sector has a very wide-ranging scale, from USD 45.00 to up to USD 2,750.00 monthly. The low end of the scale, USD 45.00 indicates monthly wages creating a least/minimum wage; and wages in the public sector usually vary from USD138.00 to USD 1,48.60 monthly. Labour as a factor of production is a crucial element for growth. The fact is that incomes from employment propel utilisation of goods and services on the market which eventually brings about economic prosperity of a country.

The labour force in Chikwawa District is about 21,223 people consisting of people working in all sectors including self-employment, civil service, industries, and estates. Many people in the district are employed at Illovo Sugar Estate at Nchalo and Government Departments. The least are employed in Non-Governmental Organisations and small commercial estates among others.

A considerable number of people in Karonga District are involved in the buying and selling of agricultural produce such as rice, maize, cotton, and beans. In addition, occupations such as civil servants, shop attendants, house servants, minibus drivers and security guards are prevalent. The District Labour Office in Karonga indicates that 30,000 individuals are self-employed, 8000 are involved in commerce, 7,000 are civil servants and 800 works in the local industry.

Salima District Labour Office makes sure that no employer provides conditions of service that are below the minimum standard in the areas of but not limited to minimum wages, sick leave, maternity leave, and overtime and weekly rest days. The district has both skilled and unskilled labour. Skilled labour brings greater pay because of professional skills unlike unskilled labour. Labour complaints rise from grievances of employees on issues related to conditions of employment agreed between employers and workers based on the minimum standard guidelines stipulated in the employment Act No.6 of 2000 Cap 55:02.

According to 2011 Welfare and Monitoring Survey, Zomba District has mean employment rate of 68.8% (Zomba District Council, 2013). Evidently, this employment rate is greater among men (68.2%) as opposed to women (49%). On the contrary, unemployment rate stands at 31.3% on average which is far greater than the national unemployment rate of 15.8%. Subsistence farming forms 50% of the total labour force while salaried workers, casual labourers, and the self-employed share 26%, 3%, and 12% correspondingly.

Tourism

Chikwawa District has several sites of potential for tourism development such as Kapichira falls, Madziotentha spring, Diwa spring, Kapichira Hydro Electric Power Station, Lengwe National Park, Majete Game Reserve, offers good site seeing. Lengwe National Park covers an area of 887 square kilometres and common wildlife in the Park are Antelopes, and Nyala, Buffaloes, Kudu, Livingstone Suni, Impala, Warthogs, Bush bucks and Bush Pigs, Grysbok, Common Duikers, Leopards, Hyenas, and Civet (GoM, 2010c). Monkeys like Samango are also available in the Park and the Park is also a home to various types of fascinating birds. The Illovo Sugar Company also established Nyala Park for Tourism and wildlife found include Nyalas, Zebras, and Nswalas. Camels are also reared at this Park. Majete Wildlife Reserve is in Chikwawa District, 70 kilometres, southwest of Blantyre and 17 kilometres from Chikwawa District headquarters. It was gazetted as a protected area in 1955 and covers an area of 691 square km and has a variety of wild animals ranging from the superlative African Elephants, Buffaloes, Sable Antelopes, Zebra, Bushbucks, Kudu, Elands, Reedbucks, Waterbucks, Impala, Nyala, Hartebeests, Hippos, Warthogs, Bush Pigs, and Rhinos (Chikwawa District Council, 2011).

Karonga District is currently evolving into the tourism industry and the district has numerous places with huge capability for tourism. The present main tourism enticement in the district include the Karonga Museum and Lake Malawi, small enticements are Stevenson Road and the African Lakes Company Trading Post. The district's tourism potential is exceptional as it is an entry point for nomadic visitors to and from Malawi. There are several places/sites devoted to enticing and assisting tourists and these are beaches, Karonga Museum, Malema Site (where the oldest humankind was found approximately 2.5 million years old), Mkungwe Hot Spring, Mlare Craft Centre, Mwakashunguti Excavation Site, mines, hotels and lodges along the lake. Development of tourism in the district encounters numerous of challenges like lack of marketing, poor linkages between communities and developers, and tourism office,

poor water and air transport service providers, and undeveloped cultural heritage sites (Karonga District Council, 2013a).

Salima District is one of the main tourism destinations in Malawi and tourism in the district is dependent on cultural and natural heritage that the district is bestowed with. The main tourist attraction is Lake Malawi and its small islands, nevertheless, there are other tourist enticements such as Kuti Game Ranch in Salima Town, Senga Bay hills, Crocodile farm in Sengabay, Thuma forestry reserve near Salima town, cultural activities like initiation ceremonies, Gule wamkulu, Chipoka harbour, Curio markets in and along the road to Sengabay, water sporting activities in Lake Malawi, and fishing villages along Lake Malawi. There are several hotels and lodges, and restaurants in the district specifically at Salima town, Chipoka, and Sengabay (GoM, 2010c). The tourism sector in the District is encountering several problems such as absence of tourism development zones leading to unplanned lakeshore developments. This brought a great consequence on the general usefulness of the beaches of Lake Malawi and their facilities and services, environmental degradation has led to decreased wildlife and fish populace in preserved areas, the tourism industry in Salima has inadequate trained manpower who can excellently and proficiently support the industry, and inadequate infrastructure for boosting tourism (Salima District Council, 2011b).

Zomba District is bestowed with natural splendour and different tourist attractions. It has a varied landscape which provides a diversity of distinctive natural attractions varying from Zomba, Chikala and Malosa mountains to flat plains of Lake Chilwa. Additionally, historical buildings, cultural heritage, and Zomba City as the centre of the district provide a diversity of appealing places and activities. Nevertheless, the tourism probability is not completely utilised. There is potential for the development of a vibrant and lucrative tourism sector in Zomba District but there are few investments in the sector which leaves the potential slightly exploited. The locality of Zomba District in proximity of the large city of Blantyre and Liwonde Town and not too far from the capital

Lilongwe makes it a potentially principal recreation area for leisure tourist, specifically for the developing metropolitan middle-class (Zomba District Council, 2009).

4.2.8. Education in the study districts

Education is important because it helps to enhance literacy levels of any person hence having the capacity to understand issues and plan to any course of action. Similarly, for communities to understand issues of climate change and climate resilience, they ought to be literate for effective planning and implementation of any action for resilient livelihoods.

Chikwawa District

There are currently 160 public primary schools in the district and 91 are Full Primary Schools, while 69 are Junior Primary Schools. A better number of these schools have amenities that are of poor quality and inferior such as church buildings and grass-thatched classrooms and under trees. The other challenge these schools experience is teachers' shortage. Currently, the district has two registered private schools, the rest are not enlisted. Most of these private primary schools also operate in inferior infrastructure/structures. They do not have adequate teaching and learning materials, have both unqualified and unprofessional teachers. Primary school educational system encounters problems such as understaffing, inadequate infrastructure, and high rate of school dropout (Chikwawa District Council, 2011).

The highest enrolment of 107,148 was in 2011 academic year in relation to the past years. Boys enrolment is relatively higher at 58% as compared to girls which is at 41% (Chikwawa District Council, 2014:53. In general, primary pupil enrolment is greatest in term one and enrolment decreases as school calendar goes to term three. The decrease in pupil enrolment in term three could be attributed to cultural events that take place especially after harvests. Total pass rate for both boys and girls

were greatest in 2011 and has been constant at 75% for several years. There are insignificant disparities about both boys and girls pass rates and dropouts in the district.

There is presently a total of 1233 both permanent and temporal classrooms, 940 both qualified and unqualified teachers, 492 houses for teachers and 7461 pupils' desks. The ratio of pupil to classroom is currently at 114:1 which is above and nearly twice as much as the national average of 60 pupils per classroom. The district has 20 secondary schools and out of these, 16 are Community Day Secondary Schools, 1-day secondary school and 2 boarding secondary schools. Secondary school pupil to Desk ratio is 2:1 and has been constant for the last three years and is within the endorsed national ratio of 2: 1. The student to teacher ratio is 23:1 as of 2013, a slight increase from 21:1 in 2010 but below the recommended ratio of 60:1 (Chikwawa District Council, 2011).

Karonga District

Karonga District has 162 public primary schools, 5 private primary schools, 22 public secondary schools, 6 private secondary schools and 2 colleges. The district is allotted into 11 education zones each managed by Primary Education Advisor (PEA). The literacy rate for Karonga is 74.9%, marginally less than the northern region average of 77 percent but above the national average of 65.4%. The Primary School enrolment rate was 99% in 2013 and this shows that 99% of all children of school-going age (6-13) were attending school. The district has 1,249 primary school teachers of which 125 are Open Distance Learning student teachers allocated in all the zones. The student to teacher ratio in 2015 was 92:1 which is greater than the national recommended ratio of 60:1. The school dropout was at 2% as of 2015 because of family responsibility, marriage, illnesses, pregnancy, and long distances (Karonga District Council, 2013). There are 22 secondary schools in the district controlled by Education Division Manager and out of these, 13 are unapproved Community Day Secondary Schools, 4 approved

community Day Secondary Schools, 3 conventional secondary schools, and 2 grant aided secondary schools. The district has 6 private secondary schools thereby bringing the total to 28.

Enrolment for Secondary School has risen from 68.4% in 2012 to 78.4% in 2015 and this is credited to building of modern and extra schools in the district (National Statistical Office, 2012 and 2015). In public schools, there are 216 teachers teaching 7,434 students and 21.5% of the teachers unprofessional. The education sector in the district is encountering several challenges and they comprise lack of teachers, inadequate school infrastructure, insufficient financial resources, and early pregnancies.

Salima District

Salima education sector has been devolved into zones. There are 9 zones, 128 public schools, and total enrolment of 85,876 students. The district also has 2 private primary schools. The schools within the town have lower pupil teacher ratio on average than those in the remote areas. This is the lowest than the district and national levels since most of the teachers are females who follow their spouses working in towns and some teachers are urged to be near Health Centers due to their ill health condition (Salima District Council, 2011b: 73-78).

Repeating and dropout rates continue to be high as data for 2008 to 2010 indicate with standard 1 dropout getting to 36% in 2010 before decreasing to 3% in 2011. Many schools in Salima have school management committees that are not functional. School Improvement Plans (SIPs) were formulated in almost all schools largely because they were requisites for the schools to get support to schools from Education Management Unit.

The district has 2 conventional secondary schools, 11 approved Community Day Secondary Schools (CDSS), 3 unapproved CDSS and 1 Private Secondary School. The total enrolment in Secondary schools is 4052 pupils out of which 1,701 are girls, and total number of teachers is 232. Salima District has 96 qualified teachers (70 males and 26

females) making 37% of qualified teachers. There is low access to secondary education and hence the need for community mobilization to campaign for more learners particularly girls to go to school. The low participation of girls in secondary school is largely because of early marriages, fishing industry, and severe shortage of space in secondary schools (Salima District Council, 2011b).

Zomba District

The district has 200 public primary schools with a total enrolment of 213,078 (104,869 males and 108,209 females). The public primary schools have a total of 2,587 (1,429 males and 1,158 females) teachers (NSO, 2008). There are 5 private primary schools. There has been an increase in girls' enrolment over the past five years. The increase in number of girls has been more than the number of boys. The rise in the girls was due to more education related programmes emphasis on girls and not boys. There was a fall of the enrolment for both boys and girls in 2013 owing to the drought that prevailed in some parts of the district which led to lack of food. The literacy rate is at 76% which is greater than the national rate of 65.8% in the 2016/17 Primary School Leaving Certificate examinations results.

The number of public primary schools rose by 2%, from 197 schools in 2013 to 200 as of December 2016. Inadequate number of classrooms in the district is becoming more and more critical. The Policy of the Ministry show that a classroom must be occupied by at least 60 learners yet in some schools, classrooms accommodate up to 200 learners. The district has an average learner /classroom ratio of 142:1 (Zomba District Council, 2009).

The education sector in Zomba district encounters challenges such as poor-quality education, inadequate school infrastructure, uneven distribution of teachers, inadequate instructional materials such as books, high teacher-pupil ratio, inefficiencies in the education systems, high absenteeism, repetition and dropout rates, low community involvement in school development projects and interventions.

4.2.9. Infrastructure and utilities in the study districts

Chikwawa District

The road network in the district is bad due to the nature of the roads since they all have a black-cotton soil surface. The populace has restricted access to different parts in the district particularly during the rainy season when the roads are usually slick, eroded, and many roads have either a washed away bridge or a broken bridge. There are two major kinds of road surface in Chikwawa District and are tarmac and earth roads. The tarmac road is a continuation of the road from Blantyre to Chikwawa and to Bangula and covers 91.8 kilometres starting from Madziabango in Chikwawa to Sorgin (Chikwawa and Nsanje boundary). The roads in Chikwawa district are classified into four as Main Roads; Secondary Roads; District Roads; and Feeder Roads.

The district depends mainly on road transport compared to water and air transport. The most reliable and fast forms of transport are minibuses, and lorries on long distances. On short distances, bicycle hiring “Shapa” is common and reaches the remotest parts of the district. Vehicles, motorcycles, and peddling bicycles are utilised on the roads whilst boats and canoes are used on the waters particularly of Shire River. Air transport is commonly used by Illovo Sugar Company for checking and supervising activities on the farm.

Malawi Postal Corporation offers postal services and there are four Post offices and one postal agency in the district. Malawi Postal Corporation uses buses, mail vans and motorcycles to expediate mail delivery. Telekom Networks Malawi and Airtel Malawi Limited offers cellular network in Chikwawa. Telephone network for fixed telephones and mobile phones is found in the district, although mobile phone network is bad in the remote parts of the district particularly Telecom network. In some areas the network is disturbed depending on topographic position one is situated (Chikwawa District Council, 2011).

Chikwawa District has several radio stations, but the dominant ones are Malawi Broadcasting Corporation, Zodiak Broadcasting Station, Trans World Radio, British Broadcasting Corporation, and Voice of America. Radio reception is, however, highly dependent on the model of the radio an individual has, and the channels chosen. The people of Chikwawa District have access to some Newspapers that reach the district in time. Chikwawa gets its electricity from Kapichira Hydro-Electric plant, which is located within the district. This also supplies electricity to the rest of the country.

Karonga District

There are fourty-nine prevalent roads in Karonga District, and these roads are classified into four and are: main roads, district roads, secondary roads, and tertiary or feeder roads. The three main roads are tarmac, and the remaining forty-six are made of earth. As of 2013, the district had 7 main roads, 14 district roads, 4 secondary roads, and 28 tertiary roads amounting to 589.7 km of roads.

The district has 90 bridges crossing or straddling over rivers and streams on the roads of Karonga district and 13 of them are made of timber and the remaining 73 are made of concrete. A few bridges are not operational because of flooding, impassable roads leading to bridges, and lack of maintenance. The district has access to land water and air transportation. It has three bus terminals, one steamer that runs on Lake Malawi and acts as a ferry. The district has one main airport and one airstrip.

The district also has postal offices for offering different services e.g., telephone networks, cellular networks (Airtel, Telekom Networks Malawi, and Malawi Telecommunication Limited), radio and television network (Zodiak broadcasting Station, Malawi Broadcasting Corporation, British Broadcasting Corporation), National Publications and Internet Services, Power Generating Plants and Substations like Wovwe Min Hydro Power Generation Plant (Karonga District Council, 2013).

Salima District

There are 54 existing roads in Salima District, and these roads are classified into four classes and they include main roads, district roads, secondary roads, and feeder roads. The three major roads are bituminised, and the remaining fourty-six are made of earth. As of 2015, the district had 5 main roads, 11 district roads, 6 secondary roads, and 32 tertiary roads amounting to 752.47 km of roads. The district has 80 bridges spanning over rivers on the roads of the district and 16 of these are bedecked with timber and the remaining 64 are bedecked with concrete. Some bridges are not functional due to flooding, impassable roads leading to bridges, and lack of maintenance. The district has access to land, water, and air transport. It has two bus terminals, and a railway line. The district has one airwing for the Malawi Defense Force. The district also has postal offices for different services, telephone networks, cellular networks (Airtel, Telekom Networks Malawi, and Malawi Telecommunication Limited), radio and television network (Zodiak broadcasting Station, Malawi Broadcasting Corporation, British Broadcasting Corporation).

Zomba District

Zomba District has a better road network in comparison to other districts in Malawi (Zomba District Council, 2018). Nevertheless, a good number of roads are in a bad condition and require rehabilitation specifically following the devastating 2015 floods and intense rains which destroyed most of the road infrastructure throughout the country. The Blantyre-Zomba-Lilongwe (M3) Road is the only main road that passes through the district from Namadzi bridge to Likwenu bridge covering 63 kilometres. The road is bituminized and the latest upgrading from Blantyre to Chinamwali in Zomba has significantly reduced the drive time between the two districts. The other vital road which has just been completed and is categorised as main road but was categorised as secondary road before completion is the Zomba-Jali-Phalombe-Chitakale road. It is 102 km transecting Zomba, Phalombe and Mulanje. The district has five secondary roads covering 121.3 kilometres.

The most common means of transport in Zomba District in order of use rank are walking, bicycles, motorcycles, and cars. For medium distances within the district or to nearby areas, the most common means of transport is a minibus. Large capacity buses are used for long distance travels where available or connecting multiple modes such as walking, bicycle or motorcycle and minibus. The other common modes of transport are taxis even though not very common in the most remote areas of the district. In terms of water transport, boats are a very important means of transport on Lake Chilwa, especially between the western shore of the lake and the islands on the lake. The islands of Chisi, Chinguma, Ngotangota and Lungazi in TA Mkumbira are accessible only by boat and air. The Limbe-Liwonde-Nayuchi rail line passes through the western part of the district.

In terms of communication, there are ten post offices and five postal agencies situated at Zomba City, Domasi, Chilema, Jali, Mayaka, Nasawa, Mlumbe, Thondwe, Magomero and Chingale. The postal agencies are found at Mwambo, Namadidi, Masaula, Sakata and Namisonga. There are three mobile network operators offering services in Zomba district namely Telecom Networks Malawi (TNM), Airtel Malawi, and Malawi Telecommunication Limited (MTL). All main national radio and television programmes can be received in Zomba District. In spite of this, it is indicated that only 7.7% of the households possess a TV while 42.7% possess a radio (GoM, 2016e). The radio stations with major listenership in Zomba include Malawi Broadcasting Cooperation Radio, Zodiak Radio, Radio Maria, YONECO Radio, and Chancellor College Community Radio.

CHAPTER 5: RESEARCH METHODOLOGY

This chapter highlights the methodology, approaches and processes used in carrying out the study in the four districts. It, therefore, focuses on actual research methodologies used for data collection, research design, sampling frame, sampling techniques, sample size, data gathering procedures, data gathering instruments and tools, data analysis strategies, ways of ensuring validity and reliability of data, and plans for pilot or testing of the data gathering instruments. The chapter has clearly spelt the details on each methodology and the justification as to why it was used during the study.

5.1. RESEARCH DESIGN (ORGANISATION AND APPROACH)

The research revolved around key issues of effects of climate change, natural disasters and building community resilience. It tried to unearth different mechanisms and to what extent are Malawian communities in the selected districts build their resilience to improve their socioeconomic status and livelihoods for a resilient nation. It also investigated key perceptions of rural communities on climate change, sustainable livelihoods and climate change adaptation actions/approaches employed by communities to obviate susceptibility thereby increase their resilience.

The study was organised in such a way that it was a cross-sectional research and followed a descriptive and explorative assessment and analysis in order to come up with the required thematic issues on resilience building. The literature affirms that a cross-sectional design/plan needs the gathering of data on several situations and at a sole point in time, and this helps in gathering a body of quantitative and qualitative data in association with two or more factors that are consequently analysed to identify models and relationships (Bryman, 2001). The research was conducted in four selected districts of Karonga in the northern region, Salima in the central region, Chikwawa and

Zomba in the Southern region as described in detail in Chapter 4. These districts are very much affected by climate change and experience disasters related to changes in climate on annual basis of which their socio-economic and livelihood activities are oftentimes disrupted. This approach enabled the researcher to reach out to key respondents in their respective localities such as development practitioners of different expertise at the local or community level as key informants, vulnerable households, Government Officers, and a few community members who participated in the focus group discussions. This organisation helped in coming up with effective and reliable data that reflected on the actual context of climate change impact in the study areas.

In terms of the approach, the study used various tools and instruments for effective data collection and their detailed description has been provided in 5.2. Structured questionnaires and checklists were designed for collection of detailed, reliable, and relevant data from respondents. These were designed in a way that both qualitative and quantitative data were gathered. Key informants were also identified and interviewed with the aim of getting more reliable data because they are the people considered to have experience, knowledge, and skills on the areas of the study. They are also believed to have inhabited in the study area for a long time or are retired people who have worked in various development initiatives. A guide or checklist of questions was developed for the key informants and this helped in getting real time data from the key informants that were reached with the study. Focus group discussions were also conducted in all the areas that were reached during the study in order to get collective data from households and communities. A total of six enumerators or research assistants were recruited and oriented and taught in data gathering procedures and how to administer and record data in various questionnaires. This enabled them assist in piloting or testing the study, which was ably done, and that the data collection, data entry and analysis were also done.

5.2. DATA GATHERING PROCEDURES AND INSTRUMENTS

The data gathering process for this study constituted qualitative and quantitative approaches. These approaches were utilised to gather or collect data from community/household members by administering structured questionnaires. Supplementing the research design with the suitable and applicable research approaches assists in enhancing attainment of official and usable data for analysis (Bryman, 2001; Oppenheim, 1992). Thus, a diverse research method that brings about quantitative and qualitative data was embraced for the research. Quantitative study is an investigation approach that focuses on quantity in the gathering and analysis of data, and it involves logical or inferential method to test philosophies while qualitative research mostly focuses on an inductive method to come up with philosophies (Bryman, 2001). Quantitative data was consequently gathered on agreed household variables, asset ownership, economic activities and development actions implemented for adaptation and resilience building, while qualitative data was gathered and utilised to measure institutional, capacity, and technical aspects and appraise their integration to the quantitative data.

Data was also generated from key informants through individual in-depth interviews and semi-structured interviews using a detailed checklist. These are the individuals who have special understanding, knowledge and experience on climate change, disasters, general development discourse and resilience building, and included traditional leaders, practicing development practitioners (NGO and Government Officers), retired development practitioners and teachers/lecturers. Secondary data was gathered through review of various documents by the government, development institutions, Non-Governmental Organisations, and newspapers in Malawi and elsewhere to put the research into context.

As highlighted in the preceding section, the data gathering instruments were devised for data collection and they included detailed checklists for

key informants and focus group discussions, detailed structured questionnaires for household interviews. A checklist was also developed for conducting Focus Group Discussions (FGD) that ensure triangulation of data and information gathered from key informants and individual households. In essence, data attainment in this study was strengthened through triangulation or a mixture of approaches including quantitative and qualitative methods as affirmed by Patton (1990). Patton contended that triangulation is a strong and influential resolution to the challenge of depending too much on any single data sources or approach as it tends to affect the validity and credibility of results. Comparable and related aspects were treated across data generation approaches such as in the questionnaire, FGDs, and in-depth interviews to authenticate data obtained from various sources and crosscheck for difference, and conjunction of opinions and ideas voiced by various groupings.

The actual data collection for this study was conducted between April and June 2019 and was done in all the fours districts, Traditional leaders, Government Officers from various departments and agencies, and Non-Governmental Organisations. Data was collected according to the expectations through KIIs, household respondents and FGDs. The sections below describe various data gathering instruments that were used during this exercise/study.

5.2.1. Structured household questionnaire

A questionnaire is a study tool comprising of a sequence of questions for the purpose of collecting information and data from respondents for analysing the findings (Gilham, 2000).

The household questionnaire for this study was devised in tandem with the research objectives and research questions and comprises a variety of aspects that offered a comprehension of the socio-economic features of the study respondents and their opinions of climate change, climate change impacts and resilience building. The questionnaire had a set of themes and questions that aimed at understanding community livelihoods, general climate change knowledge of respondents,

resilience building mechanisms, and among other aspects. The questionnaire was designed in a such a way that it was easy to administer and that respondents can follow the discussion (Gilham, 2000). Before setting up the questions, an extensive reading was done on literature related to the preparation of survey questions (Oppenheim, 1992), and this was done to understand the need to incorporate the relevant aspects of the study in the final questionnaire. The structured questionnaire is indicated as Annex 4 on page 342.

Four hundred and two (402) questionnaires were administered to respondents in all the four districts of Chikwawa (102), Karonga (98), Salima (95) and Zomba (107) and all the relevant data were collected for the purpose of this study. The total number of households or questionnaires were determined by using the Fischer's formula as explained in section 6.3. This was determined in reference to the total households for the 4 study districts and it was just a proportional of that population. The respondents/households were based on their involvement in various livelihoods activities, experience in development work, and their interest in community work. These questionnaires had several questions relevant to the themes of the study and the questions were properly coded. The total number of respondents per district were randomly sampled or selected in liaison with the village chiefs, traditional leaders and some extension workers based in the respective areas. This was just a representative of the total households of the study districts, and this represented 1% of the total population. The questionnaires were administered to the respondents through one on one or face to face interviews to get data from the sources. Before the questionnaires were administered, consent was sought from the respondents and all the research ethics were followed.

The structured questionnaire helped in collecting household data in aspects such as demography and socio-economic characteristics, tenure and land use, crop, and livestock production (agriculture for livelihoods), household assets, organisational influencing factors, climate change, and key resilience building strategies.

5.2.2. Key Informant Interviews (KIIs)

There are several theoretical definitions for Key Informant Interviews (KIIs). Kumar (1989) defines it as the process of cross-examining of knowledgeable individuals who are possibly to offer the needed information, ideas, and perceptions on a specific matter (Kumar, 1989). Key informant interviews are also regarded as qualitative in-depth questions (interviews) with people who understand and are knowledgeable of what is currently happening in the locality or community (Kreuger, 1998). Lewis, Ritchie, and Legard (2003) argue that in-depth interviews are a dialogue with an aim through which knowledge about a social world is built. Through this conversation, the interviewer leads the interviewee to new insights. Semi-structured interviews offer depth of exploration on complex subjects and are easier to organise (Denzin & Lincoln, 2003). The focus group discussions, therefore, provided a chance for the researcher to follow up on the responses from the respondents through the probing process, and were helpful in the study. Participants were probed to give their views and recommendations on several aspects that border around the successful resilience building. The aim of key informant interviews is to gather information from a diversity of respondents such traditional leaders, professionals, experts of inhabitants who possess first-hand knowhow about the society. Identification of key informants entails investigating who the experts/professionals are in dealing with the key aspects of the research (Chambers, 1992).

A total of 20 key informants were interviewed and these included those from the study districts, the Civil Society Organisations, and government departments at national level. Key informant interviews were conducted to gather quantitative and qualitative data including perceptions and opinions on climate change adaptation and resilience building. The interviews conducted utilised a checklist of issues that associated with the research objectives and tailored to the various individuals who were interviewed. The Key Informant Interview guides were used as prompters in a flexible style to make the interviews more conversational

while still structured and controlled. The flexible way the interviews were carried out allowed for the interviewees to raise additional/complementary issues. To be specific, the researcher conducted interviews and meetings with concerned government officials, a few community members, and relevant stakeholders. Key informants were identified for purposes of data triangulation. Finally, the interviews were carried out with people that were deemed to have special or exceptional information and insights on the key issues being tackled. The key informants for this study were selected cautiously with support of remote households that participated in the FGDs, extension workers, Government and NGO staff and local leadership in the study districts visited. Key informants were identified from the following key institutions: Ministry of Agriculture, Irrigation and Water Development; Ministry of Local Government and Rural Development; Environmental Affairs Department; Department of Economic Planning and Development; Department of Disaster Management Affairs; Department of Climate Change and Meteorological Services; Department of Forestry; Department of Irrigation Services; Department of Water Resources; District Agriculture Development Offices; Environmental District Offices; Food and Agriculture Organisation of the United Nations; Catholic Development Commission in Malawi; and Civil Society Network on Climate Change. The key informant interviews were held out at accessible areas preferred by the key informants using a checklist with open ended questions. Refer to Annex 5 on page 352, and Annex 6 on page 353.

The information was collected from the participants' experiences and perceptions through face-to-face interviews, and these were also through dialogue and participatory processes. The interviews (that are qualitative), the participants were not given pre-conceived ideas and responses from where they can make choices/decisions, but they were made to provide their insights from their own reflections on climate change adaptation and resilience building and any other relevant aspect related to climate change in general.

5.2.3. Focus Group Discussions (FGDs)

The FGDs are interviews directed using semi-structured questions for investigators to intensely gaze into matters and cultivate new positions of inquest that occur throughout the interviews (Denscombe, 2007). Hennik (2014) also describes Focus Group Discussions as interactive discussions between six to eight pre-selected participants led by a moderator (the researcher) with a focus on specific issues. It is important to note that utilising semi-structured interviews permits the researcher to look more intensely into aspects and establish fresh areas of enquiry that evolve or emerge during the interviews. FGDs compared to questionnaire interviews allow delicate and complex matters to be more spontaneously deliberated in groups when people would not want to deliberate them single-handedly with a visitor/outsider (Krueger, 1994). In line with this philosophy, semi-structured interviews were administered to compliment and relate data that was produced in the household questionnaire and key informant interviews.

Semi-structured questions in a form of checklists were developed and were administered during the focus group discussions (refer to Annex 7 on page 354). A few individuals who are familiar with various development issues in areas of climate change, irrigation, agriculture production, rural livelihoods and other issues were targeted and participated in the FGDs. These were conducted with special selected groups in the districts such as the youths, female headed households, male headed households, women, and men together. The FGDs had 6 to 8 participants each and 16 FGDs were conducted across all the districts. The FGDs were determined based on the following criteria or categories of people:

- 1 Focus Group Discussion with males only.
- 1 Focus Group Discussion with females only.
- 1 Focus Group Discussion with a mixed group of women and men.
- 1 Focus Group Discussion with community leaders (Climate change champions, lead famers, and chiefs).

- 1 Focus Group Discussion with Government and NGO staff in the district.

In Karonga, 4 FGDs were conducted representing males, females, males and females, and NGOs. The issues obtained from the FGDs varied from one group to the other based on their experience, needs and cultural setup. In Salima, only 3 FGDs were conducted representing females, males, and community leaders. There were very few members representing NGOs and that women and men did not want to mix due to cultural beliefs. In Chikwawa, 5 FGDs were conducted representing the 5 categories indicated above. This was because the respondents were available in all the categories. In Zomba, 4 FGDs were done representing males, females, community leaders and NGOs. There was no FGD with a mixed group because respondents were not comfortable to come together due to what they called cultural beliefs.

The members that participated in the FGDs were selected purposefully in liaison with local leaders and change agents based on their experience, knowledge, and active involvement in day-to-day development interventions in their respective areas. The groups composition was varied to get real data from all the groups because if the groups were common and of the same size, it would be difficult to get precise and reliable data. This could be because some participants especially women could not actively participate and give their opinions. The idea of conducting gender disaggregated and age categorised interviews was to allow for more focused discussions and free space of discussions among the different gender and age social groups. This helped in collating how different gender and age groups perceive issues of climate change adaptation and resilience building and other relevant aspects related to climate change. Checklists with open ended questions were administered to the groups and related information on their livelihood, ways of increasing their adaptive capacity and resilience building were gathered. The questions were linked to some of key issues identified to

the structured questionnaire that was administered to household respondents, and/or individual interviews.

After the discussions, main issues that were brought up by each group were examined and assessed and fresh thoughts vital for more deliberations were prioritised. This also helped in digging deeper from the FGDs participants on several aspects of their life related to climate change and resilience building. The community groups and individuals were critical in providing first-hand information about their knowledge, attitudes, and practices on climate change adaptation and resilience in general.

5.2.4. Survey monkey

A survey monkey tool was used to get quick information from some experts more especially different government departments on general information of climate change, adaptation, resilience building, and climate change governance in Malawi.

A few simple questions with pre-conceived answers were prepared in a form of a survey monkey and sent to some key informant interviews for getting information. The target population of the survey monkey was determined by the number of stakeholders that are involved in climate change and resilience building programming in Malawi and these were selected randomly using random tables. A total of 20 stakeholders from Government, NGO sector, Civil Society, the Private sector, Faith Based Organisations, and some renowned consultants were selected to participate in the survey monkey. Out of 20 participants, 14 representing 70% of the targeted participants responded to the survey monkey. This helped in the triangulation of information and data that was collected from FGDs and structured household questionnaires.

5.3. THE POPULATION, SAMPLE FRAME, SAMPLING TECHNIQUES AND SAMPLE SIZE

Sampling frame of this research were the vulnerable households in the four districts of Chikwawa, Zomba, Salima and Karonga. In reference to the 2018 National Population Census Report for Malawi, the districts

have estimated population as follows: Chikwawa (564,684), Karonga (365,028), Salima (478,346) and Zomba (746,724). However, a small number of households per district were targeted as respondents due to some other complexities.

The researcher purposively selected Traditional Authorities (TAs) heavily impacted by climate change and disasters to conduct the study. The TAs were selected using a simple criterion that focused on the vulnerability levels of those areas. The criteria included prevalence of droughts and dry spells, occurrence of floods, access to water, food insecurity, and environmental degradation levels. This was adopted from the Post Disaster Needs Assessment Report of 2019 by the Government of Malawi. There were several TAs that were found to be more vulnerable but only a few were purposefully selected for easy management of the areas. Sampling of the vulnerable households/respondents were done using simple random sampling method. This was intended to provide a statistical basis for claiming that a sample size is representative of the target population.

Sample size for community members/households were determined by using Fischer's formula and set at 95% confidence level and 5% error margin (degree of precision). With no prior information on proportion of community members in target areas involved in resilience building initiatives, it was assumed that there is equal chance of finding respondents not involved in such interventions at all; thus, the probability of success is set at 50%. It is also assumed that if there is no estimate available for the study populace and its characteristics, the researcher may use 50% or less of the given sample. Fitting this in a formula to get minimum standard size, the following was obtained:

$K = x^2 s (1-s)/d^2$

K is minimum preferred sample size if the population is more than 10,000.

x is standard normal deviate equivalent to 95% confidence level that is 1.96.

s is probability for finding a respondent with at least one resilience building intervention; 1 -s is compliment of s; d is error margin or degree of precision. Replacing the symbols with figures above, we get the following:

$K= K= (1.96)^2*0.05*0.05/0.05^2$

= 384

This sample size was just the minimum desired, however, the researcher partially increased the size depending on population clusters in the respective targeted districts. It is important to note that the population size of the study area was not deliberately factored in the formula because the population is very high. This means that if it was factored in, the sample size could be huge of which the research would not have been able to reach out to all respondents, hence a reasonable sample size of 402.The study also sampled key informants purposively in order to get right people for the study. Eventually, the sample size for the household interviews was intentionally increased to 402 for effective representation of the districts' population. Data was collected from 102 households in Chikwawa, 98 households in Karonga, 95 households in Salima and 107 households in Zomba. The sample size of the study districts was a representative of their respective total households and the sample size were purposively selected. For example, Zomba District has higher population or households than the rest of the districts hence having a lager sample size. The key informant interviews assisted in generating reliable data because they had objective perspectives on the related affairs in the districts. Key informants were identified based on the type of work they do related to the themes of the study (development practitioners from civil service and NGOs), and experience of retired individuals in climate change management. A sum of twenty (20) key informants were identified and reached with interviews during the study

from the districts and national level departments and agencies, and Civil Society Organisations.

5.4. DATA ANALYSIS STRATEGIES

After data collection, both quantitative and qualitative data from the questionnaires were entered into data entry software soon after collection. The quantitative or numerical data were analysed using software package of Statistical Package for Social Science (SPSS) and Excel. The data were then analysed, interpreted and a judgement reached for the meanings of the findings in a household and community perspective. To compliment the SPSS, cross tabulation was done to ensure that patterns, trends, and the relationships between the parameters were identified. This helped in drawing trends, comparisons, and relationships of the elements of the data that was collected and analysed. Interpretation involved looking at the raw data and analyse what their meanings were, what the most significant results/findings were, and draw recommendations and conclusions. Qualitative data from study questionnaires and checklists were used to augment quantitative findings. The essence of analysis was to gain general understanding and depth from perspectives of different stakeholders in resilience building initiatives. Qualitative data from in-depth interviews or consultations with stakeholders and observations were transcribed, coded, and then interpreted based on objectives of the study. All interviews were recorded, transcribed, and analysed using a grounded theory approach (Corbin and Strauss, 1990) whereby codes were adjoined to quotes to develop issues section in the thesis. Data were categorised into recurrent themes that were relevant to study objectives and provide answers to study questions.

5.5. WAYS TO ENSURE VALIDITY AND RELIABILITY

UNICEF (2013) defined data validation as any task that aims at confirming whether the value of the data element comes from the given set is of standard/acceptable values. Data validation and reliability is ensured when key elements are met and these include accuracy, coherence and comparability, clarity and accessibility, and its timeliness

(Van der Loo, M. 2015). To ensure data validity and reliability for this study, the researcher carried out several tasks as described in the subsequent paragraphs below.

After daily field work of data collection, all the transcripts of every research assistant/enumerator were thoroughly checked, and data were kept in safe files. In other words, data were recorded in various files. This was done to ensure validity and consistency checks and data cleaning.

The researcher carried out field follow ups and supervision for research assistants during data collection. The data collection team operated within strict supervision and quality control system which comprised of daily field data collection debriefing sessions to discuss challenges and constraints and fix them promptly. With consent from the study respondents, recording of interviews in verbatim was done so that transcription of notes was guaranteed. Non-verbal communication of issues was also noted down. The data that were gathered were subjected to editing to eliminate discrepancies, errors and inconsistencies for coherence and clarity.

In addition, various techniques and methodologies were used with the purpose of triangulating the data collected to ensure validity and reliability. For instance, Key Informant Interviews, Focus Group Discussions, and through observations helped to validate the data that was provided by households and Focus Group Discussions.

Data entry was done right in the field by the researcher and other two experienced enumerators to ensure that the data was safely recorded in SPSS and Excel. This entails that all errors that were identified in the data collection process were rectified right in the field during the data entry exercise. It was vital to also run through the questionnaires with data to see if there were some omissions and gaps through comparison with data from the rest of the enumerators. This process assisted in cleaning up the data hence coming up with reliable data.

5.6. PLANS FOR PILOT STUDIES OR PRE-TESTING OF DATA GATHERING INSTRUMENTS

The researcher made sure that testing of data gathering instruments was carried out prior to the commencement of the actual data collection. The testing was done by selecting a few community members in one of the villages (household respondents) and government officers (key informants).

The researcher provided an orientation training to research assistants who supported in data collection for them to comprehend and familiarize with the tools and methods for collecting data enshrined in the study from the lens of the researcher. The orientation was conducted for half a day. This was very crucial and formed part of quality assurance so that questions were denotatively asked in the same manner by the different research assistants in the field. The training was necessitated despite the experience of the researcher and research assistants. The training covered specific objectives of the study, dos and don’ts in the study such as how to establish a rapport, time management with talkative respondents, being always neutral and avoiding leading the interviewee, the dangers of non-verbal and body language (i.e. dress code in the field, eye contact, intonation of voice, shaking head in approval or disapproval) and many pitfalls in the interviewing process. The training also focused much on how to administer the questionnaire by acquainting the research assistants with the questions, how to collect the data and also building their knowledge in some key aspects of the study such as early warning systems, resilience building, indigenous knowledge, among others.

The pre-testing exercise was carried out in Zomba District which was one of the study districts so that the lessons from the pre-testing were not far detached from the reality on the ground. The pre-testing was intended to help identify comprehension problems and the appropriateness of response options. The tools were then revised accordingly. This helped in determining whether the instruments were

enough or not. During testing of the instruments, it was discovered that some instruments, especially the household questionnaire, were not adequate in the sense that there were a few gaps as such relevant modifications were made. For example, some issues were coming out from the respondents but were not part of the questionnaire and/or checklists like on how people without land survive and use and monitoring of early warning systems that are prevalent in that locality.

The data that were gathered during the pretesting or pilot study in Zomba District was analysed using Excel and the parameters related to the thematic areas of the questionnaire came out clearly. This was despite having shortfalls in that some questions needed to be included in the questionnaire that were not there when the pilot study was being carried out, however, the change was not significant. The results, therefore, were deliberately not included in the main study because the researcher wanted to have relevant data since the tools were modified and these were used for comparisons only. The total number of households in this case remained 402.

5.7. ETHICAL CONSIDERATIONS DURING THE STUDY

An ethical clearance with the UNISA Ethics Committee for the study proposal was done and it was duly approved before the study commenced.

The study collected a lot of primary data from community members and other stakeholders. Informed consent was, therefore, sought from the respondents before data collection began. An information sheet was written in local language, read audibly to the respondents and a copy provided to them before they took part in the study. The collected data did not contain any identifiers and the data collection tool did not have areas where personal data was collected, instead codes were used to protect the identity of the respondents. The study respondents were informed that taking part in the study was voluntary and that they had a choice to pull out their participation or not respond to any question at any time during the interviews. The study did not expect to cause any harm

to the participants or respondents as such they were informed accordingly what was expected of them. The researcher provided refreshments to participants of the focus group discussions who were called from distant places to some central locations and stayed longer at a venue of the discussions.

5.8. COMPUTER LITERACY LEVEL AND INTERNET AVAILABILITY IN THE STUDY AREAS

Regardless of the rise in the utilisation of computers in Malawi, the growth rate is still very low, and it is even lower than the rate of the Continent of Africa (NSO, 2015b). About 1,600,000 Malawians were able to own and utilise computers and access to internet. This translates into 12.8% of the total population of 13,029,498 by that time (International Telecommunication Union, 2015). The low utilisation of computers in Malawi is at 2.2% and this is fostered by low levels of literacy and low levels of income amongst Malawian populace. The high price of computer gadgets has exacerbated the situation of low computer and internet utilisation. However, the recent survey conducted by the National Statistical office in Malawi in 2018 shows that there is further increase of 3% of the population who have access to and utilise computers.

In this regard, many parts of the research areas, computer literacy levels are very low. This is because many inhabitants are ultra-poor and can hardly meet the basic needs so having knowledge in computer is not their priority. This means that most of the population in the study areas do not have access to computers let alone operate it. The only group of people who can have access to computers and are computer literate are the extension workers, students, and government officers that support development programmes in these respective study areas. This group of people (extension workers, students, and government officers) that have access to computers and are computer literate constitutes to about 1.3% in Karonga, 2.1% in Salima, 2.8% in Chikwawa and 2% in Zomba.

Internet is a global public computer system and provides an access to several communication services and these include news, webs, emails, among others by using different gadgets such as computers, mobile phones, tablets, digital television, and others. Accessibility is usually through a static and immovable network. About 3.1% of Malawi's population have access to internet (NSO, 2015b). The study areas also have a low access to internet as evidenced by the National Statistical Office survey report on the use of internet in Malawi of which it says that 3.1% of population have access to and use of internet, Salima has 7%, Zomba has 1.9% and Chikwawa has 2.1%.

The percentages above indicate that the study areas have low access and use of computers, and access to and use of internet. It is important to note that internet is available in the research areas and the most available internet services include mobile phone connectivity, use of dongles supplied by some network providers like Airtel Malawi and Telekom Networks Malawi, and Wireless broadband.

5.9. SUMMARY

The chapter provided a description of the research methodology. The methodology involved use of simple random sampling to identify respondents to the study and purposive sampling to get experts and key informants for FGDs and key informant interviews. A structured questionnaire was administered to the respondents, focus group discussions were also conducted to get more insights on the issues related to climate change. In addition, focus group discussions and key informant interviews were done to dig deeper for new information.

In this study, a combination of both qualitative and quantitative information was gathered and then a mixture of data analysis strategies was used. Two data analysis packages, Excel and SPSS were used to come up with results of findings in all the themes of the study.

The subsequent chapter focuses on the findings and discussions by highlighting the detailed analysis of the results and relationships of characteristics of resilience and key themes of the study.

CHAPTER 6: ANALYSIS OF CLIMATE CHANGE RESILIENCE OF VULNERABLE RURAL COMMUNITIES

The study focused on the analysis of climate change resilience of vulnerable rural communities in Malawi. This chapter provides the detailed analysis and interpretation of the results of the study that are presented in line with its objectives. This is, therefore, a detailed synthesis of the findings of the study that was carried out in the four districts of Karonga, Salima, Chikwawa and Zomba. The analysis is based on several themes related to the study objectives.

During the study, structured questionnaires were administered to study households, FGDs conducted in the study areas, and KIIs were held in both study areas and with various relevant Government Ministries and Civil Society Organisations respectively to collect the data.

Data from household respondents were verified and triangulated through observations during the interviews since data collection was done right at the household and further probing during FGDs and KIIs. Data from FGDs were triangulated by getting further information from KIIs conducted with officers from selected and relevant Government ministries and Civil Society Organisations, while data from KIIs were triangulated by reviewing some literature or documentation related to the themes of the data sought.

The household's respondents were the members of the households that were interviewed at community level and this refers to the villages that were visited during the study. The FGDs comprised selected households/members of the community that participated in the discussions representing the entire community. The KIIs were conducted with a few selected members at district and national levels who are conversant with climate change and development issues. The detailed analysis of the data gathered during the study from the study districts and the findings are described in this chapter in relation to the themes. The themes include demography and socio-economic characteristics of

the study respondents, economic security, water supply, disaster preparedness, peace and security, household opinions on their resilience status, documentation, and dissemination of climate change resilience in Malawi, and synthesis of data to key research questions.

6.1. DEMOGRAPHY AND SOCIOECONOMIC CHARACTERISTICS OF STUDY RESPONDENTS

Demography and socioeconomic characteristics have implications on climate change adaptation and resilience building as such it is very important to comprehend them in any study. Various studies indicate that education, marital status, household size, age, number of children, and occupation have effect on the livelihoods of communities including food security and resilience building.

6.1.1. Total households interviewed

Table 6.1 below shows that a total of 402 households were interviewed from the four study districts of Chikwawa, Karonga, Salima and Zomba using a structured questionnaire. A total of 102 households in Chikwawa, 95 households in Salima, 98 households in Karonga and 107 households in Zomba were sampled and interviewed (refer to Chapter 5 on how they were selected). The results from the sampled households in the table showed that the average household size in the study districts is 5.7 for Karonga, 5.6 for Salima, 5.1 for Zomba and 5.1 for Chikwawa, while the average household size for all the study districts is 5.4.

Table 6.1: Households interviewed per district

District	Frequency	Percentage
Karonga	98	24.4%
Salima	95	23.6%
Zomba	107	26.6%
Chikwawa	102	25.4%
Total	**402**	**100.0%**

In terms of households interviewed per Traditional Authority (TA) in the districts (figure 6.1 below), the results indicate that households from two Traditional Authorities were conducted in Chikwawa District and these are Kasisi and Maseya. In TA Kasisi, 33 respondents were interviewed while in TA Maseya, 69 respondents were interviewed. In Karonga District, interviews were conducted in TA Kyungu and 98 respondents were interviewed. In Salima, 95 respondents were interviewed under TA Ndindi, while in Zomba District, 107 respondents were interviewed in TA Mwambo.

The results also show that the average age of the household heads interviewed during the study is 46 for Karonga, 52 for Salima, 50 for Zomba, and 60 for Chikwawa while the overall average age of the respondents is 52. This means that the households targeted were mature enough to provide the researcher with good data on the issues of climate change.

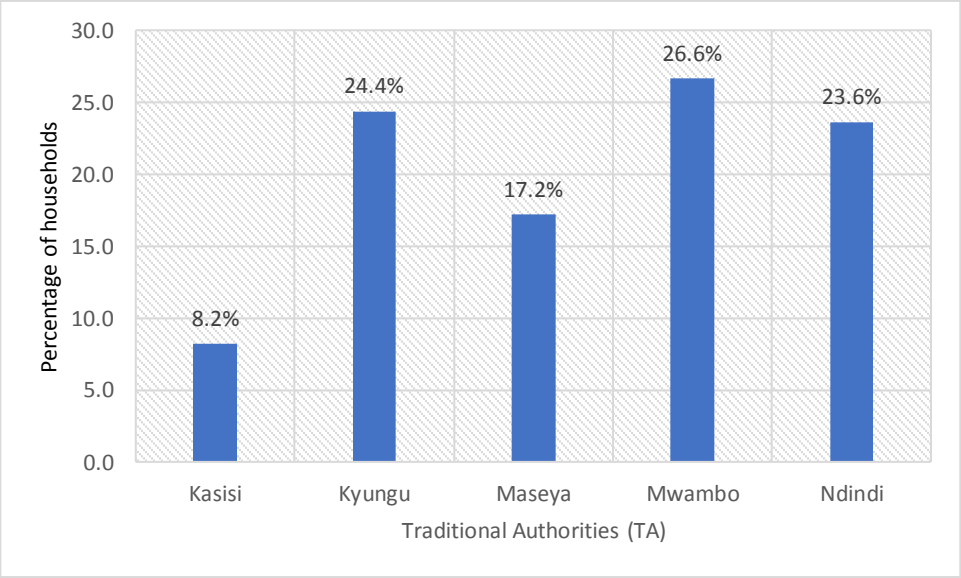

Figure 6.1: Households interviewed at Traditional Authority Level

6.1.2. Gender of households

As regards to the gender lens, out of the 402 households interviewed, 153 females were interviewed while 249 male households (see figure 6.2 – pie chart). In terms of district level households, it is discovered that

Karonga had 75.5% male and 24.5% female, Salima had 47.4% male and 52.6% female, Zomba had 50.5% male and 49.5% female, and Chikwawa had 73.5% male and 26.5% female.

This implies that the study interviewed more men than women, the reason being that in most of the areas, men are regarded as heads of households and therefore, are given responsibilities to represent the household. However, it was also found out that there were women who head some households and are also part of making decisions for the household or community hence they were also targeted in this study.

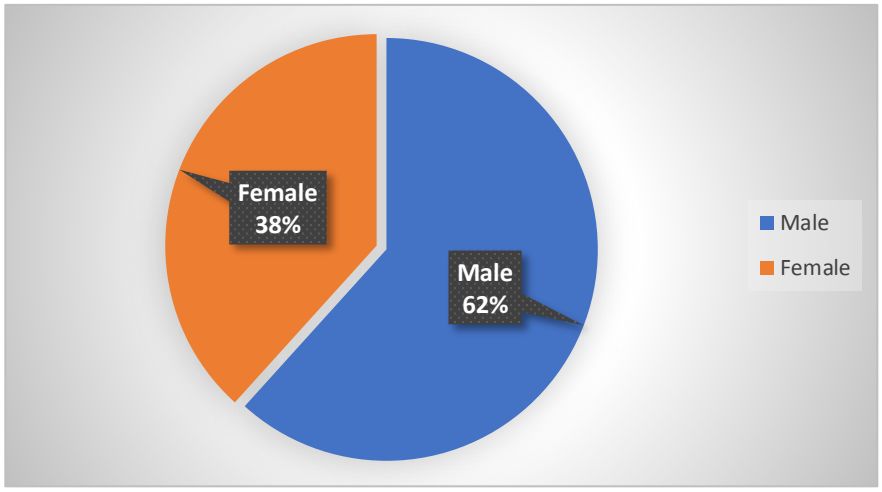

Figure 6.2: Gender of head of households interviewed

6.1.3. Marital status of the households

In terms of marital status (figure 6.3), 76% of the households were married, 3.2% were not married, 13.5% were widows, 4.2% were widowers and 3.1% were divorced in Karonga. In Salima, 71% households were married, 4.3% were not married, 10.8% were widows, 2.2% were widowers, and 11.8% were divorced. In Zomba, 76.2% households were married, 1% were not married, 5.7% were widows, 5.7 were widowers, and 11.4% were divorced. While in Chikwawa, 73.7% households were married, 2.5% were not married, 8.6% were widows, 6.1% were widowers, and 9.1% were divorced. The overall percentages for marital status of the households in all the four study districts are

shown in figure 6.3 below. Marital status is one of the critical factors in understanding general livelihoods options and climate resilience building actions because they are linked to gender and development. Marriage as an institution provides a platform for sharing ideas on how to improve households' livelihoods and this helps household members to understand the needs of the households. It is also a foundation for all households in a society to lead and observe the cultural systems and customs. However, it is also important to know that marital status affects the social fabric of the society hence affecting development of a community in one way or the other.

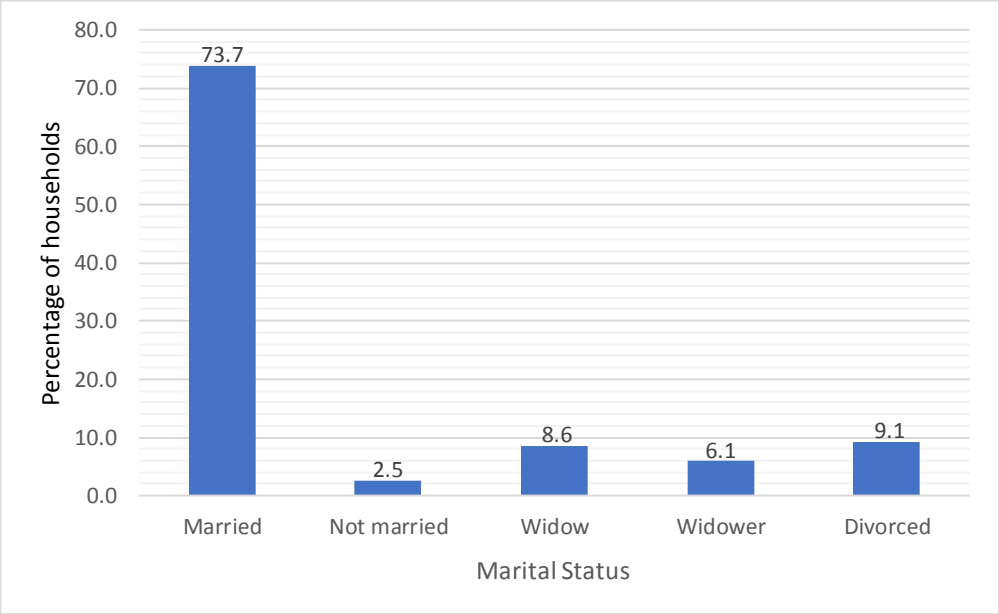

Figure 6.3: Marital status of study respondents

6.1.4. Languages spoken in the study areas

As regards to languages that are spoken in the study districts, the results from households and Focus Group Discussions show that Ngonde and Tumbuka (50 % and 45% respectively) are spoken widely in Karonga; Chichewa and Yao (75% and 25% respectively) are spoken widely in Salima; Chichewa and Sena (50 and 50% respectively) are spoken widely in Chikwawa; and Chichewa and Lhomwe (60% and 40% respectively) are spoken widely in Zomba. This means that the common language in all the four districts is Chichewa though people in Karonga

can understand it and have challenges in fluently speaking it. It should be taken into consideration that language is a very important tool for communication as such it is key to any development discourse. This is because transfer of knowledge, information and skills requires effective communication hence language is crucial in realising this. So, for any initiative on climate resilience building among communities to be achieved, communication through their preferred or native language is very vital.

6.1.5. Education levels in the study districts

The study results as shown in figure 6.4 discovered that many households interviewed attended Primary school education followed by those households that have never attended any school. In general terms, this means that out of the total 402 households, 318 households representing 79% know how to read. This implies that most of the respondents can understand contemporary issues that affect their own life, and they can plan on how to improve their livelihood.

Based on the statistics from the districts, education levels are also instrumental in understanding the socio-economic contexts of the respective study areas. Literacy levels of the households/communities coupled with literacy abilities is an important determinant to livelihoods improvement and climate resilience building (Tran et al, 2018). For example, if a society is composed of illiterate people, it means it is difficult for them to comprehend any development related issues let alone extension messages from development practitioners. This can lead to loss of livelihoods, slowed development and eventually a society which is not resilient to various challenges more especially climate change. On the other hand, when a society has people with high literacy levels, they are able to understand any aspects of development, have better uptake of extension services, are able to initiate their own actions to improve their livelihoods, increase their adaptive capacity, and are able to build resilience to climate change and related shocks. As a matter

of emphasis, it is a fact that high literacy levels influence knowledge uptake and interpretation of current affairs in a positive manner whereas low literacy levels impede it (Maharjan & Chihetri, 2006).

It should be noted from the findings that the numbers of people attaining school was dwindling drastically from primary to tertiary due to what they called lack of resources to support education, early child pregnancies and marriages, and poor school infrastructures. This entails that most of the respondents or households that were interviewed had either primary or junior secondary school education levels and that college and university education is a problem. It was also discovered that in all the four study districts, the most affected group of youth in terms of school dropout is girls due to early child pregnancies and marriages. This gives a burden to the society in the sense that there is an increase in population, the marriages have no adequate resources to support their day-to-day livelihood as such they cannot contribute to socio-economic development of the community. In the end, there is wide spread of poverty in the community hence declined economic and resilience levels.

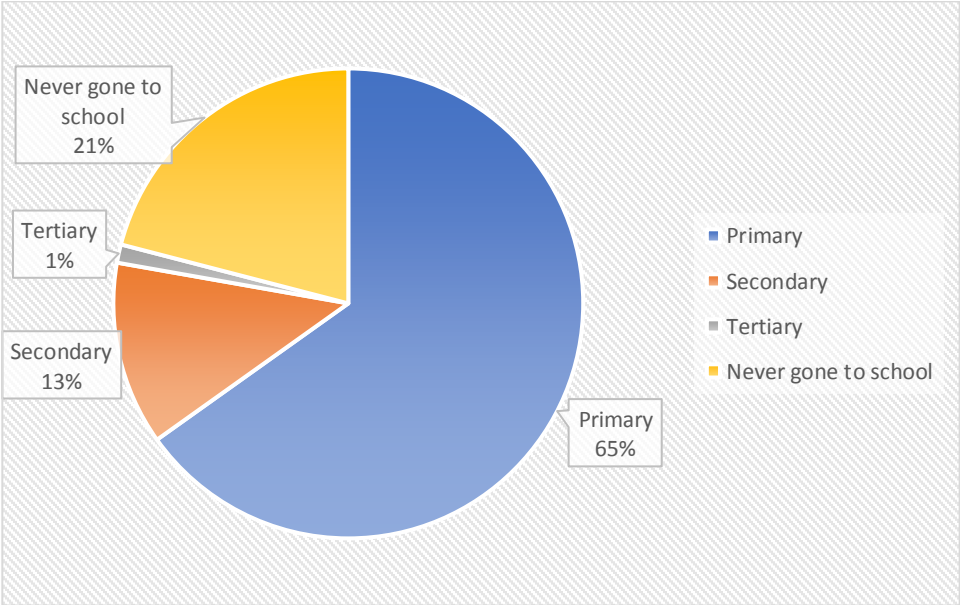

Figure 6.4: Education levels for Respondents or Households

6.1.6. Occupation of respondents/households

The study discovered that the respondents are involved in more than one occupation for their day-to-day livelihood. Table 6.2 below shows the frequency of households involved in a particular occupation and the percentage number of that frequency. The occupations are indicated according to the respondents' priority of ranking of the occupation and their significance in improving livelihoods and building resilience. As indicated in table 6.2 below, it is important to note that the number of households interviewed was still 402 but the total went to 802 because the researcher counted the frequency. This is because a household was involved in more than one occupation hence double counting.

Different types of occupations are important determinants of a household's well-being because they support different socio-economic activities in each community or locality. Most of the occupations are on farm and non-fam, meaning that there is a combination of various strategies of improving household livelihoods. That's the reason why livelihoods are linked to climate change and resilience building as they also determine the context in which adaptation to climate change and building community resilience to climate change is achieved. The occupations of the respondents shown in table 6.2 above are also presented in figure 6.5 to show percentages of the occupations.

The results show that across the study districts, the most significant occupation that the households or respondents are involved in for their well-being include agriculture, piece work, trading, and fishing. The least significant occupations that were also identified are wage labour, formal employment, and mining. It is vital to understand that agriculture is the main occupation for households across the four study districts which is a source of food and income. The different types of occupations that are being undertaken in these study areas signify the types of livelihoods that are being enjoyed by communities/respondents themselves. These occupations are linked to climate change hence they are affected by its impacts differently and this determines the type of strategies for livelihoods improvement as indicated above. The other occupations are

regarded as least or minor because they are secondary or optional to the households, and that sometimes they are used as alternatives when the main occupations are not providing adequate income, food and other basic resources required for households and community livelihood.

Table 6.2: Occupation of the households

Occupation	Frequency	Percentage
Agriculture/farming	366	45.6%
Trader	99	12.3%
Wage labour	32	4.0%
Piece work	234	29.2%
Fishing	47	5.9%
Formal employment	22	2.7%
Mining	2	0.2%
Total	**802**	**100%**

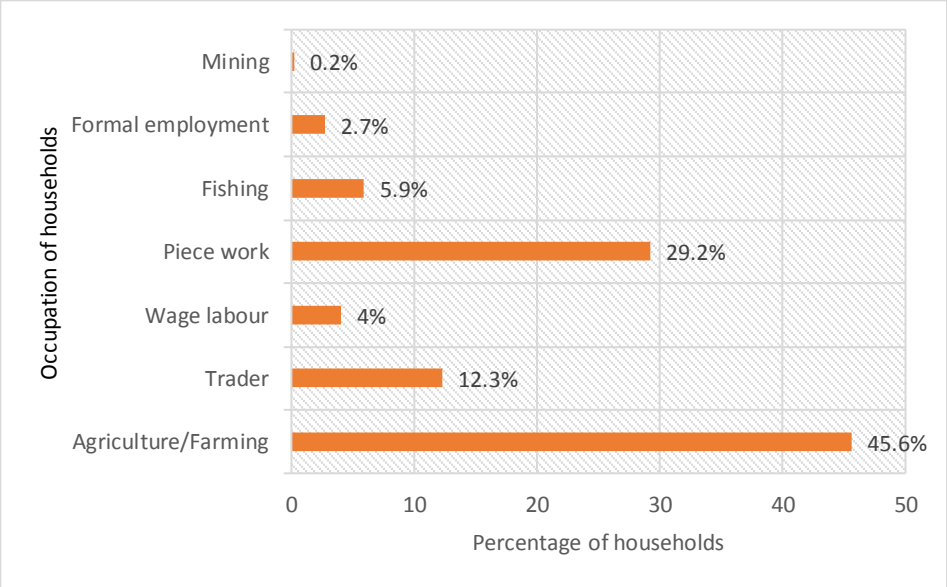

Figure 6.5: Occupation of Households, n= 402

6.2. ECONOMIC SECURITY

This is one of the characteristics of community resilience, and the study investigated the extent of economic security in the study areas by looking into several themes.

6.2.1. Land tenure and land use

Land is one of the important factors for agricultural productivity and livelihoods improvement and it is a resource that contribute to any development. Land is used for agricultural production (farmland), infrastructure development (roads, schools, railways), housing (residential), recreation (regeneration, leisure, non-essentials like national parks, and forests), and commercial use (enterprises, industries, and factories).

Land ownership by households

The findings show that most of the households interviewed own land for agriculture and other uses (figure 6.6). It was found during the FGDs that in the study area there are two types of marriage system which are patrilineal (Chitengwa), and matrilineal (Chikamwini). Marriage systems have allusions on livelihoods programming such that some gender groups are not willing to invest in their matrimonial homes because of the cultural values associated with the marriage system in the area. For instance, under matrilineal systems, men are afraid to invest in their matrimonial homes as they are not permanent citizens of the villages. It was also discovered that when males are in matrilineal marriage systems, they cannot even invest in environment and natural resources management as part of contributing to recreation, for instance, men declined that they would not plant trees in their matrimonial homes. It is understood that land use and land cover variations are said to be impinging on climate processes at subnational, national, and global levels (Mahmood, Pielke, Hubbard, Ni yogi, Bonan, Lawrence, McNider, McAlpine, Etter, Gameda, Qian, Carleton, Beltran-Przekurat, Chase, Quintanar, Adegoke, Vezhapp arambu, Conner, Asefi, sertel, Legates, Wu, Hale, Frauenfeld, Watts, Shepherd, Mitra, Anantharaj, Fall, Lund, Trevino, Blanken, Du, Chang, & Leeper. 2010). In this case, marriage

systems have a bearing on land ownership and can affect how land would be utilised hence affecting agricultural productivity and other land uses.

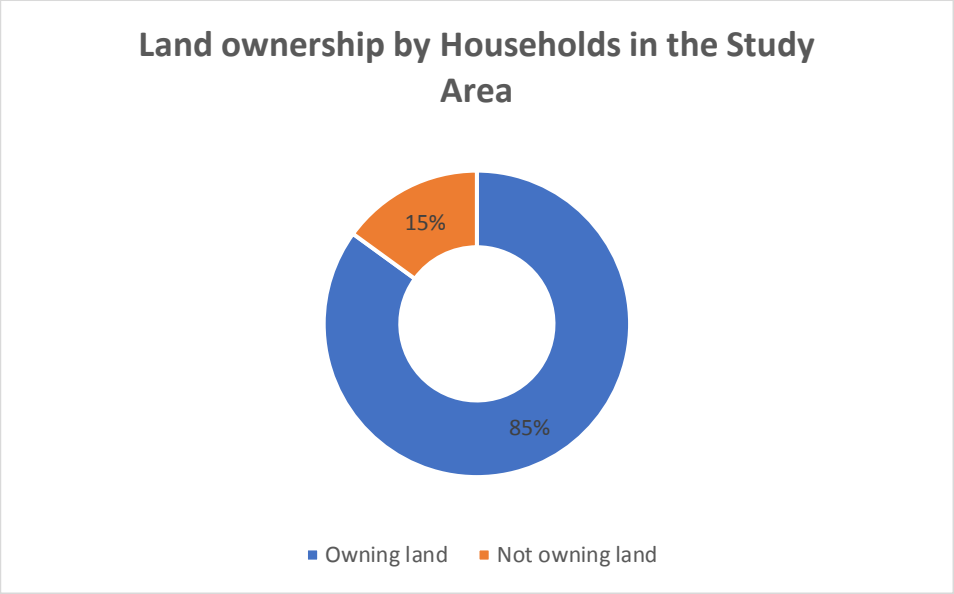

Figure 6.6: Land ownership by households

Land utilisation by households

The results on utilisation of land show that out of the 342 total households that own the land, 318 households representing 93% of these households indicated that they cultivate all the land for agricultural production while 24 households representing 7% of the households indicated that they do not cultivate all the land. Further, those households that do not cultivate all the land said that they utilise the remaining land by renting it to others for financial gain, share cropping, and fallowing it. According to the results (Table 6.3), households utilise the land for various ways and they include renting it for financial gain, do share cropping, and practise fallowing of the land.

Households that do not own any land were asked how they produce crops, and it was discovered that out of the total of 60 households that do not own land, 38 respondents representing 62.7% rent land from others to grow crops while 22 respondents representing 37.3% buy the produce for their households.

It should be known that land is a precious resource that supports households in ensuring that the household has perennial income because of the agricultural produce grown on it and when it is rented out for income. Land plays a vital role in supporting households improve their resilient livelihoods.

Table 6.3: Utilisation of remaining land by households

Purpose	Frequency	Percentage (%)
Rent it for financial gain	10	55.6%
Share cropping	3	16.7%
Fallow	5	27.8%
Total	18	100.0%

The 342 total households that own land were also asked whether they have documentation for their land or not. It was reported that most of the households have no documentation of the land while a few households have documentation for their land in a form of title deed or lease certificate as shown in figure 6.7 below. This is typical of Malawian villagers because most of the land owned by villages is not documented. The land is transferred from grandparents to children and to grandchildren, the land is transferred through the lineage of that family and this acts as security for the land. It should also be noted that most of the land is customary in nature across the country.

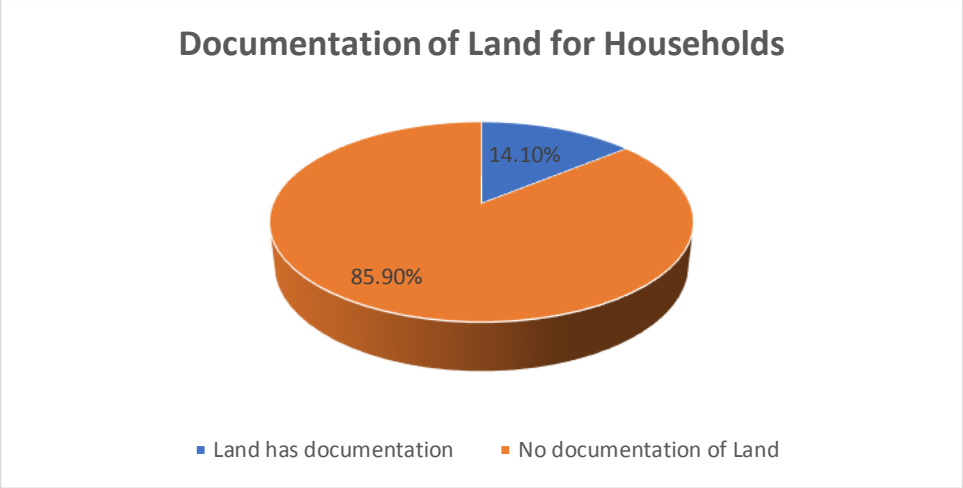

Figure 6.7: Documentation of land for households in the districts

Fertility of the soil in the study districts

The fertility of soil/land determines its productivity in relation to agricultural production or farming. The findings on soil fertility in all the three districts was discovered through observation and self-reporting of respondents. Across all the study districts, the findings revealed that 253 respondents representing 74% of the households' own land that is of low fertility while 89 respondents representing 26% of the households' own land that is slightly fertile. Figure 6.8 shows findings for each district on household with land that is slightly fertile and those households with land that has low fertility or is less fertile. This mean that according to the results, Zomba District has soils that are more or slightly fertile than any other district. In other words, most of the soils in Chikwawa, Karonga and Salima have low fertility such that their productivity is low. This entails that most of the land in these study districts is infertile and require improvement through application of either organic or chemical fertilisers for maximum productivity.

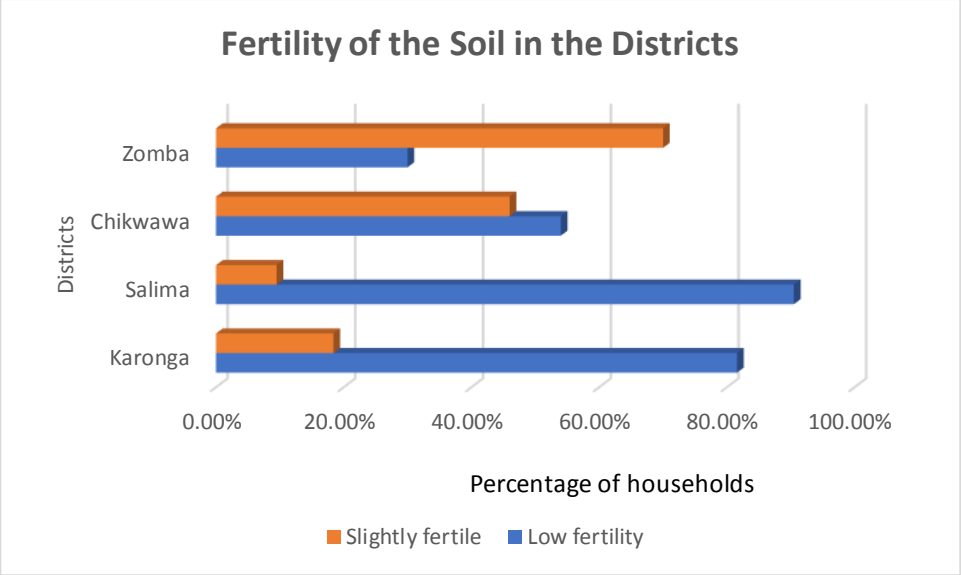

Figure 6.8: Fertility of soil in the study districts

6.2.2. Types of farming by households

The results indicate different types of farming that the respondents' practice as part of livelihood improvement and adapting to the changing climate. It is reported that the households in the study districts are involved in various types of farming and they include mixed farming, rainfed agriculture, and irrigated farming (Figure 6.9). It was discovered during the study that in all the study districts, households still depend on rainfed agriculture for their livelihood despite facing the challenge of changing climate seconded by mixed faming (production of various crops and livestock for food and income), and the least adopted type of farming is irrigation. This is the case when irrigated agriculture has proved to be one of the best strategies for adapting to climate change impacts because it is a source of supplementary food to what is produced by rainfed and a source of additional income. Farmers are facing challenges to implement irrigated farming technology because of inadequate technical knowhow in the management of related activities, sufficient resources, little or no extension service to improve on the practise, and lack of political will in relation to investing in irrigation farming in Malawi.

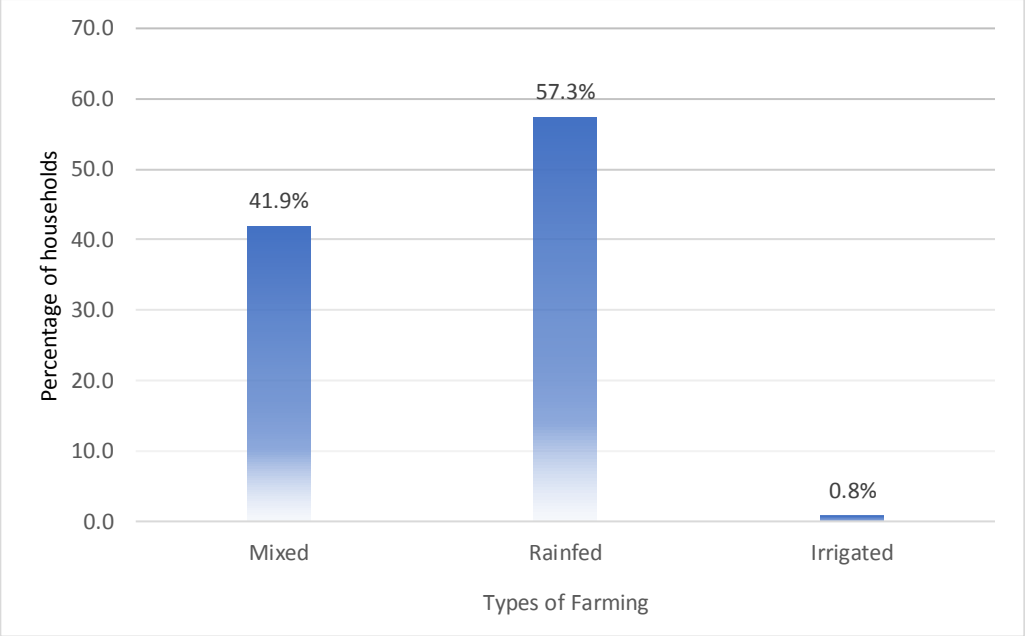

Figure 6.9: Types of farming practised by respondents

6.2.3. Crop husbandry for households

Crop husbandry is also one of the elements that support households in ensuring that household income and food are accessible because of various crops produced. The study established that the households in the districts grow various crops for their livelihoods. This entails that the main source of livelihood and income is farming or crop production.

According to the findings, the frequencies of various crops in terms of production varies significantly based on how the respondents value the crops grown. According to the results, crops grown by the households in the study districts include maize, groundnuts, pigeon peas, sweet potato, sorghum, cassava, millet, beans, soybeans, sugarcane, paprika, and tobacco. The results as shown in Table 6.4 clearly indicate that the most grown crops in the study areas whether as cash crop or food crops include maize, groundnuts, pigeon peas, sweet potato, sorghum, rice, and cassava. This means that the households are practising crop diversification but on a low scale because very few households were able to grow more than one crop for household food and income, such that most households do not diversify their crops at a larger and commercial

scale. This is affecting their objectives of improving their food security status and household income.

Table 6.4: Crop husbandry for the population in the Study areas

Crop	Frequency	Percentage
Maize	371	92.3%
Groundnuts	139	34.6%
Pigeon peas	127	31.6%
Sweet potato	110	27.4%
Sorghum	79	19.7%
Rice	68	16.9%
Cassava	67	16.7%
Millet	50	12.4%
Beans	43	10.7%
Soybeans	25	6.2%
Sugarcane	12	3.0%
Paprika	4	1.0%
Tobacco	1	0.2%

6.2.4. Main sources of food for households

The respondents were also asked their main sources of food and the results revealed several sources of food for the households in the study districts. The results show that the respondents rely on own production as their main source of food; depend on buying the food as their main source of food; relying on free distribution or relief work as their source of food; and they go for piece work as another main source of food (figure 6.10).

This implies that the two main sources of food in the study areas are own production and buying the produce. Own production means that they produce their own crops since they own land, while buying the produce relates to the fact that they purchase from traders or those people that produce food crops on their land.

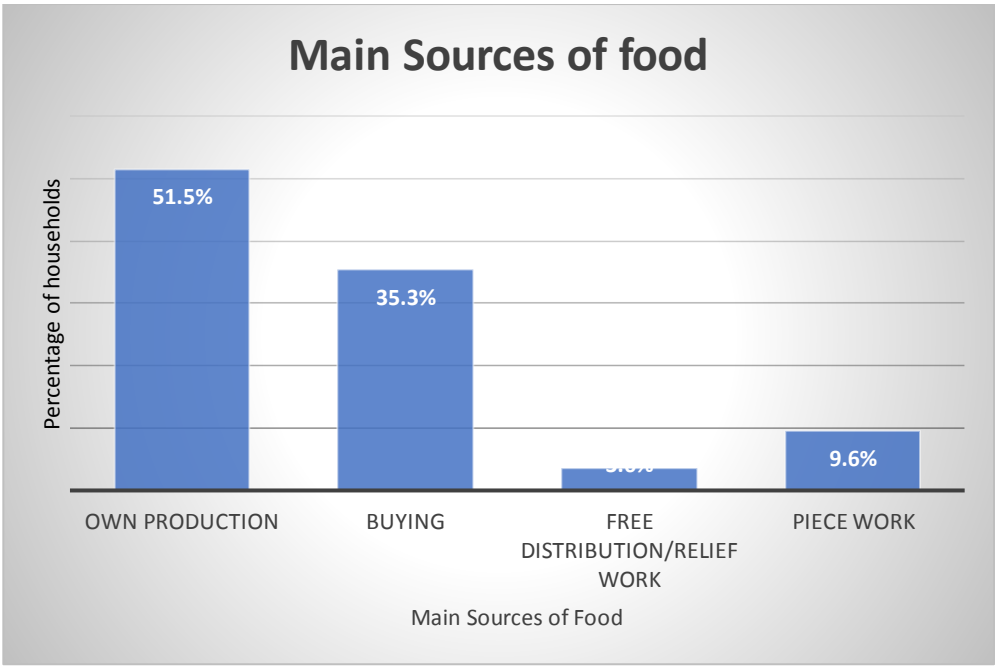

Figure 6.10: Main sources of food for the respondents in the study area

6.2.5. Yield of major crops in the study areas

The results discovered that yields for all crops vary according to production in all the households (Table 6.5). This means that production of various crops is affected by a few factors that are related to climate change and these include soil infertility, droughts, dry spells, pests and diseases, uneven distribution, and inadequate amounts of rainfall.

The standard deviations of all the crops still show differences regarding yield for each crop per harvest. For example, maize is produced in large quantities seconded by sweet potatoes, while the crop with lowest yield is Paprika. It should be noted that the standard deviation of the crops simply signifies the uniformity of yields of the crops among the farmers. This means that the respondents from all the study districts value maize as a staple food and sometimes sell it for income. According to households' responses, maize is the main staple food for people of Salima and Zomba, cassava and maize are main staple foods for people of Karonga, sorghum and millet are main staple foods for Chikwawa. Beans, groundnuts, soybeans, paprika, sweet potato, pigeon peas and

sugarcane are main cash crops across all the study district even though they can also be used as food.

Table 6.5: Yield in kilogrammes of major crops in the study areas

	N	Minimum	Maximum	Mean	Standard. Deviation
Maize	361	0	3,750	308.1	386.3
Beans	47	5	250	73.0	65.8
Groundnuts	120	10	1,250	174.5	210.0
Soybeans	19	15	600	141.1	178.3
Cassava	42	10	1,000	153.3	199.4
Paprika	4	20	100	48.8	36.6
Sweet potato	81	15	1,500	185.6	275.3
Pigeon peas	115	5	1,500	84.0	147.3
Sugar cane	10	12.5	400	186.8	130.6
Sorghum	73	0	1,250	165.6	204.3
Millet	41	25	750	220.1	178.6

6.2.6. Challenges faced by respondents in agriculture production

The study also attempted to identify challenges faced by the respondents in general agricultural production and they mentioned several challenges of which most of them are also related to climate change and livelihoods.

The total number of households interviewed was 402 but the frequency was higher because of double counting since almost all the challenges affect all the respondents reached and a household is affected by more than one challenge. The results revealed that theft, floods, livestock and crop raiding, weeds, lack of oxen, inadequate labour, small land size, soil erosion, lack of improved agricultural inputs, soil infertility, drought, insects and diseases, and erratic rainfall.

The results in figure 6.11 below show that the main challenges that affect agricultural production include erratic rainfall; insects, pests, and diseases; drought; soil infertility, lack of improved agricultural inputs, soil erosion and small land size.

The major challenges as described above are erratic rainfall, drought, and lack of improved agricultural inputs. It is important to note that erratic rainfall and drought can be averted if the smallholder farmers access improved agricultural inputs, unfortunately, this is not the case. It was discovered that farmers in these study districts use recycled seeds, primitive and traditional pesticides that are not effective. In addition, they have no access to improved fertilisers to boost their agricultural productivity.

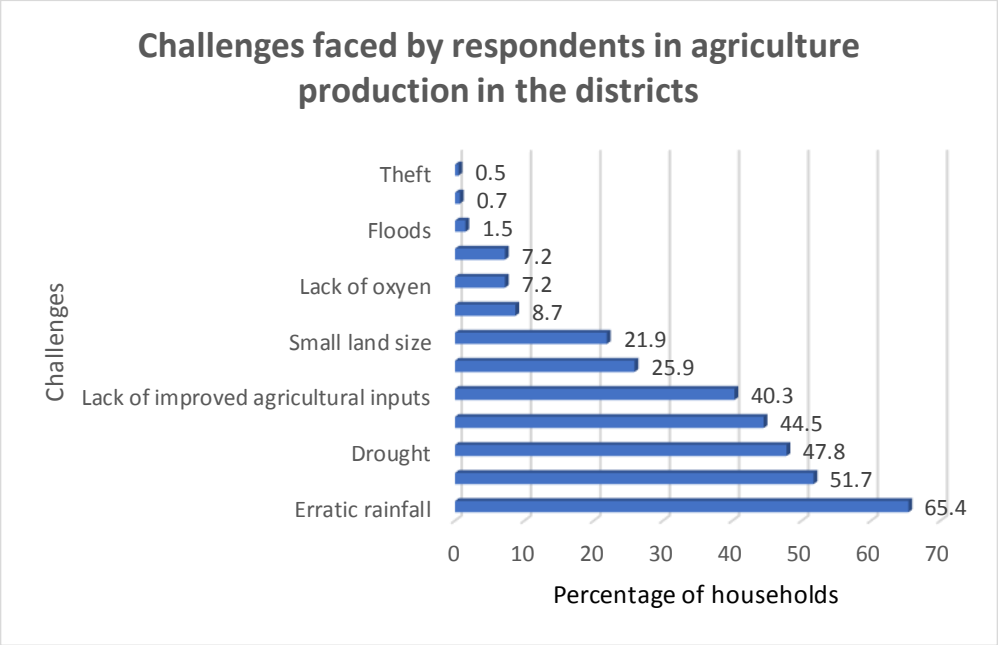

Figure 6.11: Challenges faced by respondents in agriculture production

6.2.7. Strategies for meeting daily needs in times of cash and food shortage

The challenges in agriculture production bring scarcity and shortages of necessities at household and community levels. Bearing this in mind, the respondents were asked about the strategies that they employ to meet daily needs in times of cash and food shortage.

The results indicate that the respondents employ various strategies for meeting daily needs in times of cash and food shortage and they include practising petty trade, piece work, selling livestock and/or household assets. These are regarded as the strategies employed by the

respondents to avert cash and food shortages. Figure 6.12 indicates that the respondents prefer piece work seconded by practising petty trade, and finally selling livestock and/or household assets.

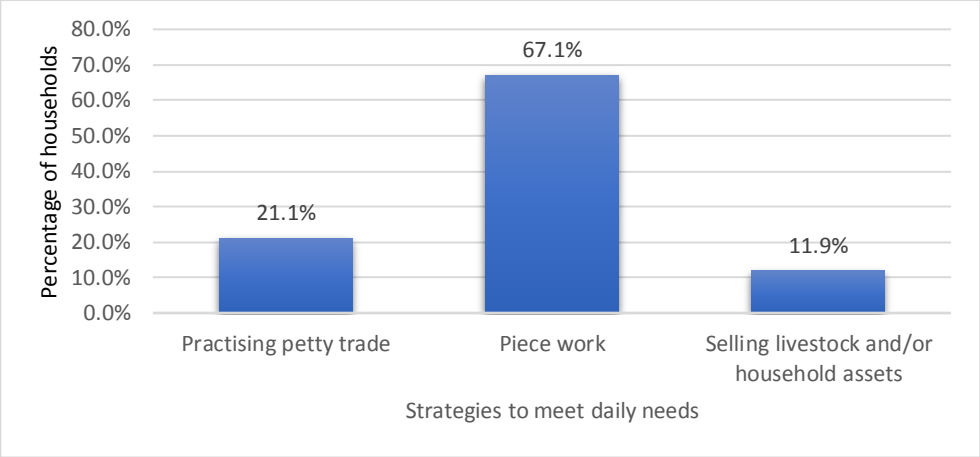

Figure 6.12: Strategies employed in times of cash and food shortage

6.2.8. Livestock production

Livestock production is one of the important interventions that can help in ensuring that rural communities are adapting to climate change because livestock provide milk and meat for food and nutrition security, and household income after selling them.

Livestock ownership by households

The study results discovered that some household's own livestock while others do not. The total 402 households were interviewed, and the findings show that 232 households representing 57.7% reported that they own livestock, 170 households representing 42.3% stated that they do not own livestock. Figure 6.13 is a bar chart showing types of livestock owned by the households in the study area. This means that the main types of livestock reared by households in the study districts include chickens, goats, ducks, pigs, and cattle.

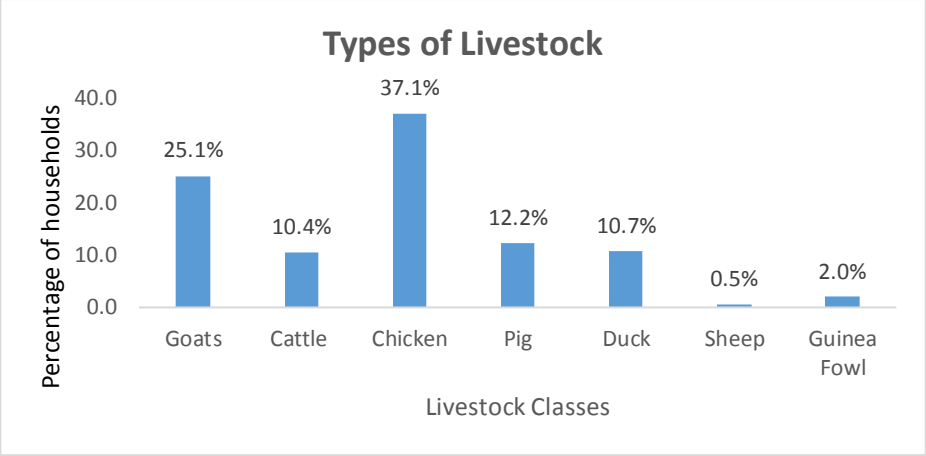

Figure 6.13: Types of livestock owned by households

The results show that most of the households do rear chickens seconded by goats probably because they are easy to be tamed and a preference of the households. Looking at the status of different types of livestock owned by households in the study area, there are still many households that do not rear any livestock. As indicated earlier, livestock production is one important strategy for climate adaptation and resilience building. In Southern Africa, livestock is becoming more significant as a strategy for adapting to climate change that contribute to building household and community resilience (Belachew & Zuberti, 2015).

Beyond livestock ownership of the respondents, an analysis of the respondents in terms of livestock ownership and their estimated values was done. Table 6.6 below highlights minimum livestock owned, maximum livestock owned, the average ownership, and the average estimated value in all the districts under the study. Cumulative results indicate that goats, chickens, and pigs are mostly owned by respondents, while in terms of value of the livestock that are not highly owned but are better off are cattle and pigs. However, ownership of these livestock is on a small scale because of poverty levels at household and community levels in the study districts. Cattle and pigs followed by goats fetch high prices when sold and are regarded as important in boosting household income within a short period.

It is vital to note and understand that for most of the classes of livestock reared in these study areas, the standard deviation is precise because the number of livestock is not normally and evenly distributed. People have different herds of livestock though not at a commercial scale, and it was discovered that some farmers/households keep livestock just for prestige.

Table 6.6: Livestock owned and average estimate value in Malawi Kwacha

Class of Livestock	N	Minimum	Maximum	Mean	Std. Deviation	Average Estimated value (MK)
Goats	101	1	16	2.73	2.588	56,848
Cattle	42	1.00	21.00	3.8810	3.72338	610,447
Chickens	149	1	30	5.32	4.716	131,198
Pigs	49	1	35	4.27	7.339	82,320
Ducks	43	1	4000	97.07	609.373	12,495
Sheep	2	1	5	3.00	2.828	22,500
Guinea fowls	8	2	20	6.00	6.094	9,761

6.2.9. Household assets

Availability of assets in the household implies that the household can cope with climate shocks or any shocks because they help in improving their livelihoods. Household assets provide alternative livelihood opportunities to the members of the household because they can use them for various purposes.

Assets ownership by households

When asked, all the households indicated that they have assets of some sort. The respondents stated that they own different types of household assets that contribute to their livelihoods. The study findings show the frequency of assets ownership in all respective districts (Table 6.7). The

respondents in the study districts own radios, oxcarts, ploughs or ridgers, sprayers, sewing machines, motorcycles, television, decent houses, and hoes. No household owns a car in the study districts. Ownership of assets in the districts is a problem as evidenced by the low percentages and this signifies high levels of poverty that affect livelihood options. This, in turn, also affects resilience of households to climate change because of inadequate livelihoods alternatives. However, those households that own some assets show some levels of resilience and improved livelihoods.

Table 6.7: Household assets ownership in the study districts

Type of Asset	Karonga (% Ownership)	Salima (% Ownership)	Chikwawa (% Ownership)	Zomba (% Ownership)	Estimated Unit Value (USD)
Radio	10.3%	12%	3%	5%	25.00
Bicycle	15%	13%	2.8%	10%	80.00
Oxcart	0.5%	2%	0%	0%	460.00
Plough/Ridger	3%	1.7%	0%	0%	1200.00
Sprayer	0.7%	2%	1%	0%	200.00
Sewing Machine	0%	0%	0%	0.5%	150.00
Motorcycle	0.2%	1.8%	0%	0%	4,000.00
Car	0%	0%	0%	0%	0.00
Television	0%	1.2%	1%	0%	170.00
House	55.7%	72%	45%	68%	600.00
Hoes	82.5%	80.1%	76%	92.3%	7.50

Ways of acquiring household assets

The households narrated that there are several ways of how they acquire the household assets. The study revealed that households in the study district acquire their household assets by buying, getting them through donations, exchange for labour, and getting from relatives.

It is clear from the results (figure 6.14) that most households own assets that have low value because they can afford to buy and use them. The household income levels do not allow them to go for other assets with high value as such there is a big gap between household income and the assets that can help in improving their livelihood. This is related to household status as regards to poverty levels in such a way that if a household has little or no meaningful assets, it becomes very difficult to plan and implement actions that will lead to increased food self-sufficiency, food security, increased income, and access to decent life. As a result, the household is oftentimes engaged in petty activities to survive and not to uplift their well-being by going beyond survival mechanism. This eventually prevents the household or community from coming up with ideas and plans of how it can improve the life of members and increase their resilient livelihoods.

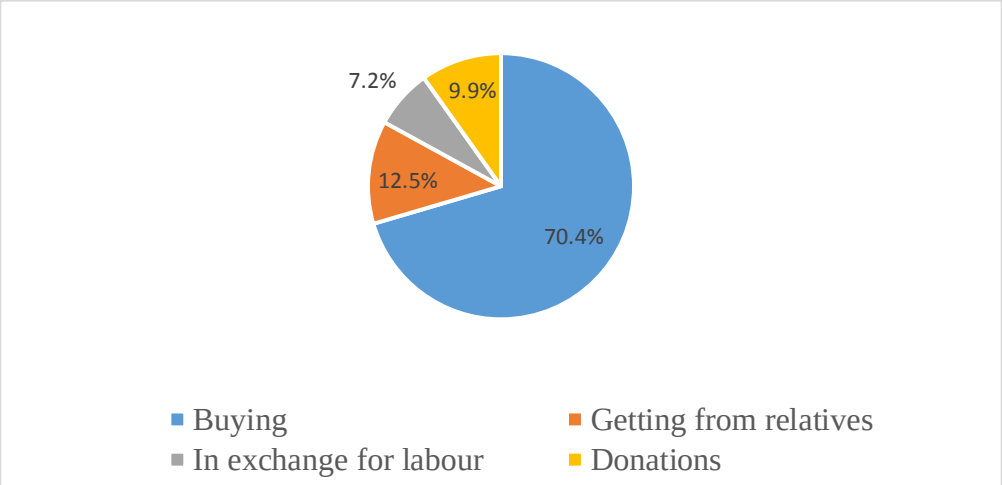

Figure 6.14: Ways of acquiring household assets

Assets contribution to livelihood of households

The respondents were also asked on how the assets contribute to their livelihoods and they explained that assets bring income to the household, bring food after selling them, help in transportation, for farming activities, shelter, and information and communication (figure 6.15).

The uses of assets in any household or society provide a basis for resilient livelihoods because they provide an opportunity for households to access basic amenities. For example, when some assets help to bring income in the household, what will happen is that the income will make it easy for the household to buy some basic things such as food, clothes, additional assets, and pay for other services. Similarly, if a household depends on agriculture as is the case in all the study areas, some assets will help in ensuring that agricultural activities are easily implemented. This assists households that rely on farming for their livelihoods since they will be able to produce crops for food and cash. It is important to note that household assets are key in improving household livelihoods and resilience building.

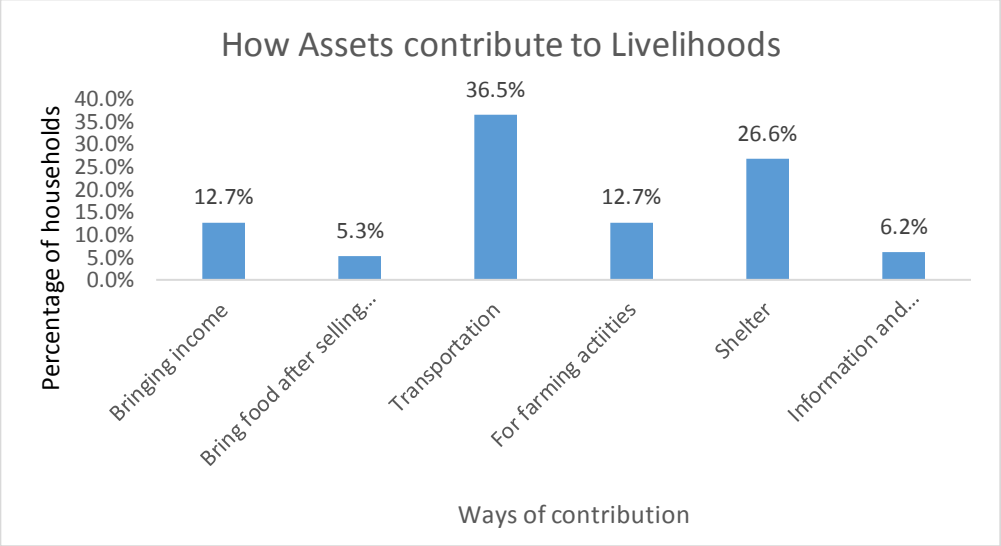

Figure 6.15: Ways of how assets contribute to livelihoods of households

6.1.10. Sources of credit for households in the districts

The study results revealed that the households have some sources of credit for household use in terms of meeting livelihood opportunities and these include getting credit from relatives, micro loan institutions, banks, cooperatives, Village Savings and Loans (figure 6.16). The results clearly indicate that the main sources of credit which the households rely on are relatives, Village Savings and Loans (VSL), and cooperatives.

For households to enjoy daily living, there is a need to have access of some sort of income that will enable them to improve their purchasing power. This means that if households have steady income, they can do various enterprises and purchase household's basic needs. Household income is determined by several elements and some of them are size of the household, gender of its members, household members age, health status, educational level, availability of capital and assets, ethnicity of the households and employment status (Tuyen, 2015). As such, study respondents were asked of how they get their income for various uses in the household.

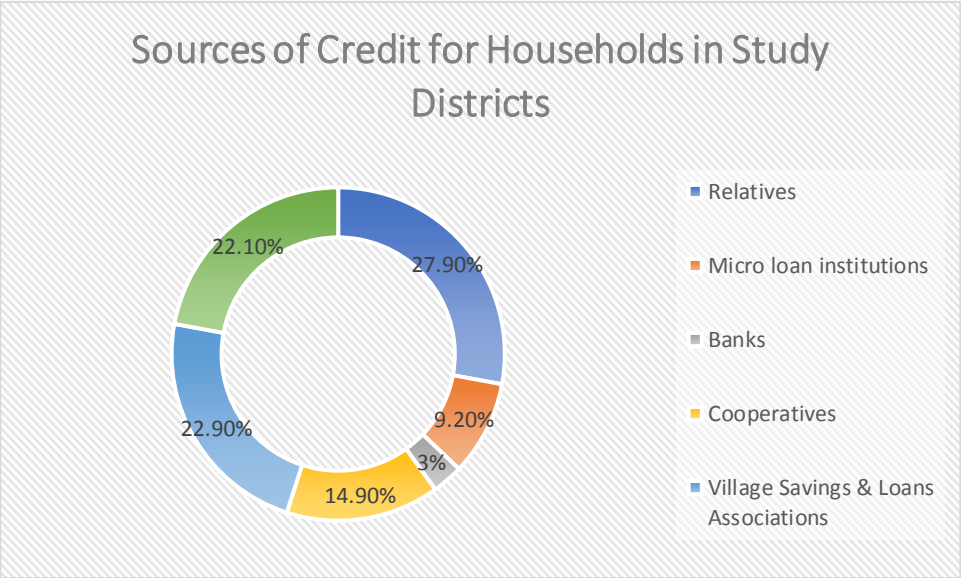

Figure 6.16: Sources of credit for households

6.2.11. Coping mechanisms and availability of food

Coping mechanisms in times of livestock and crop failure

The study tried to discover coping mechanisms that people employ to cushion themselves from effects of climate change in times of livestock and crop failure. Table 6.8 below shows specific findings in terms of results in percentage in relation to peoples' coping mechanisms in times of livestock and crop failure. The respondents provided more than one (multiple) mechanisms across the four study districts. The results show that the major mechanisms include piece work, reducing number of meals per day, borrow money with interest, begging from friends, and fetching fuelwood for sale. The other mechanisms employed at a small scale are migration, wild fruits collection, and sale of household assets including livestock.

Table 6.8: Coping mechanisms in times of livestock and crop failure

Coping Mechanism	District Name				Average Total
	Karonga	Salima	Zomba	Chikwawa	
Piece work	75%	94.7%	96.2%	91.1%	89.4%
Reduce number of meals per day	46.9%	60.6%	41.9%	47.5%	49%
Borrow money with interest	18.8%	31.9%	3.8%	19.8%	18.2%
Migration	1%	1.1%	1.9%	8.9%	3.3%
Begging from friends	25%	30.9%	20%	40.6%	29%
Wild fruits collection	2.1%	14.9%	3.8%	18.8%	9.8%
Fetching fuelwood for sale	24%	55.3%	1%	9.9%	21.7%
Sale of household assets including livestock	24%	4.3%	1%	14.9%	10.9%

Kind of assistance households get in times of food deficit

The respondents were also asked the kind of assistance they get from the Government and other stakeholders such as Non-Governmental Organisations (NGOs) to supplement to food deficits. The findings (figure 6.17) revealed the types of assistance that they get from stakeholders in times of food deficit, and they include getting food aid from the Government, getting cash transfer from the government, and food for work programme. This implies that the three major types of assistance that people in the study districts get from Government and other stakeholders are food aid, cash transfer, and food for work programme. Karonga District has lower food aid as compared to the other three districts because the area relies much on support from the government, and logistical challenges due to distance affect food aid. There are very little or no Non-Governmental Organisations and Non-State Actors who provide humanitarian support to vulnerable households in this area as compared to the other districts. In addition, it is discovered that there are clear differences in food aid, cash transfers and food for work programme combined. This is like that because the Government and other stakeholders provide support to households based on the need as per the annual assessments that are done on households vulnerability. The assessments reveal the levels of vulnerability for each element in a district. According to the Post Disaster Needs Assessment of 2019, the findings show that some districts are more vulnerable than others on aspects of food insecurity, income among other factors. For example, the report indicates Karonga, Chikwawa and Zomba as more hit by climate related disasters hence more vulnerable.

Since most of the respondents indicated that they are aware of climate change and that climate change brings about effects and impacts on the livelihood of people, they were then asked if there are any positive opportunities that they think climate change has brought for them and their households. Overall, the results show that 5.8% households reported that climate change has brought positive opportunities while 94.2% households indicated that climate change has not brought

positive opportunities. The households that reported that climate change has brought positive opportunities provided reasons such as getting trained on some topical issues, accessing additional support like food aid and cash. While the majority explained that climate change is responsible for the many effects and impacts that the world at large is facing today.

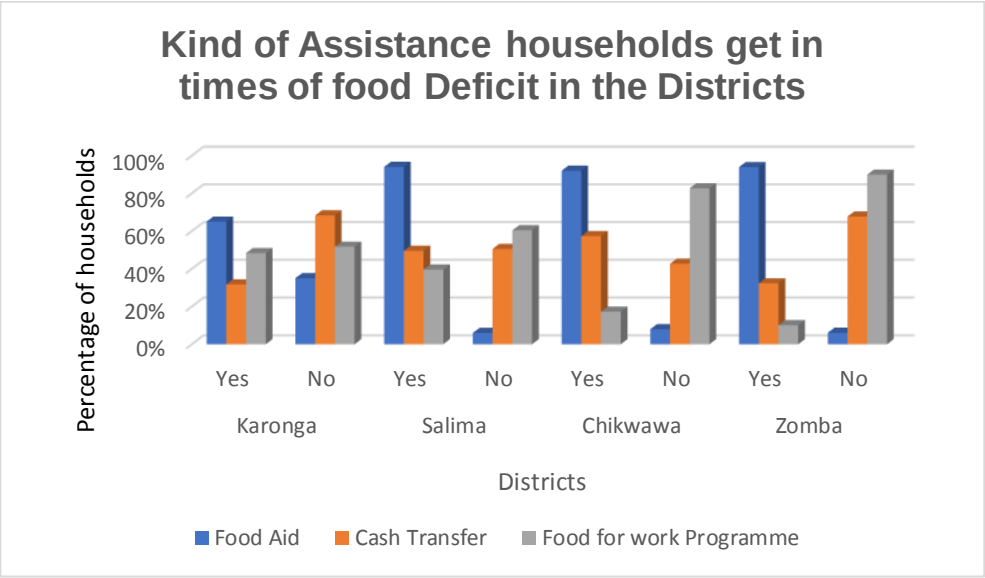

Figure 6.17: Kind of assistance households get in times of food deficit

Mechanisms employed to respond to rainfall and temperature changes

The respondents were also requested to give mechanisms which people in the study areas take on board in response to changes in rainfall and temperature. The respondents reported that the key mechanisms include planting drought resistant crops, utilise improved crop varieties, practise crop rotation, increased livestock production, and adopt and enhance irrigated agriculture. Figure 6.18 below indicates these mechanisms and how they are adopted in terms of scale in percentages. This implies that households in the study areas have the capacity to adopt some mechanisms to ensure that changes in temperature and rainfall are responded to for their improved resilient livelihoods.

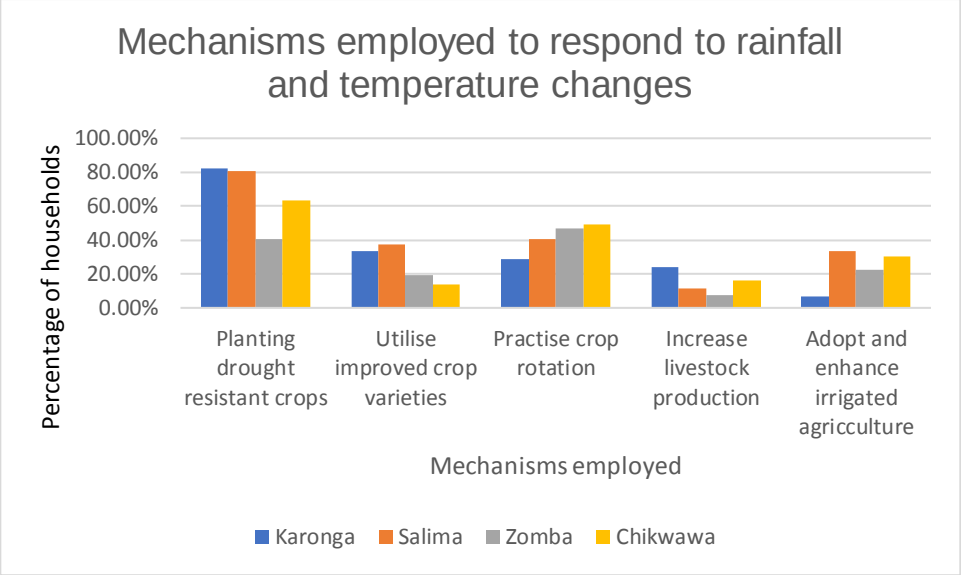

Figure 6.18: Mechanisms in response to changes in rainfall and temperatures

6.2.12. Socio-economic impacts of climate induced shocks and disasters

As explained in several sections of this study, climate change has brought several impacts and to make things worse is the fact that Malawi is greatly prone to impacts of climate change due to its location along the African Rift Valley, unsustainable urbanization, climate change, rapid population growth and environmental degradation among others (GoM, 2019). As indicated by FGDs and KIIs, the country is faced with climate related disasters and shocks and these include stormy rains, hailstorms, flooding, and droughts. This is evidenced by the fact that Malawi is identified by IPPC Fifth Assessment Report as high risk to adverse effects of climate change. In line with this, it is projected that severity and frequency of climatic shocks are likely to increase (Future Climate for Africa, 2019).

The KIIs conducted during this study with officers from some ministries and departments revealed several impacts of climate-related shocks and disasters at country level. Most of the KIIs indicated that key disasters affecting the country are floods and droughts. In the last five years floods have been predominant in Malawi particularly in the districts of Salima,

Zomba, Nsanje, Phalombe, Chikwawa, Karonga, Blantyre, Mulanje and Mangochi. It was found that apart from affecting various sectors of development, the disasters have greatly impacted negatively on rural population especially people who are physically challenged, the elderly, and children. This is the case because their already limited households' assets have been wiped out hence victimizing them on their own livelihood options.

It was also discovered that these disasters have impacted on several sectors of which many losses and damages have been made. The sectors include social sector where housing, education and health and nutrition have been affected; productive sector which includes commerce and industry, crops, fisheries, livestock production, forestry and irrigated agriculture; infrastructure sector of which losses and damages have occurred on energy, water and sanitation, transport, and water resources; and cross cutting issues that include the elderly people, gender equality and social inclusion, child protection, social protection, governance, disaster risk reduction, early warning systems and environment. All the assets linked to these sectors are damaged and became unusable thereby reducing the adaptive capacity of the people affected.

In terms of macroeconomic impact of disasters in Malawi, a lot of millions of dollars are lost, and this affected the economy of the country at large. For example, the Malawi 2019 Floods Post Disaster Needs Assessment Report stipulates that the flooding disaster in 2019 has resulted in production losses to an estimated value of about USD 9.96 million to the economy and this is an equivalent of 0.13% of the Growth Domestic Product. These impacts have been steered by losses in productive sectors that are key in the country's development such as agriculture, construction, electricity and water, trade, transport housing and food provision amenities. It is also revealed that disasters have left intense and extensive impacts on human and social development at personal, family and community levels. It is believed that 60 people lost their lives in 2019 alone, 670 people were hurt/injured, and 99,728 people were

displaced. It is estimated that more than 500 farmers and small micro-businesspeople lost a part of their household income because of these incidents.

The Government of Malawi has estimated that the recuperation and rebuilding requirements for the disaster impacts are at USD 370.5 million and this covers costs for restoration of the supply and access to water and sanitation, health and education, and recovery of agriculture production to support affected people to recuperate from their pre-disaster level of household revenue.

The findings from FGDs and respondents at community level show that in the study districts, people are also facing devastating impacts of disasters especially floods and drought. In Karonga district, the key disasters are droughts, floods and sometimes earthquakes. Over the years, people in the district have suffered impacts whereby there has been shortage of water that induces water and sanitation related problems, crop productivity has been in decline thereby affecting economic gains and livelihoods, and infrastructure being destroyed and washed away.

In Salima District, the major disasters are drought and floods, and these have affected mostly the agriculture and infrastructure sectors where crops and livestock are always washed away and in the end affect yield, and destruction of infrastructures like roads, and bridges thereby rendering communication and transportation within the district almost impossible. As a result, there is a decline of economic statuses of people at household and community levels.

Floods and drought are key disasters that affect the inhabitants of Chikwawa District. This district is almost a rain shadow area because it is a low-lying area and receives low rainfall amounts of rainfall in any given year as such droughts are always prominent. However, floods are also regular in the district because it is a low-lying area along the Shire Valley and most of floods come from the upland (neighboring districts of Mwanza, Thyolo, Neno and Blantyre). According to the results,

devastating impacts in the district have been loss of lives of the loved ones; destruction of infrastructures such as schools, houses, roads and bridges; crops and livestock being washed away, and deaths of livestock; and displacement of vulnerable people by floods like the elderly, children and the physically challenged. Many assets and items of high economic value that would have helped in improving resilient livelihoods of households have been destroyed and lost over the last ten years.

In Zomba District, the key disaster is flooding which regularly prevail year in year out although droughts and stormy rains also occur. Like Chikwawa and Salima Districts, people of Zomba face enormous challenges of infrastructure damage (roads, bridges, houses, and schools), washing away of crops and livestock, people becoming homeless due to destruction of homes and displacement by floods. The households and communities have very low adaptive capacity such that when the shocks and disasters hit, it becomes difficult for them to recover from the impacts.

In conclusion, the results at both national and district/community levels on socio-economic impacts of disasters bear testimony that the people in the districts are highly susceptible to climate change and face the disasters more often and almost every year. This means that climate related shocks and disasters have brought and are continuing to bring various socio-economic impacts at national, household and community levels. Smallholder farmers in the study districts are mostly affected since the agricultural sector is highly affected by these impacts. The end results of these impacts at both national and district levels include low agricultural yield leading to food insecurity, declined household's income, loss of resilient livelihoods and general poverty. These affect peoples' adaptive capacity as such they are not capable of ensuring that building climate change resilience achieved.

The findings showed some gaps in terms of the relationships of disasters, socio-economic development, and resilience building because

there was no quantifiable data to empirically verify this. It is also important to know and understand that adaptive capacity of any households is dependent on several factors. In addition to disasters that compound the impacts of climate change, there are the other factors that also compound impacts of climate change. They include poor planning and decision-making procedures that affect the direction of any action for improving the adaptive capacity of the people concerned, poverty levels which means that the people have no realistic alternatives for their livelihoods and use of productive assets, illiteracy and low knowledge levels that means that people have very low education and information for comprehending issues, weak infrastructure and services that would jeopardize some community services and livelihoods, and feeble institutions that are not strong enough and structures that are not able to provide an opportunity for people to plan and implement actions collectively. These factors are determinants of adaptive capacity of the community such that when poverty levels are reduced, institutions are strong, infrastructure and services are strong, literacy and knowledge levels are high and planning processes are effective then people can improve their adaptive capacity that would eventually lead to improved resilient livelihoods and a resilient community.

6.2.13. Climate change adaptation strategies and resilience building

Climate change adaptation plays a very important role in improving the livelihoods of any community because it contributes to resilience building. For communities to become resilient, adaptation must have strategies that would be implemented as a package in order to ensure resilience. This is linked to what is called transformational adaptation that looks at broad changes in a system and changes through several systems and it centres on the near future and long-term changes. It also looks at investigation of the efficiency of present procedures and practices, communal inequalities and unfairness, and differences in capabilities. Transformational adaptation provides an opportunity for any community or households to have long term plans of how to increase

their adaptive capacity and predict how they can deal with future and emerging shocks and crises emanating from climate change.

This study discovered that there are several strategies that communities employ to adapt to climate change at different levels as described in table 6.9 below.

Table 6.9: Strategies by respondents for adaptation and resilience building

Adaptation Strategy	KA (N)	SA (N)	CK (N)	ZA (N)	Total (N)	Percentage
Practising conservation agriculture	40	46	80	52	218	18.9%
Enhance crop production	21	45	25	40	131	11.4%
Enhance livestock production for income	21	12	15	10	58	5.0%
Tree planting for catchment conservation	48	50	22	51	171	14.8%
Enhance irrigated agriculture to supplement rain-fed farming	24	12	26	18	80	6.9%
Promote crop diversification	36	28	38	24	126	10.9%
Cultivating drought tolerant crops	23	20	53	33	129	11.2%
Employment	20	12	28	13	73	6.3%
Migration for employment	0	2	1	1	4	.3%
Income generating activities	30	27	32	25	112	9.7%
Aquaculture	2	8	6	11	27	2.3%

Table 6.9 above indicates key strategies employed by households in all the study districts (where N stands for frequency, KA stands for Karonga, SA stands for Salima, CK stands for Chikwawa, and ZA stands for Zomba). According to the findings, the key adaptation strategies for Karonga are practising conservation agriculture, enhancing crop production, enhancing livestock production for income, cultivating drought tolerant crops, practising agroforestry techniques, and promoting crop diversification. In Salima, the predominant adaptation strategies to climate change include promote crop diversification, practising conservation agriculture, employment, migration for employment, aquaculture, practising agroforestry techniques, enhance irrigated agriculture to supplement to rainfed agriculture, enhance livestock production for income and tree planting for catchment conservation. The major adaptation strategies for households in Chikwawa are practising agroforestry techniques, income generating activities, aquaculture, employment, enhance livestock production for income, practising conservation agriculture, promote crop diversification and cultivating drought tolerant crops. Finally, in Zomba District, the respondents reported that they depend on promoting crop diversification, income generating activities, enhance irrigated agriculture to supplement rainfed farming, tree planting for catchment conservation, enhance livestock production for income, enhance crop production, and practise conservation agriculture.

In this context, the extent to which adaptation is being adopted is different in all the respective districts based on scalability. It is a fact that all the adaptation strategies are employed at a small scale and subsistence levels. Much as the households in the study areas can diversify livelihoods, the level of adaptation is not sufficient to cement their adaptive capacity for resilience building.

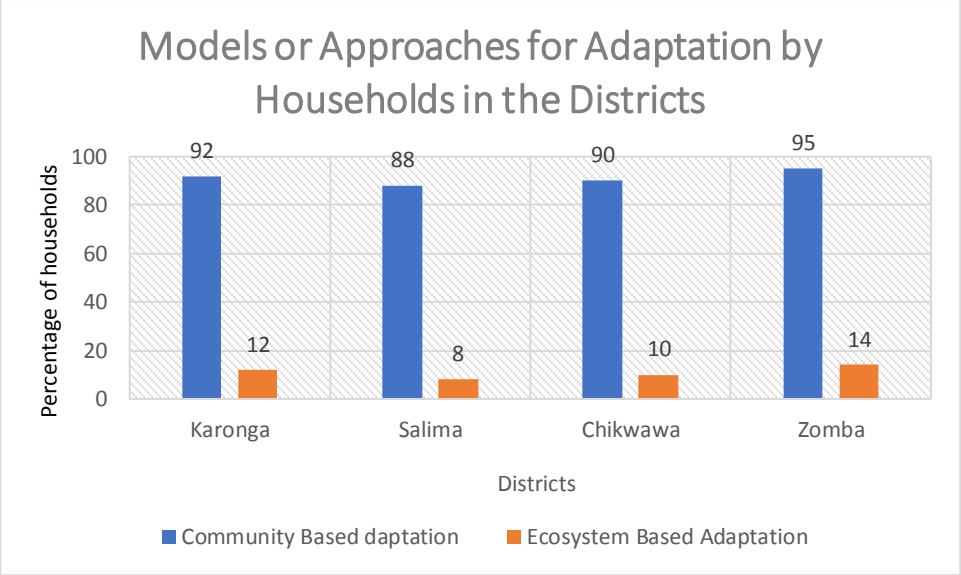

Figure 6.19: Models or approaches for adaptation by households

In relation to adaptation strategies, the results also revealed key approaches or models that the households use to enhance their adaptation and resilience building and they are Community-Based Adaptation (CBA) and Ecosystem Based Adaptation (EBA).

This means that all the adaptation strategies taken on board are either implemented using Community-Based Adaptation or Ecosystem based Adaptation (figure 6.19 above). According to the findings, many households in Karonga, Salima, Chikwawa and Zomba use Community-Based Adaptation as an approach to adaptation and resilience building. On other hand, few households in Karonga, Salima, Chikwawa, and Zomba are using Ecosystem based Adaptation for adaptation and enhancing resilient livelihoods. Overall, out of the total 402 respondents from the study districts, 360 respondents representing 89.6% are employing Community-Based Adaptation (CBA) while 42 respondents representing 10.4% respondents are using Ecosystem based Adaptation (EBA) for ensuring adaptation and resilient livelihoods.

6.3. WATER SUPPLY

In reference to chapter 2, the literature review showed that water supply is one of the significant characteristics of community resilience. Bearing this in mind, the researcher enquired from the respondents on the context of water supply in the study districts/areas.

6.3.1. Water sources for households in the study areas

The households were also asked to provide information on the sources of water in their locality.

Table 6.10: Water sources for households in the study areas

	Districts							
Source	**Karonga**		**Salima**		**Chikwawa**		**Zomba**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Boreholes	55	43	54	41	65	37	72	35
Piped water	22	76	24	71	44	58	50	57
Shallow wells	14	84	50	45	38	64	41	66
Unprotected sources	7	91	15	80	20	82	18	89

The results (table 6.10) show different water sources for households in the study areas, and they include boreholes, piped water, shallow wells, and unprotected sources. The two major sources of water for the study areas are boreholes and piped water. My observation is that the government and donors have invested many resources to provide boreholes and piped water in the study districts, hence, increase in the number of households having access to water.

6.3.2. Water access for households in the study areas

The respondents were asked on the accessibility of water in the study areas, and this is related to the availability of water for different uses such as domestic use, irrigation, for livestock and aquaculture.

Table 6.11: Water availability in the study areas

Water shortage		
District	**Yes**	**No**
Karonga	48 (48.9%)	50 (51.1%)
Salima	42 (44.2%)	53 (55.8%)
Chikwawa	58 (54.2%)	43 (45.8%)
Zomba	39 (38.2%)	68 (61.8%)
Distance covered to access water		
District	**Average Distance (km)**	**Remarks**
Karonga	1.3 km	Boreholes, piped water, unprotected sources
Salima	1.1 km	Boreholes, piped water, unprotected sources
Chikwawa	1.5 km	Boreholes, piped water, unprotected sources
Zomba	1.2 km	Boreholes, piped water, unprotected sources
Years of water scarcity condition		
District	**Year (s)**	**Remarks**
Karonga	1990, 2000, and 2015	Scarcity was severe
Salima	1992, 2002, and 2015	Scarcity was severe
Chikwawa	1992, 2002, 2010 and 2015	Scarcity was very severe
Zomba	1990, 1992, 2010	Scarcity was severe

The results on table 6.11 indicates that there is some sort of water shortage in the study areas and that households do experience it. However, most of the households believe there was no shortage of water except in Chikwawa District where a significant percentage of respondents indicated that they experience water shortage. The results, therefore, imply that water shortage in the study districts is not really a problem.

The findings also show that there were specific years when the households experienced water scarcity ranging from being severe to very severe. This means that climate change contributed to this problem. The factors that compounded this problem could be dry spells and droughts that caused lowering of water table due to little or low rainfall.

The respondents revealed that they were also having challenges in accessing to or fetching water due to long distances. The table above, for example, indicates average distances in terms of kilometres that respondents especially women cover to fetch water. The long distances have a bearing on other productive activities related to resilient livelihood improvement and general sustainable development because most of the time is spent in trying to have access to water.

6.3.3. Water harvesting structures in the study areas

Water harvesting structures on any land are paramount because they help in soil and water conservation/retention hence contributing to climate change adaptation. This is because crops would do better in any land or soil that is well drained and conserve water. In this regard, the results of the study show that 173 respondents representing 33% of the households reported that their land has different water harvesting structures, while 229 respondents representing 67% of the households indicated that their land has no water harvesting structures.

The district specific information of the results in terms of water harvesting structures is shown in figure 6.20. The water harvesting structures that were mentioned to be available on the land include box ridges, planting vetiver on contour lines, check dams, water harvesting tanks, and contour bands. This implies that most of the respondents or households have land that cannot retain water. This means the productivity of their agricultural produce may not be maximised. Water harvesting structures or technologies help in addressing water stresses where climate change is prevalent, and the water harvested can be used for domestic uses and irrigated farming. However, this is not the case in the study districts.

In relation to soil and water conservation, the study looked at the sloppiness of the land because it also has a bearing on cultivation methods, and water harvesting structures. It was found out that out of 342 households that own land, 32% indicated that their land has a medium slope, 53% reported that their land has plain slope while 15% stated that their land is steep. Most of the land in this area is plain in term

of its slope and this can make water retention easy hence improved drainage.

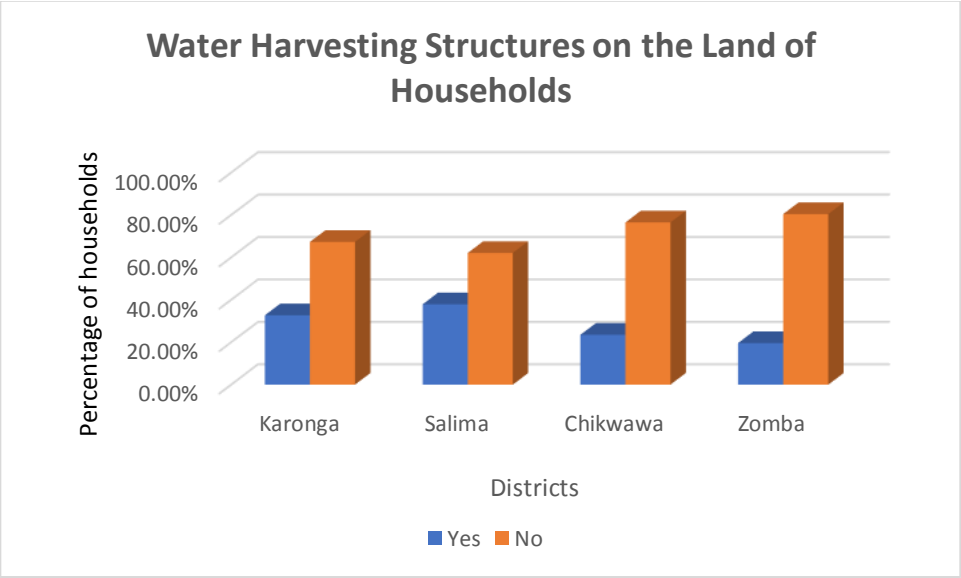

Figure 6.20: Water harvesting structures on the land of households

6.4. DISASTER PREPAREDNESS

Disaster preparedness is also a characteristic of a resilient community. Organisational influencing factors are important elements in a community that support and provide opportunities for households to improve their livelihoods, able to increase their adaptive capacity for enhanced climate change adaptation and resilience building. When community members have access to knowledge and information, they can make informed choices so long they comprehend what is required. In addition, it is a fact that information uptake by community members is dependent on their literacy levels and willingness for continuous learning. These help in disaster preparedness of any community. Information related to the same were sought to understand the extent of disaster preparedness in the study areas.

6.4.1. Sources of information for households

The households in the study area were questioned about sources of information for their knowledge in climate change adaptation and resilience building. The respondents reported that their sources of

information include radio, extension workers, community meetings, family and friends, newspaper, and television (figure 6.21). The findings of the study imply that the main sources of information for the households are radios, extension workers and community meetings.

For households to be equipped with knowledge and information, they should have access to reliable information and able to utilise that information for decision making. It is the same with climate change adaptation and resilience building, households need to have access to relevant information for effective planning and implementation of various household and community adaptation strategies.

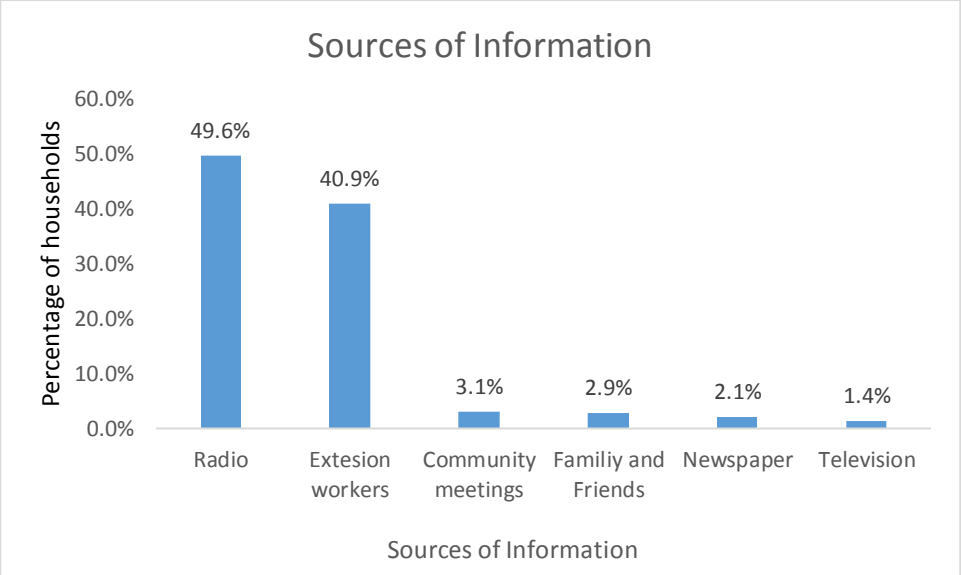

Figure 6.21: Sources of information for households

6.4.2. Household variables, opinions, and awareness to climate change

The study revealed that many households are aware of climate change and that they have heard about it (figure 6.21). Overall, out of 402 respondents, only 2 respondents representing 0.5% indicated that they have never heard about climate change and that they are not aware of it, while 400 respondents representing 99.5% reported that the have heard about climate change and that they are aware of climate change. According to the results, it implies that almost all the households in the

study districts are aware of climate change and are able to comprehend its basic concepts.

The households that indicated that they have heard about climate change were also asked which medium through which they heard about climate change. The results show that 116 representing 28.9% said they heard about it from colleagues and friends, 189 households representing 47% indicated that they heard about it from radios, 12 households representing 2.9% stated that they heard about it from school, 4 households representing 1.1% of the households indicated that they heard about it from newspapers, 76 households representing 18.8% of the households reported that they heard about climate change from government agencies, and 5 households representing 1.3% said that they heard about climate change from television. Most of the households became aware of climate change through radios, colleagues and friends, and government agencies and extension agents.

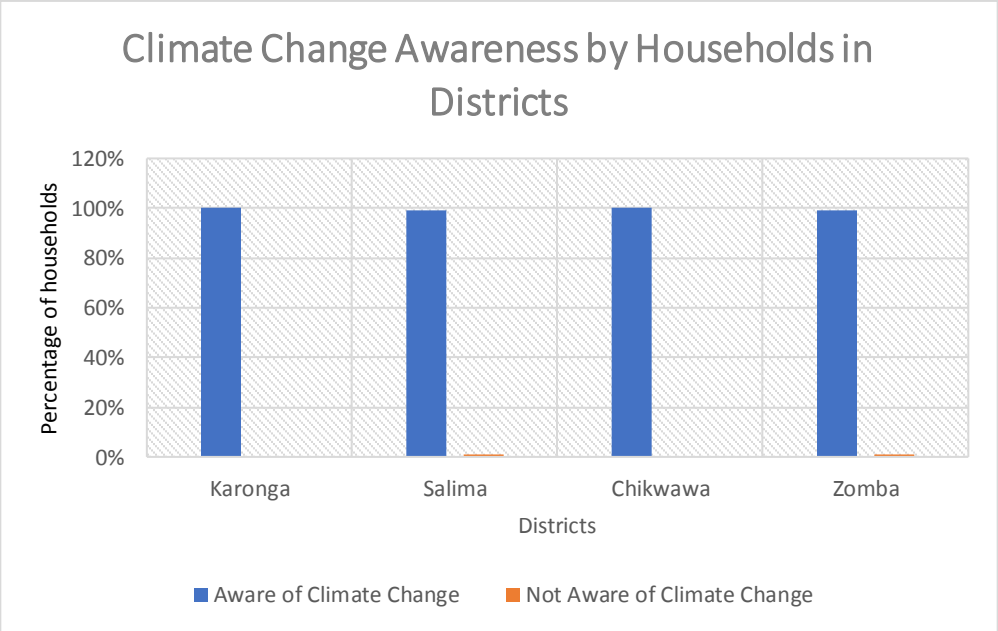

Figure 6.22: Climate change awareness by households

An enquiry to the respondents on indicators of differences in weather conditions in the study districts. The analysis also showed the responses from respondents on whether there are differences in weather conditions between the present and that of 30 years ago. The results were revealed that 88.3% of the households interviewed reported that there are

differences in weather conditions while 11.7% stated that there are no differences in weather conditions between now and the past 30 years. The respondents were also asked to provide responses on any indicators of the differences in weather conditions.

The results in figure 6.23 below revealed that most of the respondents indicated that indicators of weather differences between now and the past 30 years include late planting of various crops, strong winds, increased temperature, regular floods in a large volume, poor precipitation distribution, early cessation of precipitation, late onset of precipitation, and precipitation amount has declined. A few households reported that early onset of precipitation, precipitation amount is the same, and that precipitation amount has declined are also indicators of weather differences. This means that a few households differed with most households who stated that the above elements are indicators of weather differences. However, most households revealed that aspects of early onset of precipitation, precipitation amounts being the same, and the increase in precipitation amounts are not indicators of the weather differences between the present and the past 30 years. It is important to note that increased temperatures, strong winds, regular floods in large volume, poor precipitation distribution, and late planting of various crops are very prominent in the study areas.

It is also important to note that the indicators of weather differences between the present and the past 30 years are being used by local communities to understand climate change particularly by old people. They predict what can happen based on their experiences.

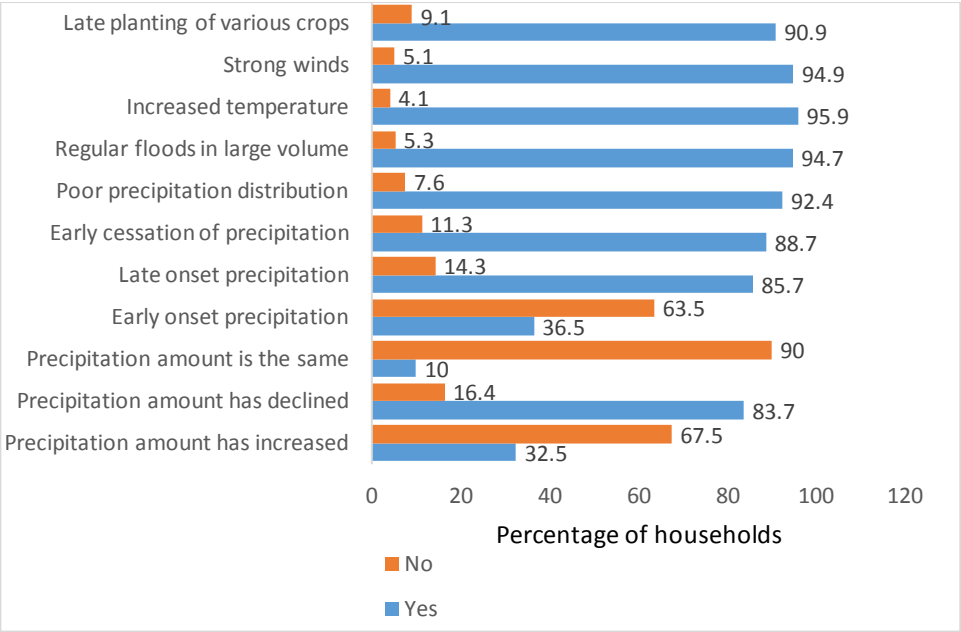

Figure 6.23: Indicators of the differences in weather conditions

The study discovered that there are variations in the status of the climatic elements/variables particularly temperatures and precipitation over the past 30 years in the study areas. Out of the total 402 households interviewed, 342 of them representing 85.1% reported that changes of these variables are becoming severe, 28 households representing 6.7% indicated that there is a slow change of the variables, 23 households representing 5.9% stated that there are little visible changes observed, while 9 households representing 2.3% said that there is no change of these variables. The respondents were also asked to indicate trends of temperatures and precipitation over the past 30 years in their locality and the results are shown in figure 6.24 below.

The results show that the respondents feel that both temperatures and precipitation have been changing or fluctuating over time. According to the respondents' opinions, this signifies the prevalence of climate change.

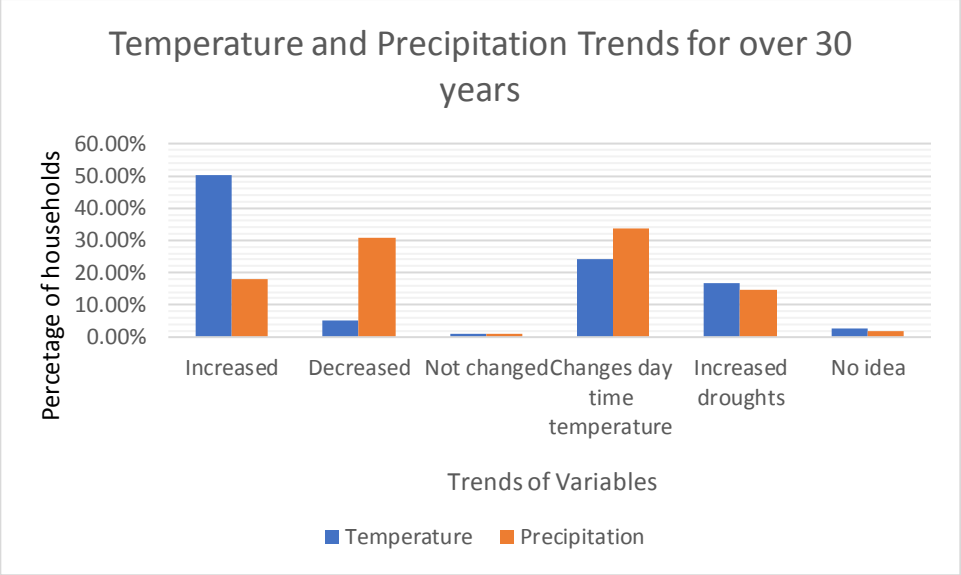

Figure 6.24: Temperature and precipitation trends opinions

Climate change has brought several consequences that impact on the lives of the people and one of these consequences is the occurrence of disasters associated with climate change. The disasters that are related to climate change include floods, erratic rainfall, prevalence of fall army worms, droughts among others. During the study, the households that were interviewed were asked if their areas have experienced any disaster that is related to climate change. Overall, out of 402 households, 12 of them representing 3% reported that their area (s) have not experienced any disaster related to climate change, while 390 households representing 97% indicated that their areas experienced disasters related to climate change. At district level, it was discovered that 97.9% of households in Karonga said the district experienced climate related disasters while 2.1% said no, 94.4% households in Salima stated that the district experienced climate relate disasters while 5.6% said no, 100% of households in Zomba indicated that the district experienced climate related disasters, and 93.6% of households in Chikwawa reported that the district experienced climate related disasters while 6.4% reported that the district did not experience any disaster related to climate change.

In addition, the households were asked to indicate types of disasters related to climate change that the districts experienced and these included floods, erratic rainfall, droughts, hailstorms, and prevalence of fall army worms. These disasters were mentioned across all the four districts of which what differed was the extent of their occurrence. The results (figure 6.25) show that floods are very prominent in Chikwawa and Zomba, erratic rainfall is very prevalent in Chikwawa and Karonga, droughts are very prominent in Karonga, Salima and Chikwawa, hailstorms are very prevalent in Salima and Zomba, while fall army worms are more prominent in Karonga and Salima.

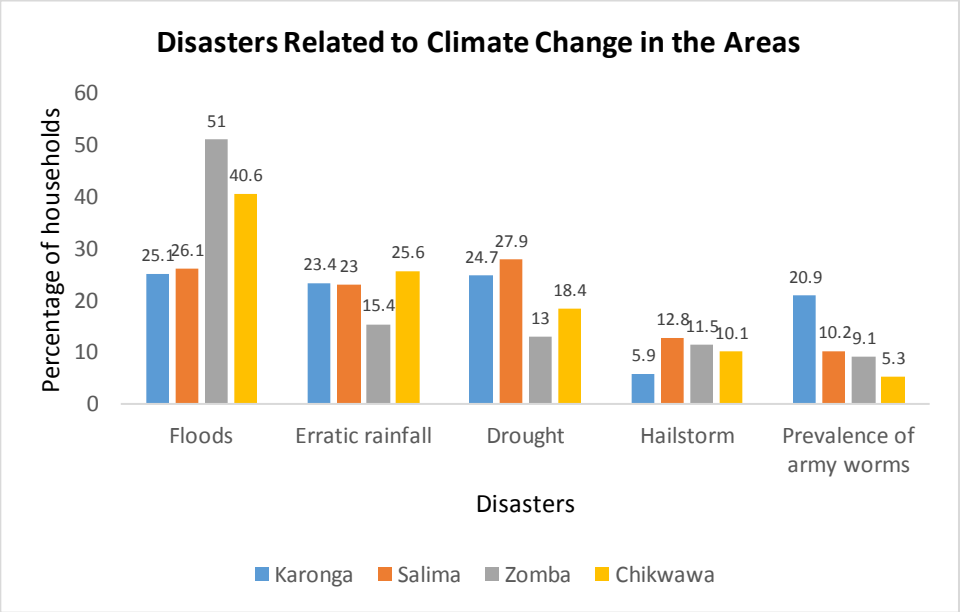

Figure 6.25: Disasters related to climate change experienced by study districts

The various disasters related to climate change highlighted above as provided by the study respondents clearly show their prominence in the respective districts and certainly, they bring about some impacts and damages to the population thereby affecting livelihoods of the same people. As such, the respondents reported that there are several damages that are caused by these disasters and they include crops washed away due to floods, soil erosion, livestock deaths, roads and bridges damaged, death of people, infestation of pests and diseases,

and house/property damage. According to the findings from the respondents in the study districts, the major damages that have been experienced by the population in the areas include washing away of crops due to floods, livestock deaths, damage to roads and bridges, and soil erosion (figure 6.26). The respondents were also asked to provide multiple responses on the disasters which they know are prevalent in their respective areas.

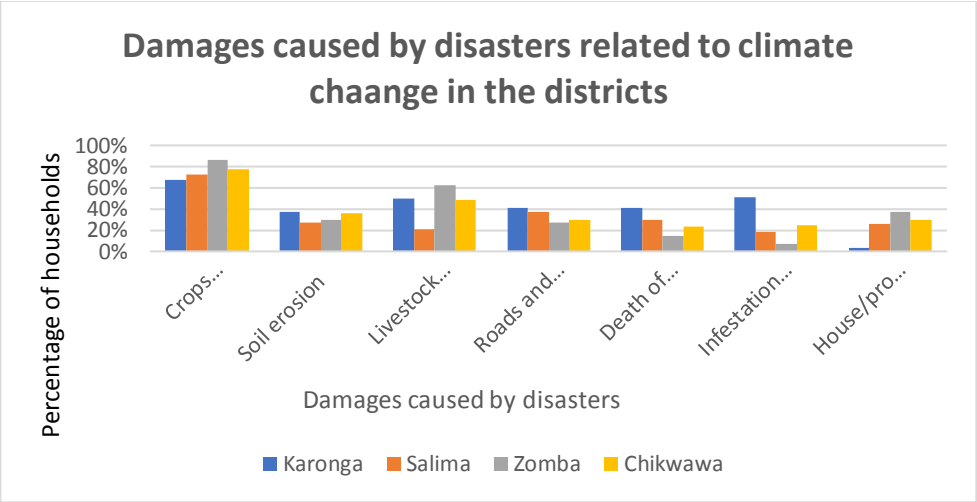

Figure 6.26: Damages caused by disasters related to climate change in the study districts

In relation to the disasters and damages that are prevalent in the study districts as described above, the respondents were also asked about any coping mechanisms that they employ in times of disasters. The respondents were able to provide multiple responses based on what they employ as far as their coping mechanisms are concerned. The coping mechanisms which were mentioned by the households in the study households include Government support, piece work, food relief and donations, petty trade, sale of family assets, sale of forest products, wage labour among others.

It was discovered that generally, the major coping mechanisms for the study districts include piece work, government support, food relief and donations, and sale of family assets in that order (table 6.12).

Table 6.12: Coping mechanisms by respondents in times of disasters

Coping Mechanism	District Name				Total
	Karonga	Salima	Zomba	Chikwawa	
Sale of family assets	15.2%	14.4%	2.8%	21.9%	13.3 %
Government support	22.8%	58.9%	54.7%	64.6%	50.5 %
Wage labour	9.8%	14.4%	1.9%	9.4%	8.6%
Climate insurance			0.9%		.3%
Sale of forest products	16.3%	32.2%	1.9%	1%	12.2 %
Petty trade	35.9%	10%	0.9%	13.5%	14.6 %
Migration to get employment	2.2%	7.8%		8.3%	4.4%
Food relief and donations	28.3%	58.9%	55.7%	39.6%	45.8 %
Piece work	60.9%	54.4%	65.1%	62.5%	60.9 %
Renting family land	8.7%	3.3%	0.9%	6.3%	4.7%

6.4.3. Indigenous Knowledge Systems (IKS)

The study revealed some types of indigenous knowledge systems that are available in the study areas and are used for early warning systems to predict any eventuality amidst climate change. Table 6.9 indicates detailed analysis of indigenous knowledge systems that are used in respective districts for early warning systems.

The results revealed that various indigenous knowledge systems are prevalent in all the study districts of Karonga, Salima, Chikwawa and

Zomba, and what differs is the scale on which communities understand and interpret them and also their utilisation. A good number of households from each district indicated that they have no idea of any indigenous knowledge systems. According to respondents' explanations, the systems help them in predicting and planning for weather and climate eventualities.

Other regional assessments reviewed by this study has agreed to these findings, for example, a study on using indigenous knowledge for seasonal quality prediction conducted by Mafongoya, Jiri, Mubaya, & Mafongoya (2017) indicated that heavy flowering or high production of mango tree signifies drought season in Tanzania, Zimbabwe and Burkina Faso; strong winds in the July through October show less rainfall in the coming season in Mali, Ethiopia and Tanzania; and army worms prevalence signifies abundant rainfall in the coming season in Tanzania, Burkina Faso and Zimbabwe. These were validated and triangulated by Mkomwa, et al., 2013 in their study on assessing the significance of indigenous knowledge of the population of Chikwawa District of Malawi. They found that most of these highlighted in table 6.13 were relied upon by the communities for early warning and planning for climate action.

According to the results from the respondents, amongst all the indigenous knowledge systems that were identified, there are some that are the major ones. These include strong winds two months before the start of rainy season; high production of mangoes (fruits); white birds flying together in one direction; high multiplication of army worms; shading of leaves of some tree species; and extreme high temperatures during rainy season. According to the communities these signify less rainfall during the rainy season, dry spells, onset of rains, dry spells or low rainfall, onset of rains, and intense rainfall respectively.

Table 6.13: Types of indigenous knowledge systems in the study districts

Type of Indigenous Knowledge	Meaning (Interpretation)	Karonga (% use)	Salima (% use)	Chikwawa (% use)	Zomba (% use)
High multiplication of army worms	Dry spells or low rainfall	5 (5.1%)	0 (0%)	0 (0%)	10 (9.3%)
High production of mangoes (fruits)	Dry spells	20 (20.4%)	20 (21%)	18 (17.6%)	18 (16.8%)
Black cloud in the west	Floods	0(0%)	2 (2.1%)	9 (8.8%)	2 (1.9%)
Peculiar sound of male goats	Imminent rains	0(0%)	0(0%)	11 (10.8%)	0 (0%)
Extreme high temperatures during rainy season	Intense rainfall	22 (22.4%)	1 (1.1%)	13 (12.7%)	7 (6.5%)
Building of nests of Nantchengwa bird in the reeds	Severe drought	0 (0%)	0 (0%)	7 (6.8%)	0 (0%)
Strange sound of white fogs	Imminent rains	0 (0%)	2 (2.1%)	0 (0%)	0 (0%)
Cold weather during rainy season	Dry spells	0 (0%)	14 (14.7%)	0 (0%)	6 (5.6%)
Shading of leaves of some tree species	Onset of rains	20 (20.4)	17 (17.9%	20 (19.6%)	7 (6.5%)
Prevalence of plenty grasshoppers/locusts	Dry spells	0 (0%)	1 (1.1%)	6 (5.9%)	5 (4.6%)
Appearance of rainbow during rainy season	Rains are about to finish or won't come	9 (9.2%)	3 (3.1%)	0 (0%)	0 (0%)
Appearance of a lot of ants	Good rains	0 (0%)	10 (10.5%)	6 (5.9%)	0 (0%)
White birds flying together in one direction	Onset of rains	0 (0%)	5 (5.3%)	0 (0%)	12 (11.2%)
An anthill bending to one direction	Direction where rains will come from	0 (0%)	4 (4.2%)	12 (11.8%)	0 (0%)
Increased mounds of termites in gardens	Prolonged dry spells	0 (0%)	16 (16.8)	10(9.8%)	0 (0%)
Strong winds 2 months before the start of rainy season	Less rainfall during the rainy season	12 (12.2%)	9 (9.5%)	15 (14.7%)	16 (14.9%)

The study also explored on the impacts of climate change in the study areas. As it was revealed in the preceding sections, most of the respondents are very much aware of climate change. It was, therefore,

imperative to understand their knowledge and experience on the negative impacts of climate change that in the end affect peoples' livelihoods. The results (figure 6.27) show that the consensus by the respondents in all the study districts on the major impacts of climate change in order of extent of impact include low crop yields, environmental degradation, low livestock production, drying up of rivers and lakes, malnutrition, increased incidences of new pests and diseases, and low fish stocks in rivers and lakes. Looking at the impacts of climate change as explained by the respondents, it was confirmed that the whole range of livelihoods for communities are being affected and they need to have capacity to lessen the impacts. The respondents were then asked if their respective households have ever received any capacity building initiatives related to climate change for them to effectively tackle climate change challenges. According to the findings, out of the total 402 households interviewed, 88 households representing 22% indicated that they have received some training initiatives while 314 households representing 78% reported that they have never received any capacity initiative related to climate change. The households that had received capacity building initiatives mentioned aspects of climate change awareness, causes of climate change, impacts of climate change, climate change and development, and climate change adaptation as some of the capacity building initiatives that they had received in relation to climate change. This means that most of the households are aware of climate change because they heard about it from village meetings, government extension workers, radio stations, newspapers, friends, and televisions. There have been very few formal capacity building initiatives aiming at informing the communities about climate change. During the study, the communities/respondents explained that bearing in mind that climate change has brought negative impacts that are affecting their livelihoods and well-being, they make sure to find ways and means of supporting their livelihoods in times of climate change. Generally, it was reported that for them to support their livelihoods, 62 households representing 15.5% depend on the use of productive assets, 232 households representing 58% participate in development work, 77

households representing 18.6% look for employment, and 31 households representing 7.9% have access to improved markets for their goods.

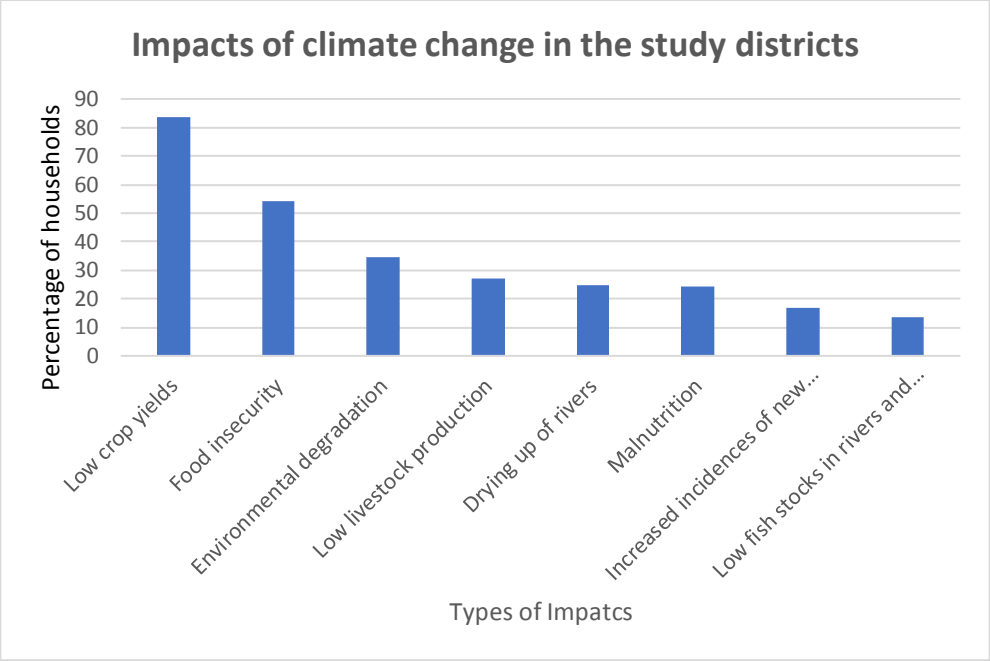

Figure 6.27: Impacts of climate change in the study districts

6.4.4. Institutional support to climate change

Institutions are very vital in implementing every socio-economic activity in a society be it at national or local level. As such climate change adaptation and resilience building depends on viable and vibrant institutions because they form social capital that promotes working relationships among people. This is true to the fact that climate change affects and inconveniences the social sections more inexplicably thereby influencing local institutions on how they can get access to and utilise various assets and resources in adaptation and resilience building (Agrawal, 2008). The absence of cohesive groups leads to reduced and feeble social capital within the community and this affects implementation of sustainable development initiatives and resilient livelihoods (Pretty & Ward, 2001).

The 15 Focus Group Discussions that were conducted during the study revealed that there are several local institutions that support planning

and implementation of climate change adaptation interventions. The notable ones being Village Civil Protection Committees, Area Civil Protection Committees, District Civil Protection Committee, and other committees that oversee development related activities. These institutions work hand in hand with government agencies in enhancing adaptive capacity and resilient livelihoods. Their role is to implement policy actions as part of improving their livelihoods and well-being.

The Focus Group Discussion (FGD) participants, Key Informants and agriculturalists argued that these institutions help in coming up with indigenous knowledge, information and skills in planning and implementation of adaptation interventions. They discuss and share information on general climate change issues, how to tackle impacts of climate change, early warning systems and how to recover from shocks in times of disasters related to climate change. It was reported by the FGD participants that climate resilience is slowly being achieved because most of the local institutions are not strong enough to make informed choices and plans. In addition, these local institutions and the social groups were used to implementing incremental adaptation that focuses on building existing adaptation actions and knowledge attained. This involves using existing models/approaches in managing climate change but aims at maintaining the present actions without focusing on future uncertainties and this affects resilience building. The advantage nowadays is that the communities are commencing to go for planned adaptation of which they plan for the present and the future in relation to adaptation practices. Some of the Key Informants attested to this by explaining that planned adaptation is transformative because the local institutions and the people ensure that they integrate new and innovative ideas/solutions for sustainable development and resilience building.

At national level, Malawi has several institutions implementing climate change related programmes, and all these are coordinated by Environmental Affairs Department under Ministry of Natural Resources, Energy and Mining. There are various technical and steering committees on climate change that oversee technical planning, implementation, and

policy direction of climate change. The Government institutions are supported by the civil society and Non-Governmental Organisations of which some are into actual implementation of resilient livelihoods projects while some are involved in policy analysis and advocacy. The KIIs indicated that Malawi has faced drastic impacts related to climate change and these include low agricultural yield resulting in food insecurity and malnutrition, infrastructure damage, loss of lives, occurrence of new diseases, unavailability of water resources among others.

Despite having relevant institutions that support climate change management and programming in Malawi through coordination, there are still challenges that affect climate change governance in the country. For instance, there is lack of political will in ensuring that funding is available specifically for climate change programming, little or no allocation of resources in the national fiscal plan year in year out. The other challenge is non-availability of a designated entity or institution to spearhead issues of climate change from project identification to implementation, monitoring and evaluation and reporting even though the process of establishing a National Climate Change Fund commenced but at snail's pace.

6.4.5. Climate change trends in the study districts for the past 30 years

Various development practitioners and scientists have explained that the globe is warming up and that temperatures and rainfall patterns are changing. It is, therefore, vital for this study to assess and triangulate or confirm whether climate change is a reality in the study districts of Karonga, Salima, Chikwawa and Zomba and Malawi in general as indicated by respondents during FGDs and KIIs.

It should be emphasised that the data were sourced from Department of Climate Change and Meteorological Services (DCCMS) in the Ministry of Natural Resources, Energy and Mining. The data, in terms of figures were collected over time from the Department's weather stations

established across all the districts of the country and were recorded and analysed annually. In other words, the data presented in this section were drawn by the researcher using the given statistics to get the results in terms of trends. This data is used locally and internationally by analysing the historical and current trends of temperatures and precipitation for the country. This enables stakeholders and scientists to make comparisons and determine projections of temperature changes and amounts of precipitation in the near future. This helps in planning for mechanisms for addressing or reducing negative impacts of climate change while at the same time there is an enhancement of climate change adaptation.

It is important to note that the use of regression equations for figures of temperature and rainfall trends in the study areas is not necessary because a meta-analysis of the secondary data for temperature and rainfall patterns for the study areas was not undertaken for the purposes of this research. In addition, first-hand analysis of the data was not done and what follows in each trendline is a summary of interpretation of the secondary data provided by DCCMS.

Methodology for the review of climate change trends in study areas

The review of the trend lines focused much on the existing data or knowledge of temperature changes and rainfall patterns. The researcher reviewed the existing data to understand the trends in the 30-year period for the study districts to inform changes and patterns of temperatures and rainfall patterns respectively. Secondary analysis which is the practice of using secondary data in research (Crossman, A. 2019:2) was used in this research to determine the trend lines. A semi-systematic or narrative review was also used to synthesise the state of knowledge and the ability to understand a historical overview or timeline of a specific topic (Snyder, 2019:335). In this case, the focus was on the trend lines of the temperature changes and rainfall patterns of the study areas. In relation to this, a content analysis or review was also used to

identify, analyse, and report patterns in the form of themes (temperature trends, and rainfall trends).

This section of the thesis, therefore, aims to review the secondary data on temperature and rainfall patterns for the study districts in the past 30 years (between 1988 and 2018) as provided by DCCMS to understand their trends and/or changes.

Temperature trends in Karonga District

Temperatures in Karonga are slightly hot. According to the data that was analysed, the annual average minimum temperature is 19.9°C which rises to 21.8°C in the production season and goes down to 18.7°C in the winter season. The yearly average maximum temperature is 31°C and this does not change much during the year (GoM, 2018a). Karonga district is one of the districts with hot conditions and temperatures and these typically range from 18.7°C to 31.6°C.

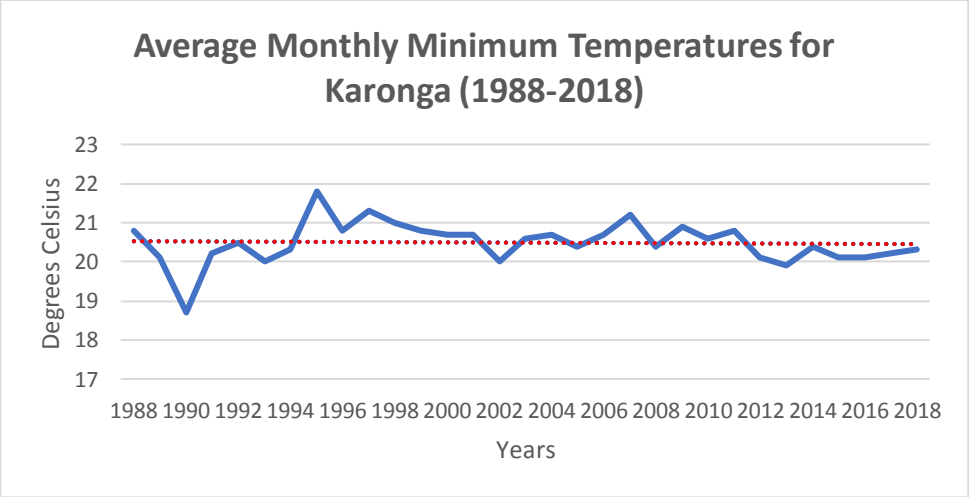

Figure 6.28: Average monthly minimum temperatures for Karonga District (DCCMS, 2018)

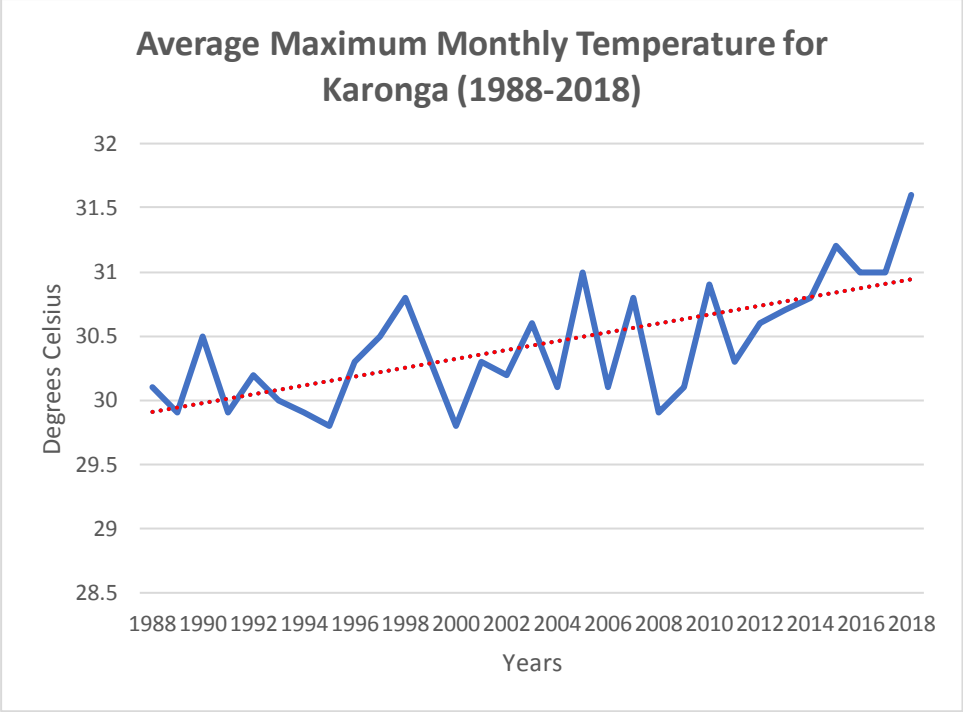

Figure 6.29 Average monthly maximum temperatures for Karonga District (DCCMS, 2018)

Looking at the meteorological data (1988-2018) appraised by this study and in figures 6.28 and 6.29, the trends indicate that there has been a minor but stable increase in monthly minimum and maximum temperatures in Karonga over the 30 years period. In comparison to maximum and minimum temperature trends, the later indicates more rise in high degrees as opposed to the former. In reference to the assessment done by the United States Agency for International Development (USAID), 2012, it was observed that the average annual temperatures have increased by 0.9°C between 1960 and 2006, and at an average rate of 0.21°C for every 10 years. Daily temperature surveillances indicate rising trends of hot days and nights in all seasons for the study district and the occurrence of hot days indicate certain significant increase although highly inconsistent.

This is in tandem with study findings where 94.3% of respondents observed changes in temperatures and the assertion made by FGDs that days and nights were becoming warmer than in the past. The average

number of hot days per year in Malawi has risen by 30.5, which is a supplementary 8.3% of days between 1960 and 2003 period. Climate change and variability appraisals and studies in Malawi show that the average number of hot nights per year has risen by 41, which is a supplementary 11.1% of nights between 1960 and 2003 period. The degree of a rise is observed mostly in DJF when the average number of hot DJF nights has risen by 5.5 days per month which is a supplementary 17.6% of DJF nights throughout this duration (UNDP 2010; USAID 2012b). This is also supported and verified by several other assessments and studies carried out locally to produce and record noticeable and forecast impacts of climate change in the country. The First National Communications Report (GoM, 2002) and the Second National Communications Report (GoM, 2011b) to the UNFCCC exposed that the frequency of hot days and hot nights had intensified in all the seasons throughout the years.

In related assessments that were appraised by this study also show temperature related extremes such that Malawi is encountering rising temperature trends of 0.9°C detected between 1960 and 2006, and hotter seasons (Zulu, 2017). The increase in frequency of intense temperature events distressing human beings, livestock and crops are anticipated to be more increasingly common and widespread and particularly this will bring severe impacts on crop productivity and food security of smallholder farmers. Furthermore, Global Circulation Models (GCM) forecasted that the average temperature in Malawi could increase by 1.1 to 3.0°C in the 2060's and by 1.5 to 5.0°C by the end of 2090 (IPCC, 2007c).

Rainfall trends in Karonga District

This study analysed the meteorological data related to rainfall for the district for the period of 30 years of 1988-2018 as indicated in figure 6.30.

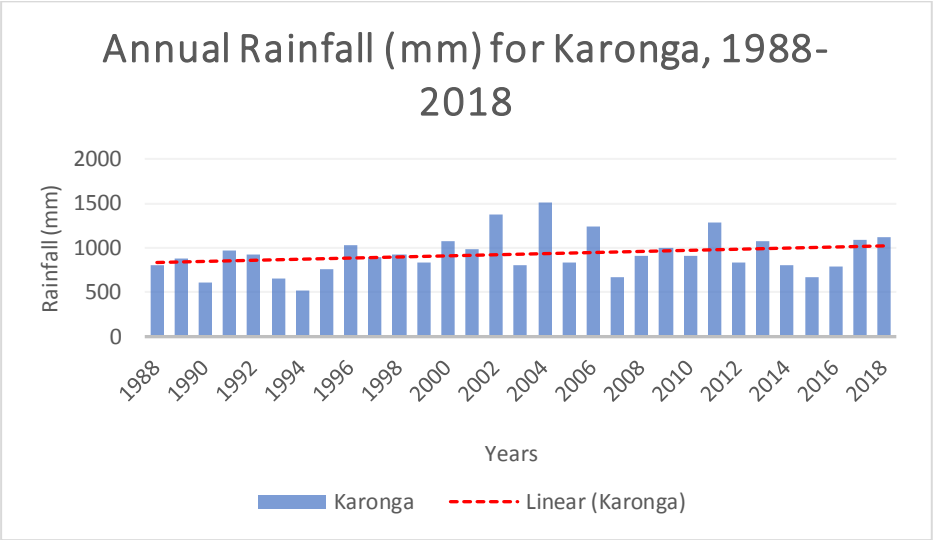

Figure 6.30: Annual Rainfall (mm) for Karonga District (DCCMS, 2018)

The study results from respondents showed that there was felt reduction in precipitation/rainfall but while this was the case, the meteorological data, and surveillances of rainfall over the district (figure 6.30) do not indicate statistically major trends and long-term patterns except for the period between 2006 and 2018 which indicates fluctuation of annual total rainfall. Historically, the data suggests that there is a rise in evaporation and a reduction in yearly runoff, and there have been more incidences of water shortage in the current years (GoM, 2016b). In relation to this, the meteorological data analysed from the district in the course of this study show annual variability with slender reduction at one period and slender rise at another in rainfall trends line. Astonishingly, findings from a regional analysis for southern Africa from six downscaled General Circulation Models indicated yearly rises in precipitation for Malawi. Nonetheless, Model imitations indicate widespread deviations or differences in forecasted variations in the scale of future El Niño occurrences. It is understood that climate for Malawi is somehow sturdily affected or swayed by ENSO thereby causing ambiguity in climate

forecasts (McSweeney, Jones, Lee, & Rowell (2014). The district experiences unpredictable and unreliable rainfall, for example, Karonga district has an annual average rainfall of 958.9 mm but with the highest total annual rainfall of 1287.5 mm registered in 2011 while the lowest total annual rainfall is 519.3 mm registered in 1994 (GoM, 2018a).

In terms of the time when the rainy season commences, the data analysed agrees with FGDs and KIIs findings. The rains commence swiftly in November in Karonga and end roughly in April or May and the peak is in December, January, and February (DJF). This means that the inadequacy of rainfall for a period of 7 to 8 months (April to November) decreases the capability of smallholder farmers to produce crops. This is the reason why the smallholder farmers in the district are always food insecure thereby affecting other livelihoods options. This in turn, affect various actions that aim at ensuring resilient livelihoods for households and communities.

Temperature trends in Salima District

In Salima District, temperatures are generally hot, and the annual average maximum temperature is 29.9°C and it does not change much in a year. The annual average minimum temperature is 20°C which goes up to 21°C in the growing season and declines to 19.6°C in the cold/winter season. Salima District is also regarded as one of the districts in Malawi with hot temperatures of which temperatures vary from 19.6°C to 30.7°C.

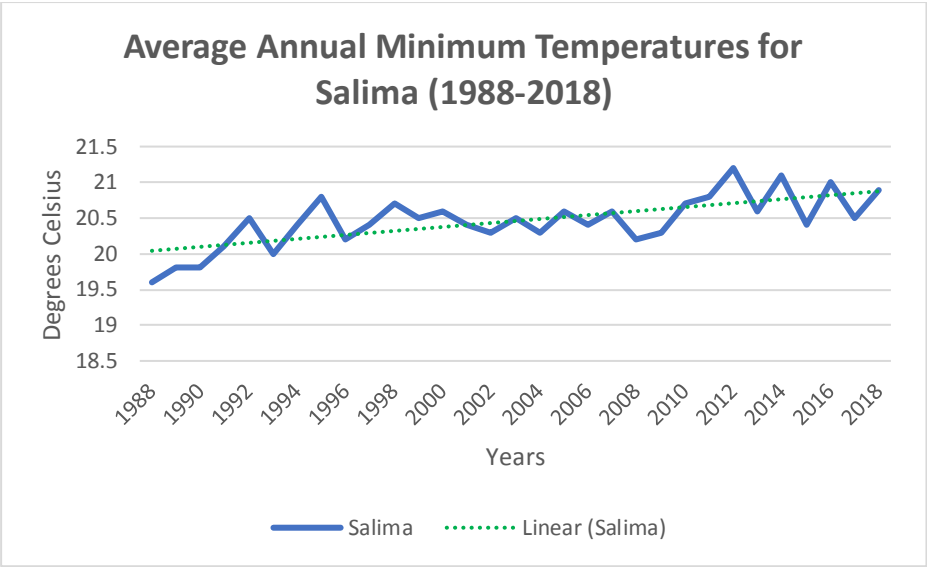

Figure 6.31: Average monthly minimum temperatures (°C) for Salima District (DCCMS, 2018)

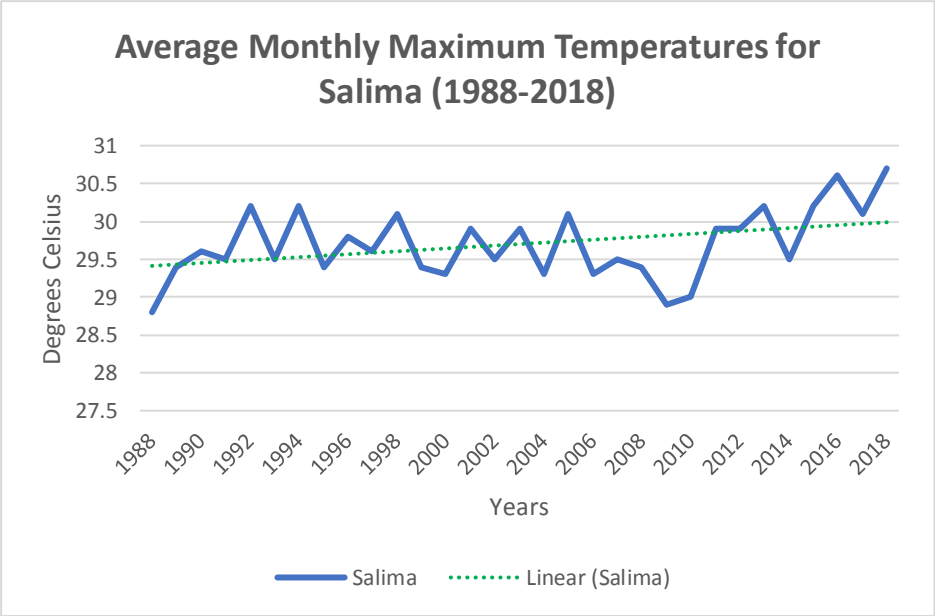

Figure 6.32: Average monthly maximum temperatures (°C) for Salima District (DCCMS, 2018)

After appraising the meteorological data (1988-2018) in figures 6.31 and 6.32, the trends indicate that there has been a minor but steady rise in monthly minimum and maximum temperatures in Salima District for the past 30 years. In trying to compare the maximum and minimum temperature trends, the minimum temperature trends indicate more rise

in high degrees as opposed to maximum temperature trends. In reference to the assessment done by the United States Agency for International Development (USAID), 2012, it was observed that the average annual temperatures have increased by 0.9°C between 1960 and 2006, and at an average rate of 0.21°C for every 10 years. Daily temperatures surveillances indicate rising trends of hot days and nights in all seasons for the study districts and the occurrence of hot days indicate certain significant increase although highly inconsistent. This is in tandem with study findings where 94.3% of respondents observed changes in temperatures and the assertion made by FGDs that days and nights were becoming warmer than in the past.

The average number of hot days per year in Malawi has risen by 30.5, which is a supplementary 8.3% of days between 1960 and 2003 period. Climate change studies done in Malawi show that the average number of hot nights per year has risen by 41, which is a supplementary 11.1% of nights between 1960and 2003 period. The degree of a rise is observed mostly in DJF when the average number of hot DJF nights has risen by 5.5 days per month which is a supplementary 17.6% of DJF nights throughout this duration (UNDP 2010; USAID 2012b). This is also supported and verified by several other assessments and studies carried out locally to produce and record noticeable and forecast impacts of climate change and variability in the country. The First National Communications Report (GoM, 2002) and the Second National Communications Report (GoM, 2011b) to the UNFCCC exposed that the frequency of hot days and hot nights had intensified in all the seasons throughout the years.

In related assessments that were appraised by this study also show temperature related extremes such that Malawi is encountering rising temperature trends of 0.9°C detected between 1960 and 2006, and hotter seasons (Leo, 2016). The increase in frequency of intense temperature events distressing human beings, livestock and crops are anticipated to be more increasingly common and widespread and particularly this will bring severe impacts on crop productivity and food

security of smallholders. Furthermore, Global Circulation Models (GCM) forecasted that the average temperature in Malawi could increase by 1.1 to 3.0°C in the 2060's and by 1.5 to 5.0°C by the end of 2090 (IPCC, 2007c).

Rainfall trends in Salima District

The meteorological data for the past 30 years (1988 – 2018) was analysed for Salima District and is presented below.

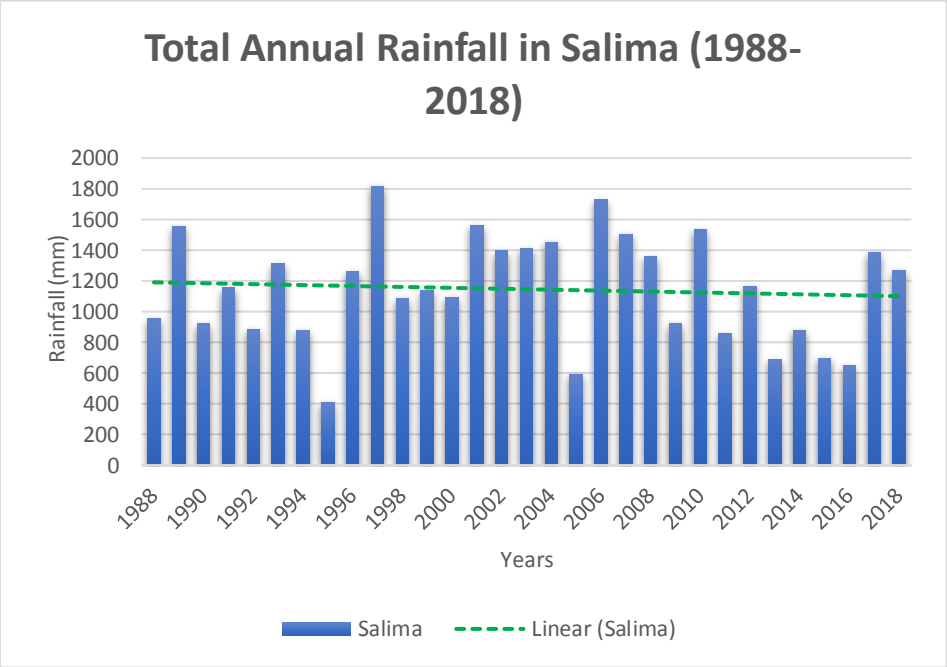

Figure 6.33: Annual rainfall (mm) for Salima District (DCCMS, 2018)

Generally, FGDs, respondents and KIIs indicated there was declining trend of precipitation/rainfall, however, the meteorological data and observations of rainfall over the district (figure 6.33 above) do not show statistically major trends and long-term patterns except for the period between 2010 and 2016 which indicates consequent reduction in annual total rainfall. As is the case with Karonga scenario, historically, the data suggests that there is a rise in evaporation and a reduction in yearly runoff, and there have been more incidences of water shortage in the current years (GoM, 2016b). In relation to this, the meteorological data for the district shows annual variability with a small reduction in rainfall

trends line. Similar studies that were analysed indicate one of the effects of an altering hydrological system as diminishing levels of water in Lake Malawi. Astoundingly and predictably, results from a regional analysis for southern Africa from six downscaled General Circulation Models indicated yearly rises in precipitation for Malawi. Nonetheless, Model imitations indicate widespread deviations or differences in forecasted variations in the scale of future El Niño occurrences (Vincent, Dougill, Mkwambisi, Cull, Stringer & Chanika, 2013).

It is understood that climate for Malawi is somehow sturdily affected or swayed by ENSO thereby causing ambiguity in climate forecasts (McSweeney, *et al*. 2014). Conversely, the major and common problem to smallholder farmers is that the district has unpredictable rainfall patterns as shown in figure 24 above. For example, the district has an annual total average of 1184 mm rainfall with the highest total annual rainfall of 1817.2 mm registered in 1997 and the lowest annual total rainfall of 410.2 mm recorded in 1995. Most of annual precipitation falls during the rainy season (November to March/April and a small amount fall in winter which is between May and July (GoM, 2018a). In terms of the time when rainy season commence, the data analysed agrees with FGDs and KIIs findings. The rains commence rapidly in November in Salima District and end abruptly in March or April and the peak is in December, January, and February. This means that the inadequacy of rainfall for a period of 7 months (May to November) decreases the capability of smallholder farmers to produce crops. This is the reason why the smallholder farmers in the district are always food insecure thereby affecting other livelihoods and development initiatives.

Temperature trends in Chikwawa District

In Chikwawa District, temperatures are very hot, and this is also one of the districts with very hot temperatures. The annual average minimum temperature is 20.5°C which goes up to 22.3°C in winter season and changes from time to time between a range of 22.3°C and 40°C.

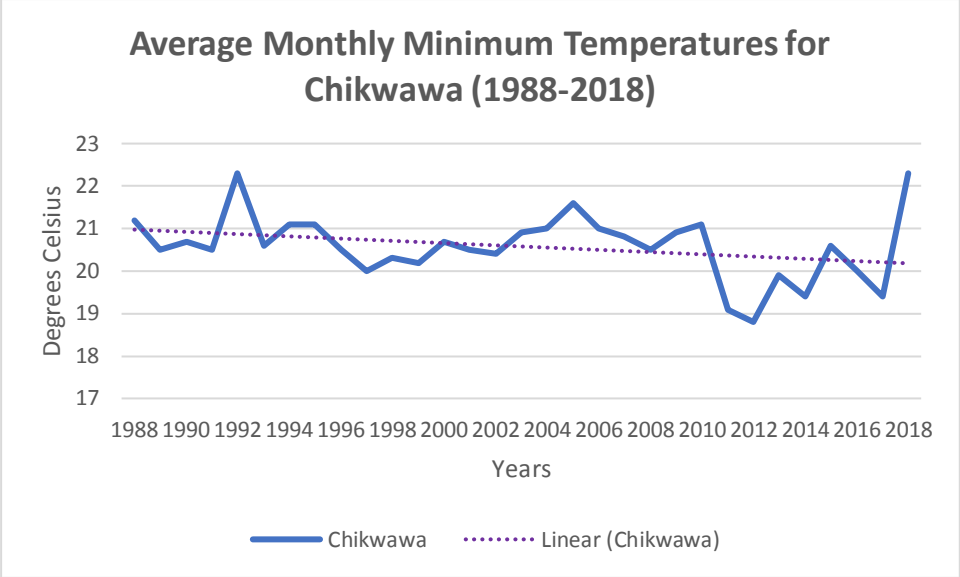

Figure 6.34: Average monthly minimum temperatures (°C) for Chikwawa District (DCCMS, 2018)

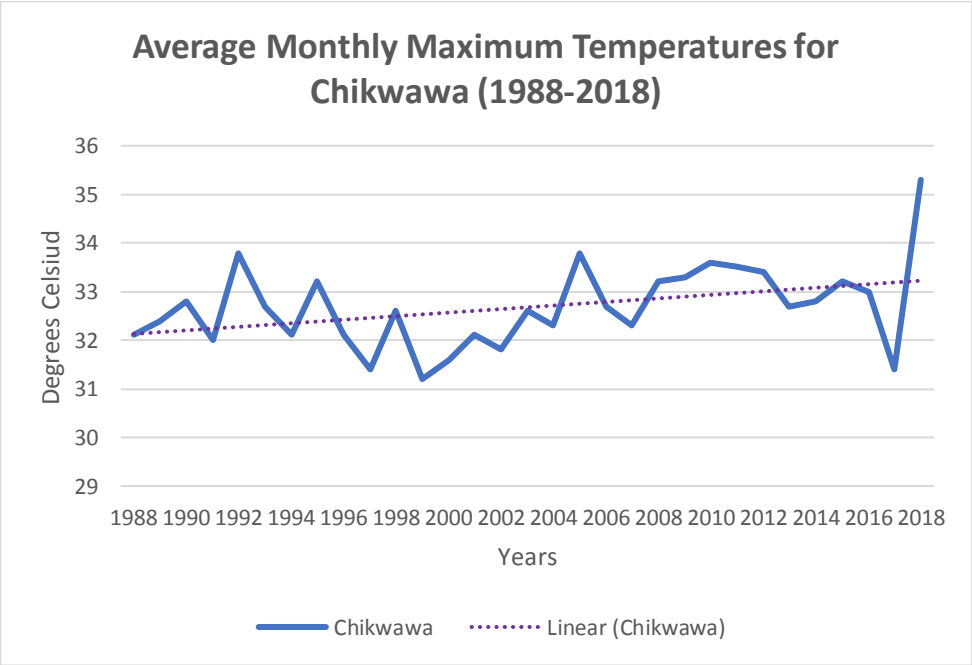

Figure 6.35: Average monthly maximum temperatures (°C) for Chikwawa District (DCCMS, 2018)

In reference to the meteorological data (1988-2018) assessed by this study in figures 6.34 and 6.35, the trends indicate that there has been a minor but constant increase in monthly minimum and maximum temperatures in Chikwawa District over the last 30 years. In comparison, the maximum temperature trends have been rising steadily but a higher increase was observed between 2010 and 2018 while and minimum temperature trends have been fluctuating over the years and increased greatly in 1992 and 2018. This is in line with the assessment done by USAID (2012b) which observed that the average annual temperatures have increased by 0.9°C between 1960 and 2006, and at an average rate of 0.21°C for every 10 years. Daily temperatures observations also showed rising trends of hot days and nights in all seasons for the district and the occurrence of hot days indicate certain significant increase although highly variable and unpredictable.

This is in tandem with study findings where 98% of respondents observed changes in temperatures and the assertion made by FGDs that days and nights were becoming warmer than in the past. This is also supported and verified by several other assessments and studies carried out locally to produce and record noticeable and forecast impacts of climate change and variability in the country. The Second National Communications Report (GoM, 2011b) to the UNFCCC exposed that the frequency of hot days and hot nights had intensified in all the seasons throughout the years. The increase in frequency of intense temperature events distressing human beings, livestock and crops are anticipated to be more increasingly common and widespread and particularly this will bring severe impacts on crop productivity and food security of smallholder farmers.

Rainfall trends in Chikwawa District

This study analysed the meteorological data for the district for the period of 30 years of 1988-2018 as indicated below.

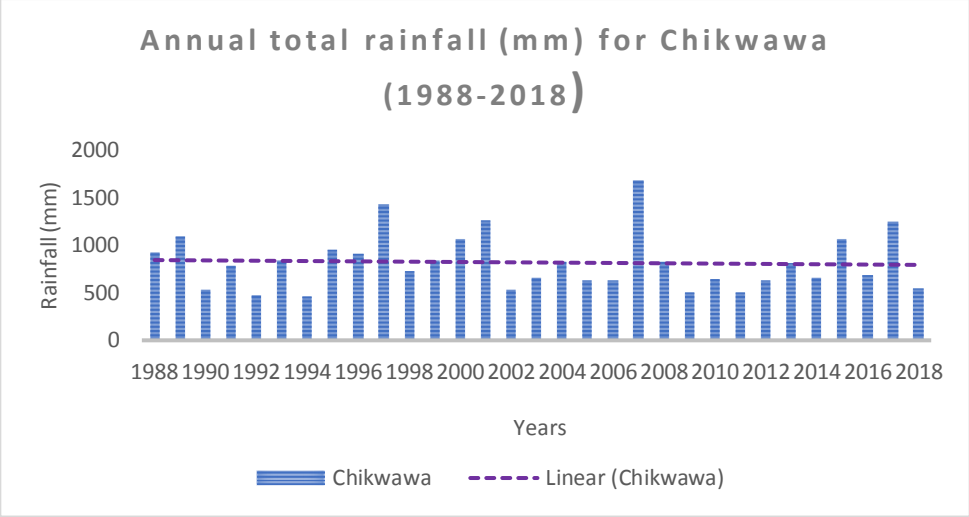

Figure 6.36: Annual rainfall (mm) for Chikwawa District (DCCMS, 2018)

The study respondents perceived on constant decline of precipitation/rainfall amounts in the district over the years. This is confirmed by the fact that the meteorological data and observations of rainfall for the district has been fluctuating across the 30-year period with reduced amounts (figure 6.36). The district has been deprived of precipitation for most of the years except 1997, 2001, 2007 and 2017 when significant amounts of rainfall were observed. Surprisingly this is one of the districts that experience flooding, and this is because of its low-lying position or inclination on the lower Shire and most of the floods are from the upland. The data implies a rise in evaporation and increased droughts because of hot weather conditions and this has led to more incidences of water shortage in the current years (GoM, 2016b). In relation to this, the meteorological data also show annual variability and increased reduction in rainfall trends line. It is important to note that he major and common challenge to smallholder farmers in the district is that there are unpredictable and unreliable rainfall patterns as shown in figure 34 above. For example, Chikwawa District has an average total annual rainfall of 845.75 mm with the highest total annual rainfall of 1425.1 mm recorded in 1997 and a lowest total annual rainfall of 455.2 mm recorded in 1994. In Chikwawa, most of annual precipitation falls during the rainy

season (November to March and a small amount fall in winter which is between May and July (GoM, 2018a).

In terms of the time when the rainy season commences, the data analysed agrees with FGDs and KIIs findings such the rains commence very late in November and ends quickly and abruptly in March and April and the peak is in January and February. This means that the inadequacy of rainfall for a period of 8 months (April to November) decreases the capability of smallholder farmers to cultivate various agricultural crops. This is the reason why the smallholder farmers in the district are always faced with food insecurity thereby affecting their well-being.

Temperature trends in Zomba District

Temperatures in Zomba District are somewhat cold. The annual average minimum temperature is 15.5°C and it rises to 16.4°C during the production season and goes down to 15.3°C in the winter/cold season while the annual average maximum temperature is 27°C which does not vary much in the course of the year (GoM, 2018a).

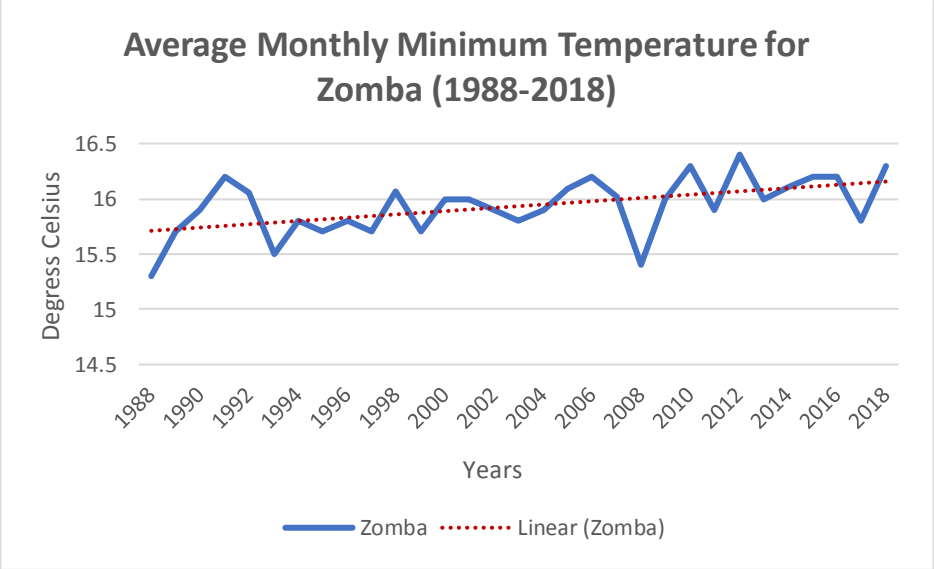

Figure 6.37: Average monthly minimum temperatures (°C) for Zomba District (DCCMS, 2018)

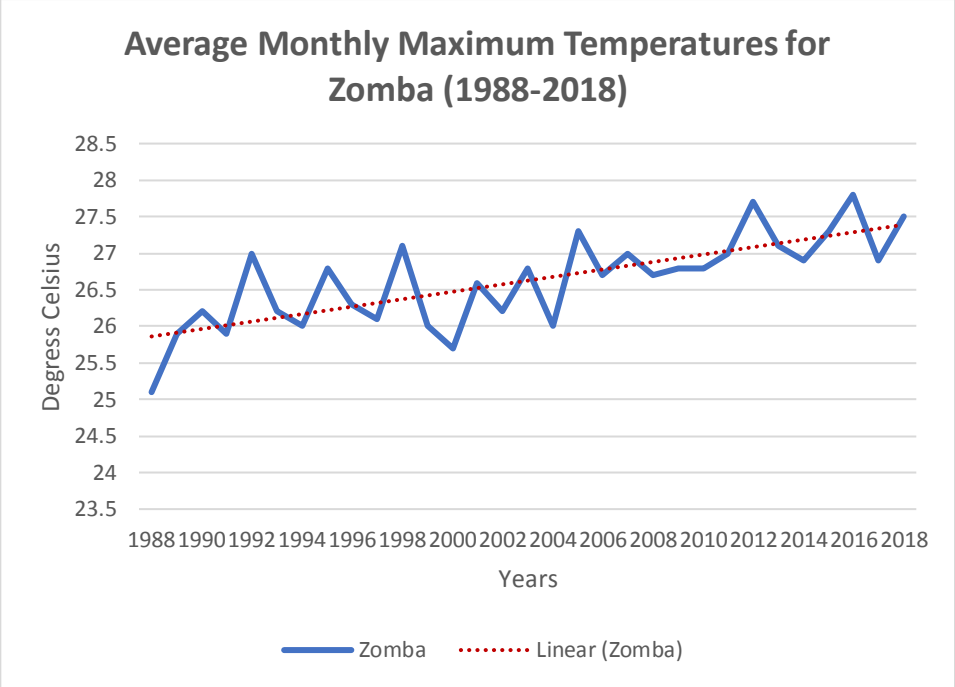

Figure 6.38: Average monthly maximum temperatures (°C) for Zomba District (DCCMS, 2018)

Meteorological data (1988-2018) from DCCMS was appraised by this study and is shown in figures 6.37 and 6.38, the trends indicate that there has been a minor but stable increase in monthly minimum and maximum temperatures in the district over the past 30 years. In comparison to maximum and minimum temperature trends, the later shows more rise in high degrees as opposed to the former. Daily temperature surveillances indicate rising trends of hot days and nights in all seasons for the district and the occurrence of hot days indicate certain significant increase although highly inconsistent. This is in line with study findings where 98.7% of respondents observed changes in temperatures and the affirmation made by FGDs and KKIs that days and nights were becoming warmer than in the past years.

In related assessments that were appraised by this study also show temperature related extremes such that Malawi is encountering rising temperature trends of 0.9°C detected between 1960 and 2006, and hotter seasons. The increase in frequency of intense temperature events distressing human beings, livestock and crops are anticipated to be more

increasingly common and widespread and particularly this will bring severe impacts on crop productivity and food security of smallholders. Furthermore, Global Circulation Models (GCM) forecasted that the average temperature in Malawi could increase by 1.1 to 3.0°C in the 2060's and by 1.5 to 5.0°C by the end of 2090 (IPCC, 2007c).

Rainfall trends in Zomba District

The study analysed meteorological data on precipitation for Zomba district over the past 30 years (1988-2018) as presented in figure 6.39 below.

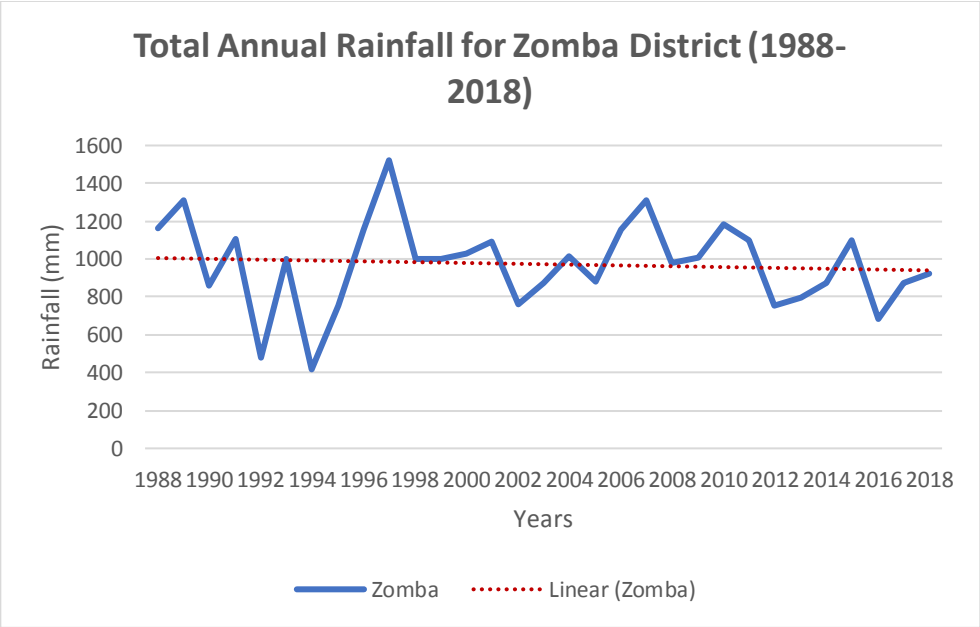

Figure 6.39: Annual rainfall (mm) for Zomba District (DCCMS, 2018)

The study respondents in Zomba District indicated that there has been a reduction in precipitation, and this has been clearly affirmed by the meteorological data and surveillances of rainfall over the district (figure 6.39). Precipitation amounts have been experiencing declining trends except the period between 1993 and 2000 when there was a steady increase of rainfall amounts, but since then, precipitation has been declining. In relation to this, the meteorological data analysed from Zomba show annual variability with little reduction in precipitation trends line. Similar studies on adaptation that were analysed around Lake

Chilwa in Zomba indicate one of the effects of an altering hydrological system as diminishing levels of water in Lake Chilwa is regarded as a regular phenomenon (Chiotha, Likongwe, Sagona, Mphepo, Likoswe, Tsirizeni, Chijere, & Mwanza, 2017)**.** The major and common problem to smallholder farmers in the district is that it has unpredictable and uneven rainfall patterns as shown in figure 6.39 above. For example, Zomba District has an annual total average rainfall of 1,005.21 mm with the highest total annual rainfall of 1312.8 mm recorded in 2007 and a lowest total annual rainfall of 417.4 mm recorded in 1994. Most of annual precipitation falls during the rainy season (November to April and very little amounts fall in winter which is between May and July (GoM, 2018a).

In terms of the time when the rainy season commences, the data assessed is in agreement with FGDs and KIIs results which say that the rains start late in November and ceases abruptly in March or April and the peak is in December, January, and February. This entails that the inadequacy of rainfall for a period of 7 months (May to November) decreases the capability of smallholder farmers to cultivate crops. This contributes to food insecurity of smallholder farmers and it results in reduced opportunities for resilient livelihoods.

In conclusion, the findings of the temperature and rainfall data analysed from the study districts has led to a presumption or opinion that climate change is a reality in the four study districts of Karonga, Salima, Chikwawa and Zomba and Malawi as a whole. It is verified that temperatures are commonly and slowly warming up, mostly the minimum temperatures. Nevertheless, throughout the duration analysed, there was a slight change in average temperatures. The seasonal data from the Department of Climate Change and Meteorological Services records that the rainy season seemed to be commencing late and ending early. In this regard, there is a general understanding on aggregate rainfall season changes. The FGDs' indications and other reports reviewed indicated that rainy seasons in all the districts are increasingly becoming shorter and unpredictable. In

addition, rainfall is decreasing little by little but progressively specifically in March and April over the study districts.

This also means that climate change will deepen food self-insufficiency and insecurity as it escalates average annual temperatures and swing the timing of and amounts of precipitation from the present patterns. Malawi is already facing increased frequency and intensity of existing climate hazards especially floods and droughts. Malawi has historically been prone to both droughts and floods arising from rainfall variability.

6.5. PEACE AND SECURITY

Peace and security is one of the characteristics of community climate resilience as discussed in chapter two. The respondents were asked to indicate if at all they enjoy peace and security in their respective areas.

6.5.1. Peace and security prevalence in the study area

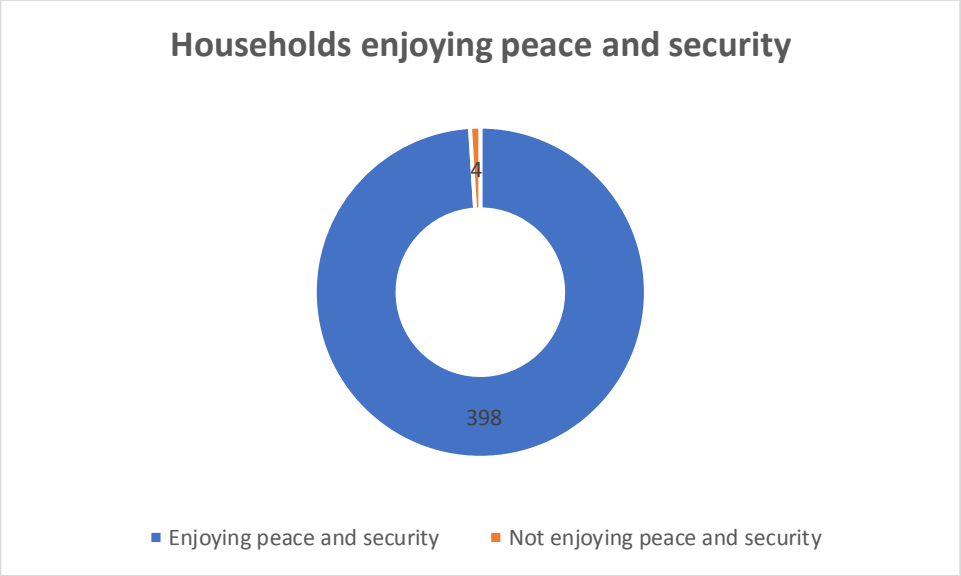

Figure 6.40: Peace and security prevalence in the study areas

The results as shown in figure 6.40 revealed that most households in the study districts are enjoying continual peace and security. This means that the communities in these areas can plan and carry out their livelihood improvement actions freely without any disruption. The study also confirms that peace and security is paramount for any community to achieve sustainable development.

6.5.2. Factors affecting peace and security of respondents

The respondents were also asked to indicate factors that affect or disturb their peace and security and the responses are shown in figure 6.41 below.

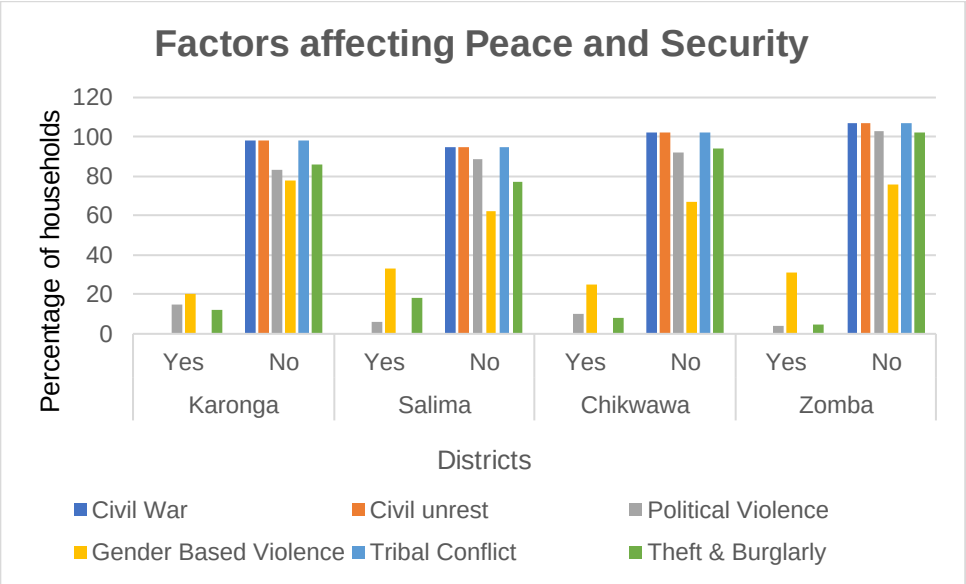

Figure 6.41: Factors affecting peace and security of respondents

The results show that out of the six potential factors that affect peace and security, gender-based violence, theft and burglary, and political violence were mentioned to be affecting the peace and security of the communities. However, these were insignificant because there were very few households that indicated such as opposed to many households that reported that they do not affect the peace and security. This implies that peace and security in the study district of Karonga, Salima, Chikwawa, and Zomba is good and that communities in these areas are enjoying continual peace and security.

6.6. HOUSEHOLDS OPINIONS ON THEIR RESILIENCE STATUS

With the purpose of identifying whether the households are resilient or not, the respondents were asked to assess their climate change resilience levels by providing some of the indicators of household resilience.

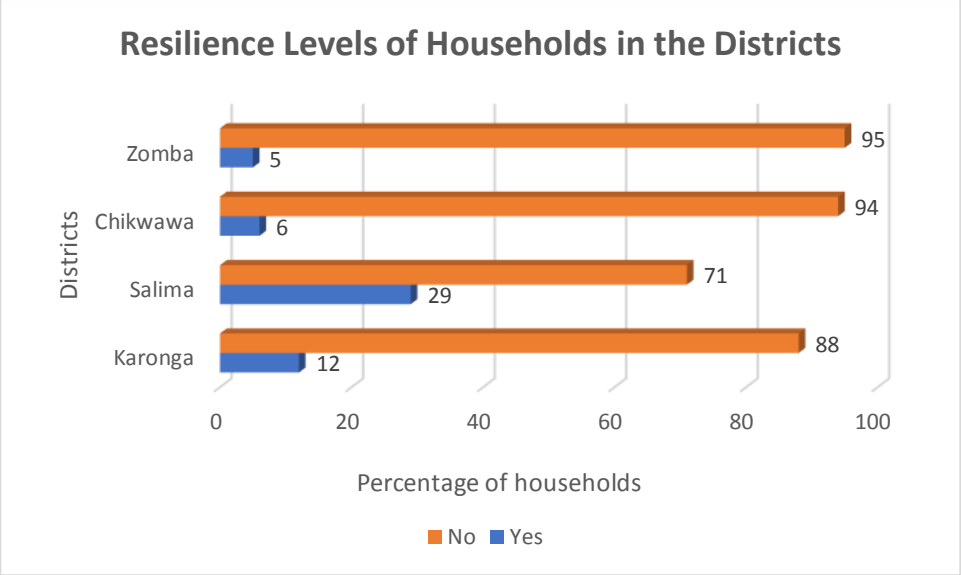

Figure 6.42: Resilient households in the study districts

According to the study (figure 6.42), few households in Karonga, in Salima, in Zomba, and in Chikwawa respectively reported that they think they are resilient to climate change while a great number of households in all the respective districts of Karonga, Salima, Chikwawa and Zomba explained that they think they are not resilient. The households that said they think they are resilient to climate change mentioned indicators such as access to clean water, getting stable income, capacity to cope and recover from shocks, capacity to secure adequate food, and capability to move out of poverty. While the majority who reported that they are not resilient said they have no adaptive capacity for them to improve their resilient livelihoods and that they lack livelihood options including basic household assets.

Looking at the differences, the findings in figure 6.42 above, the resilience levels are at different levels. However, this may not necessarily be the case because these were the opinions of the respondents. The researcher thinks that a small percentage of resilient households in Chikwawa, Karonga and Zomba is attributed to the fact that the households are faced with multiple impacts of climate change. These include various disasters like droughts and floods hence making them more vulnerable. Salima has households that are a bit more

resilient because the district does not experience periodic climatic disasters as such gains made by households contribute to their livelihood improvement.

In relation to the resilience indicators that were mentioned by the study respondents, the FGDs and KIIs revealed key contributing factors to climate change resilience. These contributing factors include the following: livestock ownership, access to finance, (formal or informal), cash or food support, access to health, subsidy for farming, irrigation, technologies and inputs for farming, education, fisheries income, environment, good and decent housing, off-farming activities (employment, business, and labour), and remittance. It is there concluded that the households in the study districts are not resilient enough because they lack livelihood options and adaptive capacity to recover from shocks and at the same time, they are not able to meet conditions for resilience building.

In terms of level of resilience for the districts, the results indicated that households in Salima are more resilient than all the other districts because 29% of households had a set of resilient livelihoods strategies. In addition, they reported that they have more than two livelihood options and are implemented as a package for adapting to climate change. On second position, 12% of the people of Karonga are building their resilience through a few resilient livelihoods to improve their adaptive capacity. Chikwawa District has 6% households being resilient according to the study results and comes third. During the study, it was revealed that most of the households in the district have no specific resilient livelihoods options because they are hit by droughts and floods every year and at least 90% of these households are on subsistence level of farming. The last district with a few households that are resilient to climate change is Zomba of which only 5% of households were deemed resilient to climate change. Most households in Zomba have little or no alternatives to farming as a way for adaptation such that when climate change impacts hit them hard, they become unable to adapt to the changes.

Deducing from the study, the results confirm in principle that all households in all the four districts are not yet fully resilient to climate change even though they are trying to implement some adaptation strategies to climate change. This means that just a few households are trying to build their resilience but not at a larger scale. In this regard, the principles of resilience which include robustness, scale, redundancy, rapidity, flexibility, self-organising and integration are not fully met and taken into play.

Findings from FGD and KIIs indicated that climate change resilience building in the study districts and Malawi in general is not fully achieved because of the following issues:

- Malawi is, on paper, a decentralised country because there is a decentralisation policy that seeks to ensure that functions, resources, and services are decentralised for effective delivery of development programmes including climate change adaptation and resilience building. The problem is that the Government is rigid, and she is not willing to devolve functions, resources, and services to district councils. A lot of bureaucracy derail and affect execution of the initiatives.
- Financial resources allocation: Even though Malawi Government recognise climate change as a threat to all sectors of development, many programmes to do with climate change management are not fully executed due to inadequate funding. Even though, the Government of Malawi does not directly and specifically allocate resources for climate change in the annual fiscal plan, implementation of climate change projects and programmes in Malawi is dependent on donors and well-wishers. It is a fact that allocating budgets to support sustainable human development, disaster management, drought relief, conservation-based agriculture helps in managing climate change indirectly in the country. However, the resources are still not adequate to deal with impacts of climate change.

- Inadequate capacity in implementation of resilience actions. Many Government departments and ministries have high vacancy rates as such smallholder farmers are not provided with extension services and other technical advice. This affects implementation of adaptation and resilience building initiatives because communities have no modern ways of doing things let alone the use of new technologies and innovation.
- Donors come with preconceived project ideas that are deemed to support climate change adaptation. However, this approach contributes to maladaptation in some contexts since it does not address real problems to do with climate change impacts. Some conditions that are attached to resources of projects and programmes related to climate change management are detrimental to climate change adaptation and climate change resilience building.
- Most of communities are not fully willing and committed to participate in development initiatives including climate change adaptation and resilience building. This is due to cultural beliefs and customs, attitude of individuals within the society and high illiteracy levels that are affecting the understanding of development issues.
- Lack of seriousness in implementing relevant policies in climate change management and other development related policies. The country has very good policies, but they are not fully implemented, may be due to lack of political will, insufficient financial resources, external influence like natural disasters that affect the economy thereby making the authorities shift their focus to more of social protection and humanitarian support, among other reasons.

In general, for a community to be resilient to climate change, some characteristics must be achieved or met to a certain extent, however, not all the characteristics are met by the households in all the districts. Firstly, economic security as one of resilience characteristics is achieved

or realised by some households even though households are not able to diversify income sources by means of alternative income sources by getting skills and knowledge in an alternative manner. Secondly, water supply is believed to be realised to a larger extent even though not all households have access to clean water. Thirdly, in terms of disaster preparedness, communities/households are believed to have the ability to improve on disaster preparedness through development of early warning systems even though not adequate. This is evidenced by the fact that households are aware of climate change, are able to interpret indigenous knowledge systems and have functional institutional arrangement to support climate change related actions such as local and national governance structures. Finally, the results depicted that households are really enjoying continued peace and security, and this is an opportunity that can propel climate change adaptation action for resilience building.

However, KIIs and FGDs reported that for households and communities to become more resilient to climate change they must meet several factors or conditions. These conditions include food security, early warning, early action to leave no-one behind, availability of financial resources, stable and resilient infrastructure, access to clean and portable water, economic security, peace and security, and disaster preparedness.

The study on its literature review and the results focused on the four characteristics of resilience. This meant that for a community to be resilient, it has to meet these characteristics at some levels. During the study, some respondents, FGDs, and KIIs provided one more characteristic of resilience and it is education. Some respondents and FGD participants indicated that they think education is one of the characteristics of resilience because those that have better education are able to articulate climate change issues and plan for effective resilient livelihoods. KIIs corroborated by emphasising that education increases peoples' literacy as such it helps people to comprehend issues easily and help in coming up with good plans for livelihood improvement

and sustainable development. So, they indicated that education plays an important role in increasing the resilience of communities in the study areas.

6.7. DOCUMENTATION AND DISSEMINATION OF CLIMATE CHANGE RESILIENCE DATA IN MALAWI

Malawi has executed several projects and programmes aiming at addressing climate change and these have focused on climate change mitigation, climate change adaptation and recently climate change resilience. Various policy documents related to climate change management were developed and enacted to ensure smooth programming and implementation of related actions. The programming and implementation of projects are done by the Government, Non-Governmental Organisations, and donor partners.

A lot of resources have been channelled to climate change management through sectoral arrangement as opposed to general themes and needs of development. This has resulted in the challenge of making one sector more relevant than others and this means that one sector benefits more than others. For instance, the agriculture sector has benefited a lot from climate change related allocation of resources because agriculture is the backbone of the country's economy and yet it is also sensitive to climate change. The agriculture sector is very important in Malawi because it contributes to around 28% of the country's Gross Domestic Product (GDP) and over 80% of the national export earnings (GoM, 2017a). Some sectors that have also benefited from climate change management interventions include water resources, irrigation, forestry, energy, fisheries, land resources conservation, and wildlife management.

The KIIs conducted during this study reported that projects and programmes on climate change are implemented according to the dictates of the financier and they are coordinated by Ministry of Natural Resources, Energy and Mining. It was indicated that most of the climate actions implemented by various stakeholders for the past ten years have

been focusing on mitigation and adaptation priorities. But nowadays, the focus of many stakeholders is on ensuring that communities and the general population build climate change resilience at individual, households, and community levels with the aim of breaking the cycle of food insecurity (GoM, 2017b).

The study results revealed that once the projects and programmes are implemented, reports are prepared to demonstrate that the projects have achieved the objectives and outcomes and are shared with implementing partners and donor partners. The challenge on this is that there are no efforts to follow up on the impact that the projects have made and how these can be sustained. Some stakeholders have tried to document reports, policy briefs, best practices, success stories and case studies related to impacts of the project on climate change adaptation and livelihoods. Out of 12 key informants interviewed at national level, 8 of them indicated that most of the actions done have been on climate change adaptation and that there has been no proper mechanism for documenting the best practices and success stories for dissemination to the general public apart from routine reporting which is a requirement for any running project. Bearing in mind that climate change adaptation is key to ensuring climate change resilience, there was a need for Government to have a mechanism for documentation and dissemination of climate change resilience for various stakeholders to learn and understand processes, methodologies, and strategies for building community resilience. This could help development practitioners to devise plans and strategies for replication and scaling up so that sustainable livelihoods through green economy measures for Malawi can lead to resilient communities as proclaimed by the overall goal of the National Climate Change Management Policy are achieved.

The problem, therefore, is that climate change adaptation and climate change resilience data is not very well and fully documented to inform future planning and implementation of plans, policies, and programmes. This affects effective implementation and introduction of innovations for resilience building that eventually slows down resilient livelihoods for the

communities. The study found out that data and information on climate change adaptation and resilience building is available but is not well documented.

6.8. SYNTHESIS OF DATA RELATED TO KEY RESEARCH QUESTIONS

Apart from the study tools (household questionnaire, Key Informant Interview guide and FGD Checklist), some key research questions related to the research objectives were devised in order to get specific results for the issues. The results related to these research questions are discussed below:

- **What are the categories of climatic hazards and shocks/stresses that occur in the community? Participants were required to identify and provide different hazards and shocks that affect their day-to-day life.**

  The results from the household respondents, FGDs and KIIs revealed that the communities face several climatic hazards and shocks. Generally, the people of Karonga, Salima, Chikwawa and Zomba Districts mentioned almost common hazards even though some of them are localised in specific places. Most of the households in Karonga stated that they face climatic hazards such as drought, dry spells, floods, strong winds, hailstorms, landslides, earthquakes, pollution, human diseases, animal diseases, and market failure. In Salima, the households reported that the climatic hazards/shocks that occur in the district include floods, droughts, dry spells, strong winds, hailstorms, earthquakes, human diseases, animal diseases, plant pests, and market failure. In Chikwawa District, many households testified that the district faces climatic hazards such as floods, droughts, dry spells, strong winds, hailstorms, pollution, animal diseases, human diseases, plant pests, and market failure. While in Zomba District, most of the households mentioned climatic hazards such as floods, droughts, dry spells, landslides, earthquake, pollution, human diseases, plant diseases, and market failure.

Through the discussions with FGDs and KIIs, there are a number of categories of these climatic hazards and shocks that were identified and include the following:

- **Water and weather-related hazards**
  These include floods, droughts, dry spells, strong winds, and hailstorms.
- **Geological and environmental**
  They include landslides, earthquakes, and pollution.
- **Disease outbreaks and pest infestations**
  The climatic hazards under this category include human diseases, animal diseases, and plant diseases.
- **Economic disturbances**
  The only hazard that was identified under this category is market failure.

- **How adaptive are the communities and individual households to climate uncertainty and/or impacts? Respondents here were required to indicate trends of climate change in their locality and how they adapt to those issues.**

The results from the respondents show that the adaptive capacity of the communities and households is not adequate because they lack knowledge, information, and skills on how to track climate challenges/impacts. This is evidenced by the fact that a larger percentage of all households indicated that they do not have the capacity to address challenges that come as a result of climate change as well as not able to recover from climate shocks and depend on assistance from relatives, government support and other non-state actors. In addition, they do not have capacity that would help them in disaster preparedness. They also mentioned that they do not have access to capacity building initiatives in the form of training and sensitisation meetings on climate change related issues, and it's only a few households that are able to attend to those

initiatives. This is due to the fact that in some areas, there are climate change related projects going on and those few households are part and parcel of the projects.

They stated that climate change is increasing over time in these districts, and they need to be equipped with some skills in preparedness, contingency planning, and recovery but unfortunately it is not the case. This situation has led to the communities in these districts to have low adaptive capacity hence contributing to low resilience building in their households and community at large.

- **Which governance issues are prevalent in the district level structures and level of participation of communities and other stakeholders in resilience building? The participants were asked to identify enabling factors within their locality and how they spearhead adaptive capacity and resilience building.**

  The study identified some governance issues that impede effective implementation of climate change actions and in particular, resilience building. The issues include non-functioning of district level civil protection committees due to limited support in terms of resources, leadership challenges where leaders are not very much conversant with their mandates, lack of coordination between and among local leaders and district authorities, and lack of political will from all the district level structures. These issues are frustrating efforts of spearheading peoples' adaptive capacity and resilience building.

- **What are the livelihood copying strategies that are employed by people in the districts to achieve climate resilience (through household economic security, access to sufficient and good quality water, disaster preparedness, and peace and security)? Respondents to provide in detail their livelihoods strategies for their daily living related to resilience characteristics.**

The study identified some types of livelihoods that the households and the community in general employ for survival amidst impact of climate change. They include use and the sale of assets for household income, food, transportation, for farming activities, shelter, and for communication; petty trading; piece work; livestock production for sale and food; and crop husbandry/production for food and income.

Most of the detailed information on types of livelihoods and livelihood strategies have been indicated on sections 6.1.6 through 6.1.11.

- **What are key strategies employed by people in the districts for climate change adaptation and building community resilience? Participants were required to identify and provide strategies or mechanisms that make adaptation and resilience building possible.**

The key strategies employed by the people in the districts include practising conservation agriculture, enhance crop production, enhance livelihood production for income, tree planting for catchment conservation, enhanced irrigated agriculture to supplement rainfed farming, promote crop diversification, cultivating drought tolerant crops, formal employment, migration for employment, income generating activities, aquaculture, and practising agroforestry techniques. Section 6.2.13 of chapter 6 provides detailed information on the strategies for adaptation and resilience building.

- **Which factors or conditions that show that building community resilience is taking place in a district or society? The participants were required to share success factors and conditions for building community climate resilience.**

The study results revealed that a few households across the districts are becoming resilient and this means that most of them are struggling to adapt to climate change and build their resilience. The

results revealed that there are several factors or conditions and characteristics that ensure community resilience building and they included access to clean and portable water, peace and security and economic security. The detailed information is shown on section 6.6 of chapter 6.

The discussions and interactions with KIIs and FGDs, the study revealed that there are many conditions or characteristics that show that households or communities are building their resilience or are becoming resilient. These include food security, early warning, early action to leave no-one behind, financial resources availability, stable and resilient infrastructure, access to clean and portable water, economic security, peace and security, and disaster preparedness.

CHAPTER 7: CONCLUSIONS, FINDINGS AND RECOMMENDATIONS

The study focused on the analysis of climate change resilience of vulnerable communities in Malawi.

Chapter 6 provided the key results/findings of the study and provided a contextual analysis of data for the findings and discussions. This chapter pinpoints, in summary, the key findings related to each objectives of the study. It, therefore, outlines conclusions, findings, and recommendations of the study. It also highlights the contribution of the study to development discourse in general.

In terms of how the chapter is organised, conclusion is a summary of the context of the study in relation to study objectives, methodology and the process, and key information on results. Then key findings are highlighted on each theme and objectives followed by contribution of the study to the field of development studies, and finally a description of recommendations based on the findings of the study.

7.1. CONCLUSION

The study was carried out with the purpose of analysing climate change resilience of vulnerable rural communities in Malawi. The focus was to establish how climate change is affecting the general livelihoods of communities in the four districts of Karonga, Salima, Chikwawa and Zomba. The other main purpose was to identify climate change adaptation and resilience building strategies employed by communities in these districts, to establish the extent of climate change adaptation and community climate change resilience building in Malawi, and to identify gaps for future research and action. Through these objectives, the study explored on climate change adaptation strategies, extent of resilience building, indicators of community resilience, and livelihood options for the respondents in the study areas among other areas.

In terms of the respondent households' characteristics, the study showed that most of them are resource poor and are in the category of poor people because a large percentage of the communities is poor, and their literacy level is low which affects comprehension of development initiatives. The households do own the assets, but these are basic ones which only support their day-to-day livelihood, of which many households do not own several and valuable productive assets. These assets, to a larger extent, contributes to households' livelihoods by bringing income, bringing food after selling them, transportation, farming activities, shelter, and information and communication. A larger percentage of households do own land but agricultural productivity on the land is at a subsistence level which limits peoples' choices in improving their livelihoods and climate change adaptation. This is exacerbated by the challenges that affect their agricultural production which include floods, livestock crop raiding, theft, lack of improved inputs, small land sizes, inadequate labour, weeds, soil erosion, soil infertility, lack of oxen, drought, and erratic rainfall.

Household variables, opinions and adaptation and awareness to climate change were assessed from respondents, development practitioners from the Civil Society Organizations and officers from Government departments and ministries and the findings were triangulated and compared with existing literature and empirical/observed results from various sources such as Meteorological Services. The general situation is that households and communities are very much aware of climate change and its impacts and the development practitioners from government departments agreed with this understanding. In addition, the communities, respondent households and FGDs conducted agreed that there are indicators of weather differences between the present and the past 30 years. This shows that they are able to understand climate change. This is observed through variations in the status of the climatic elements and variables such as temperatures and precipitation or rainfall. These indicators included late planting of various crops, strong winds, increased temperatures, regular floods in large volume, poor

precipitation distribution, early cessation of precipitation, late onset of precipitation, and decline in precipitation amount. As a result, climate change has brought several consequences that have impacted on the lives of the people and one of the consequences is the occurrence of disasters associated with climate change. The disasters include floods, erratic rainfall, droughts, dry spells, hailstorms, and prevalence of army worms. Notwithstanding communities and development practitioners being aware of climate change and its impacts, it seems there are no tangible actions taken on board to understand the climate change impacts and shocks more so that they can find solutions to withstand them.

In regard to temperature and rainfall trends for the past 30 years, the household respondents, development practitioners and stakeholders indicated that temperature and rainfall trends have been changing over time. This has been in tandem with the empirical findings from weather information collected from meteorological stations and this has been agreed upon by various climate change experts. This meteorological information/data indicate that there has been a minor but stable increase in minimum and maximum temperatures in the study districts. The minimum temperatures show more rise in degrees as opposed to maximum temperatures. While on rainfall, the analysed data indicate annual variability with slender reduction in rainfall trends line. These findings have therefore, agreed with the fact that temperatures are increasing steadily, and rainfall patterns are variable thereby affecting precipitation distribution hence making rainy seasons becoming increasingly shorter and unpredictable. It is vital to understand these weather patterns and plan effectively on how to adapt to them.

It is interesting to note that the communities have understanding of various types of indigenous knowledge systems that can be used for comprehending the nature of a disaster that may happen, predict for any eventuality and plan for a course of action for preventing the disasters. However, the communities are not taking efforts to have formal processes of using these indigenous knowledge systems. It is important

to provide more capacity building to these communities and the relevant local structures on prediction and planning on usage of these knowledge systems. These systems are proven to be helpful and reliable because the rural households and subsistence farmers keep records. There are rain gauges in their localities and the data is related to various IKS mentioned by communities.

Climate change is a big threat to socio-economic development of Malawi because it affects key sectors of development and what is required is to make sure that all institutions that spearhead implementation of climate change and environmental management programmes are vibrant in ensuring social capital within the locality. In Malawi and in the study districts in particular, there are local institutions that support implementation of climate change related work and institutions at national level support the local institutions in providing policy direction, human capital, and financial resources. The general scenario in Malawi is that much as efforts are done to address climate change impacts, these institutions are not fully supported because of lack of political will to support climate change, uncoordinated efforts among stakeholders, and inadequate financial resources coupled with misallocation of the limited available resources.

Since it is evident that climate change is here to stay, it is very important to think about innovative ways of how to increase local peoples' ability to adapt to its impacts. Climate change adaptation should be transformational in nature and should be implemented as a package. Transformational adaptation is a type of adaptation that seeks at reducing root causes of susceptibility to climate change in the long term by shifting systems away from unsustainable/untenable or undesirable trajectories (O'Brien, 2012; Olsson, Galazi, and Boonstra. 2014). The household respondents during this study mentioned several adaptation strategies that they are involved in, that are believed to contribute to their household resilience. However, it is important to understand that these strategies are employed at different scale and are not fully contributing to adaptation and resilience building. These strategies included

enhancing crop production, practising conservation agriculture, livestock production for income, tree planting for catchment conservation, irrigated agriculture to supplement rainfed agriculture, crop diversification, cultivating drought tolerant crops, employment, migration for employment, income generating activities, aquaculture, and practising agroforestry techniques. These are good strategies for adaptation; however, they are not implemented on a full scale and they lack innovations. Much as the local communities are believed to carry out these adaptation strategies and activities through Community-Based Adaptation and Ecosystem based Adaptation, it was discovered that these two approaches of adaptation are not practised at a larger scale. This is because most of the households are not really aware of them due to the fact that development practitioners, experts and stakeholders do not provide adequate capacity building to local structures on these two approaches of adaptation to climate change.

In terms of resilience building perspective, the study districts are said to be resilient though not adequate. This is because a significant number of households and Key informants indicated that they are meeting the characteristics of resilience. This, however, has to be emphasised that the characteristics are not fully met due to some challenges that the households face and are affecting their way of life. They include inadequate productive assets, inadequate capacity on climate change adaptation, insufficient household income sources, food self-insufficiency, and inadequate water supply among others. Generally, the households in the study districts are becoming resilient as evidenced by the fact that some households are able to meet or achieve economic security, water supply, disaster preparedness, and peace and security to some extent.

This study was limited to an analysis of resilience of vulnerable rural communities in Malawi and focused on areas of climate change adaptation and resilience building strategies and extent of resilience of the households. The level of resilience of the households was determined by analysing the characteristics of resilience described

above. The analysis also helped to identify a gap or a need to explore more on levels of resilience for vulnerable rural communities and contribution of resilience to socio-economic development of the country considering various factors.

7.2. KEY FINDINGS OF THE STUDY

This section outlines key findings of the study in relation to the characteristics of resilience as described in chapter 2 and also as per the analysis of results in chapter 6 and these include economic security, water supply, disaster preparedness, and peace and security.

7.2.1. Characteristic 1: Economic security

Key findings

Theme 1: Land tenure and land use

The findings (Chapter 6, section 6.2.1) show that most of the households in the study areas own land for agriculture and other uses. The land owned is used for agricultural production while those that do not cultivate their land indicated that they utilise the land by renting it to others for financial gain, share cropping, and fallowing it.

Households that do not own any land rent land from others to grow crops while others do not rent the land but buy the produce for their households. The households that own land have no documentation of the land while a few households have documentation for their land in a form of title deed or lease certificate.

Climate Change has greatly affected livelihoods of the communities in the study areas because it has contributed to environmental degradation thereby resulting in the soil loss. Regular floods and run-off are also end results of climate change that lead to soil erosion. This scenario has eventually and gradually made most of the soils in the study districts less fertile. In the end, people are not able to produce enough agricultural crops for food and income and that their livelihood needs are not adequately met.

In line with the findings described in Chapter 6, section 6.2.1 (Land utilisation), most of the households in these study districts have soils that have low fertility while others have soils that are slightly fertile. The communities measure the fertility of the soil by observing the yield of crops from that soil. This simply means that the soils that have little fertility are shown by yields realized over time while those that are slightly fertile have substantial yield over time. So, the yield of any crop in a specific land is relative to its fertility. This situation is affecting agricultural productivity which is affecting well-being and livelihoods of the households.

Theme 2: Types of farming practices (rainfed, mixed and irrigation)

Climate change is also affecting the way smallholder farmers practice their agriculture because agriculture is very sensitive to climate change. According to the findings of the study, households in the study districts practise rainfed agriculture seconded by mixed farming and then irrigated farming.

In reference to these results (chapter 6, section 6.2.2), it was discovered that in all the study districts, households still depend on rainfed agriculture for their livelihood despite facing the challenge of changing climate seconded by mixed faming (production of various crops and livestock for food and income). Due to increased impacts of climate change, livelihoods of smallholder farmers are affected, and other livelihood options are also equally affected because they are dependent on agriculture. Climate change also contributes to making vulnerable households continue to depend on rainfed agriculture instead of irrigated agriculture because of increased dry spells and droughts. This is leading to water shortages for both domestic use and irrigation farming.

During the study, the households revealed that even though irrigation is practised on a small scale, it is one of the best strategies for adapting to climate change because it is a source of supplementary food to that of produced by rainfed agriculture and is a source of additional income. Farmers are facing challenges to implement irrigated farming

technologies because of inadequate technical knowhow in the management of related activities, insufficient resources, little or no extension services to improve on the practices, lack of political will in relation to investing in irrigation farming in Malawi.

Theme 3: Crop husbandry and yield of crops

Crop production is one of the major strategies for getting means for livelihood improvement because crops are sources of food and income to meet household needs. Crop husbandry in the study areas showed that various crops are grown and these include maize, groundnuts, cassava, pigeon peas, sweet potatoes, sorghum, millet, beans, paprika and tobacco (Chapter 6, section 6.2.3). This clearly indicates that the most grown crops in the study areas whether as cash crops or food crops include maize, groundnuts, pigeon peas, sweet potato, sorghum, and cassava. This is related to the fact that the households indicated that their three main sources of food include own production, buying, free distribution or relief food, and piece work. The results also showed that the two main sources of food in the study area are own production and buying the produce. Own production implies that they produce their own crops since they own land while buying the produce relates to the fact that they purchase from traders or those people that produce food crops on their land.

The results discovered that yields for all crops vary according to production in all the households (Chapter 6, section 6.2.3). This means that production of various crops is affected by a number of factors that are related to climate change and these include soil infertility, droughts, dry spells, pests and diseases, uneven distribution, and inadequate amounts of rainfall. The standard deviations of all the crops still show differences in regard to yield for each crop per harvest. For example, maize is produced in large quantities seconded by sweet potatoes, while the crop with lowest yield is Paprika. This means that the respondents from all the study districts value maize as a staple food and sometimes sell it for income. According to respondents' responses, maize is the

main staple food for people of Salima and Zomba, cassava and maize are main staple foods for people of Karonga, sorghum and millet are main staple foods for Chikwawa. Beans, groundnuts, soybeans, paprika, sweet potato, pigeon peas and sugarcane are main cash crops across all the study districts even though they can also be used as food.

The results show that the households are practising crop diversification but on a low scale because very few households were able to grow more than one crop for household food and income such that most households do not diversify their crops at a larger and commercial scale. The findings also confirm that crop husbandry is not adequately meeting the basic needs of households because it is done on a subsistence level and therefore, affecting the livelihoods of communities. This also affects the utilisation of productive assets because they become inaccessible due to low-income levels in the households.

Theme 4: Main sources of food for households

The findings (Chapter 6, section 6.2.4) reveal that main sources of food in the study districts include own production, buying the food, relying on free distribution or relief work, and go for piece work.

According to the results, the two main sources of food in the study area are own production and buying the produce. Own production means that they produce their own crops since they own land, while buying the produce relates to the fact that they purchase from traders or those people that produce food crops on their land.

Theme 5: Yield of major crops in the study areas

The results discovered that yields for all crops vary according to production in all the households (Chapter 6, section 6.2.5). This means that production of various crops is affected by a number of factors that are related to climate change and these include soil infertility, droughts, dry spells, pests and diseases, uneven distribution, and inadequate amounts of rainfall.

The standard deviations of all the crops still show differences in regard to yield for each crop per harvest. For example, maize is produced in large quantities seconded by sweet potatoes, while the crop with lowest yield is paprika. It should be noted that the standard deviation of the crops simply signifies the uniformity of yields of the crops among the farmers. This means that the respondents from all the study districts value maize as a staple food and sometimes sell it for income. According to households' responses, maize is the main staple food for people of Salima and Zomba, cassava and maize are main staple foods for people of Karonga, sorghum and millet are main staple foods for Chikwawa. Beans, groundnuts, soybeans, paprika, sweet potato, pigeon peas and sugarcane are main cash crops across all the study district even though they can also be used as food.

Theme 6: Challenges faced by respondents in agriculture production

The study also attempted to identify challenges faced by the respondents in general agricultural production and they mentioned several challenges of which most of them are also related to climate change and livelihoods. The findings in Chapter 6, section 6.2.6 revealed that the challenges faced by farmers in agricultural production include theft, floods, livestock and crop raiding, weeds, lack of oxen, inadequate labour, small land size, soil erosion, lack of improved agricultural inputs, soil infertility, droughts, insects and diseases, and erratic rainfall.

The findings indicate that the study districts face several challenges as indicated above, but the major ones include rainfall, droughts, and lack of agricultural inputs. It was revealed that erratic rainfall and droughts can be averted if smallholder farmers are able to access improved agricultural inputs that are favourable and still do well with the harsh conditions. Unfortunately, this is not the case as it was discovered that farmers in the study districts use recycled seeds, primitive and traditional pesticides that are not effective. In addition, the farmers/households

have no access to boost their agricultural productivity (Chapter 6, section 6.2.6).

Theme 7: Strategies for meeting daily needs in times of cash and food shortage

The challenges in agriculture production bring scarcity and shortages of basic necessities at household and community level. Bearing this in mind, the respondents narrated some strategies that they employ to meet daily needs in times of cash and food shortage.

The results in chapter 6, section 6.2.7 indicate that the respondents employ various strategies for meeting daily needs in times of cash and food shortage. They include practising petty trade, piece work, selling livestock and/or household assets. These are regarded as the strategies employed by the respondents to avert cash and food shortage. The households indicated that they prefer piece work seconded by practising petty trade, and finally selling livestock and/or household assets.

Theme 8: Livestock production

The analysis of the respondents in terms of livestock ownership and their estimated values is discussed in chapter 6, section 6.2.8 which highlights minimum livestock owned, maximum livestock owned, the average ownership, and the average estimated value in all the districts under the study. Cumulative results indicate that goats, chickens, and pigs are mostly owned by respondents, while in terms of value the livestock that are not highly owned but are better off are cattle and pigs. However, ownership of these livestock is on a small scale because of poverty levels at household and community levels in the study districts. Cattle and pigs followed by goats fetch high prices when sold and are regarded as important in boosting household income within a short period.

It is vital to note and understand that for most of the classes of livestock reared in these study areas, the standard deviation is precise because the number of livestock is not normally and evenly distributed. People have different herds of livestock though not at a commercial scale, it was

discovered that some farmers/households keep livestock just for prestige.

Livestock are important in supporting the livelihoods of the smallholder farmers because they provide meat and milk for food and nutrition, and income. From the findings, different types of livestock are reared in the districts, however, production is at a very small scale such that households' livelihoods are not fully realised despite meeting some needs.

Theme 9: Household assets

Availability of assets in the household implies that the household is able to cope with climatic or any shocks because they help in improving their livelihoods. Household assets provide alternative livelihood opportunities to the members of the household because they can use them for various purposes.

The findings in chapter 6, section 6.2.9 show that all the households have assets of some sort. The respondents stated that they own different types of household assets that contribute to their livelihoods. The study findings show the frequency of assets ownership in all respective districts. The respondents in the study districts own radios, oxcarts, ploughs or ridgers, sprayers, sewing machines, motorcycles, televisions, decent houses, and hoes. No household owns a car in the study districts. Ownership of assets in the districts is a bit of a problem as evidenced by the low percentage on the ownership and this signifies high levels of poverty that affect livelihood options. This, in turn, also affects resilience of households to climate change because of inadequate livelihoods alternatives. However, those households that own some assets show some levels of resilience and improved livelihoods.

The households narrated that there are several ways of how they acquire the household assets. The study revealed that households in the study districts acquire their household assets by buying, getting them through donations, exchange for labour, getting from relatives.

It is clear from the results that most households own assets that have low value because they can afford to buy and use them. The household income levels do not allow them to go for other assets with high value as such there is a big gap between household income and the assets that can help in improving their livelihood. This is related to household status as regards to poverty levels in such a way that if a household has little or no meaningful assets, it becomes very difficult to plan and implement actions that will lead to increased food self-sufficiency, food security, increased income, and access to decent life. As a result, the household is often times engaged in petty activities to survive and not to uplift their well-being by going beyond survival mechanism. This eventually prevents the household or community from coming up with ideas and plans of how it can improve the life of members and increase their resilient livelihoods.

The findings show that the assets owned, though not adequate, contribute to livelihoods by bringing income to the household, bringing food after selling them, transportation, for farming activities, shelter, and information and communication. According to the findings in chapter 6, section 6.2.9, households indicated that assets bring income, bring food after selling them to buy food, used for transportation, used for farming activities, help them in providing shelter, and that assets are used for information and communication.

The uses of assets in any household or society provide a basis for resilient livelihoods because they provide an opportunity for households access to basic amenities. For example, when some assets help to bring income in the household, what can happen is that the income can make it easy for the household to buy some basic things such as food, clothes, additional assets, and pay for other services. Similarly, if a household depends on agriculture as is the case in all the study areas, some assets can help in ensuring that agricultural activities are easily implemented. This assist household that rely on farming for their livelihoods since they would be able to produce crops for food and cash. In addition, availability of assets in the household implies that the household is able to cope with

climatic or any shocks because they help in improving their livelihoods. Household assets provide alternative livelihood opportunities to the members of the household because they can use them for various purposes. But if most of the productive households are not available for many households, it becomes difficult to cope with climatic shocks hence inadequate livelihoods. However, ownership of assets by households in these study areas is limited and this also implies that livelihoods are limited too.

Theme 10: Sources of credit for households in the districts

The findings on the sources of credit revealed that households have some sources of credit for household use in terms of meeting livelihood opportunities and these include getting credit from relatives, micro loan institutions, banks, cooperatives, and Village Savings and Loans (chapter 6, section 6.2.10). However, these sources of credit are not reliable due to the fact that impacts of climate change have affected all sectors of development and all people are also affected in one way or the other. It could be that enterprises and trading activities are not doing well or agricultural productivity that is a source for food and income is not doing well too.

The results clearly indicate that the main sources of credit which the households rely on are relatives, Village Savings and Loans (VSL), and cooperatives. The findings also showed that some households have no sources of credit. The findings imply that a lot more people have no reliable sources of credit for supporting their actions that can contribute to livelihoods and general well-being.

Theme 11: Coping mechanisms and availability of food

The study tried to discover coping mechanisms that people employ to cushion themselves from effects of climate change in times of livestock and crop failure. The findings in chapter 6, section 6.2.11 show peoples' coping mechanisms in times of livestock and crop failure. The results show that the major mechanisms include piece work, reducing number of meals per day, borrow money with interest, asking friends, and

fetching fuelwood for sale. The other mechanisms employed at a small scale are migration, wild fruits collection, and sale of household assets including livestock.

The findings also revealed the types of assistance that the households get from stakeholders in times of food deficit, and they include getting food aid from the Government, getting cash transfer from the government, and food for work programme. This implies that the three major types of assistance that people in the study districts get from government and other stakeholders are food aid, cash transfer, and food for work programme.

Karonga District has lower food aid as compared to the other three districts because the area relies much on support from the government, and also logistical challenges due to distance affect food aid. There are very little or no Non-Governmental Organisations and Non-State Actors who provide humanitarian support to vulnerable households in this area as compared to the other districts. In addition, it is discovered that there are clear differences in food aid, cash transfers and food for work programme combined. This is like that because the government and other stakeholders provide support to households based on the need as per the annual assessments that are done. The assessments reveal the levels of vulnerability for each element in the districts. According to the Post Disaster Needs Assessment of 2019, the findings show that some districts are more vulnerable than others on aspects of food insecurity, income, among other factors. For example, the report indicates Karonga, Chikwawa and Zomba as more hit by climate relate disasters hence more vulnerable.

The respondents also provided mechanisms that people in the study areas take on board in response to changes in rainfall and temperature. They reported that the key mechanisms include planting drought resistant crops, utilise improved crop varieties, practise crop rotation, increased livestock production, and adopt and enhance irrigated agriculture. This implies that households in the study areas have the

ability to adopt some mechanisms to ensure that changes in temperature and rainfall are responded to for their improved resilient livelihoods.

Theme 12: Climate change adaptation strategies and resilience building

Climate change adaptation plays a very important role in improving the livelihoods of any community because it contributes to resilience building. For communities to become resilient, adaptation must have strategies that would be implemented as a package in order to ensure resilience. This is linked to what is called transformational adaptation that looks at broad changes in a system and changes through several systems and it centres on the near future and long-term changes. It also looks at investigation of the efficiency of present procedures and practices, communal inequalities and unfairness, and differences in capabilities. Transformational adaptation provides an opportunity for any community or households to have long-term plans of how to increase their adaptive capacity and predict how they can deal with future and emerging shocks and crises emanating from climate change.

This study findings (chapter 6, section 6.2.12) discovered that there are several strategies that communities employ to adapt to climate change at different levels. According to the findings, the key adaptation strategies for Karonga are practising conservation agriculture, enhancing crop production, enhancing livestock production for income, cultivating drought tolerant crops, practising agroforestry techniques, and promoting crop diversification. In Salima, the predominant adaptation strategies to climate change include promote crop diversification, practising conservation agriculture, employment, migration for employment, aquaculture, practising agroforestry techniques, enhance irrigated agriculture to supplement to rainfed agriculture, enhance livestock production for income and tree planting for catchment conservation. The major adaptation strategies for households in Chikwawa are practising agroforestry techniques, income generating activities, aquaculture, employment, enhance livestock

production for income, practising conservation agriculture, promote crop diversification and cultivating drought tolerant crops. Finally, in Zomba District, the respondents reported that they depend on promoting crop diversification, income generating activities, enhance irrigated agriculture to supplement rainfed farming, tree planting for catchment conservation, enhance livestock production for income, enhance crop production, and practise conservation agriculture.

In this context, the extent to which adaptation is being adopted is different in all the respective districts based on scalability. It is a fact that all the adaptation strategies are employed at a small scale and subsistence levels. Much as the households in the study areas are able to diversify livelihoods, the level of adaptation is not sufficient to cement their adaptive capacity for resilience building.

In relation to adaptation strategies, the results also revealed key approaches or models that the households use to enhance their adaptation and resilience building and they are Community-Based Adaptation (CBA) and Ecosystem Based Adaptation (EbA). This means that all the adaptation strategies taken on board are either implemented using Community-Based Adaptation or Ecosystem based Adaptation. According to the findings, many households in Karonga, Salima, Chikwawa and Zomba use Community-Based Adaptation as an approach to adaptation and resilience building. On other hand, few households in Karonga, Salima, Chikwawa, and Zomba are using Ecosystem based Adaptation for adaptation and enhancing resilient livelihoods.

7.2.2. Characteristic 2: Water supply

Key findings

Theme 1: Water sources

The results (chapter 6, section 6.3.1) show different water sources for households in the study areas, and they include boreholes, piped water, shallow wells, and unprotected sources. The two major sources of water for the study areas are boreholes and piped water. My observation is that the government and donors have invested many resources to provide boreholes and piped water in the study districts, hence, increase in the number of households having access to water.

Theme 2: Water access

The results in chapter 6, section 6.3.2 indicate that there is some sort of water shortage in the study areas and that households do experience it. However, most of the households believe there is no shortage of water except in Chikwawa District where a significant percentage of respondents indicated that they experience water shortage. The results, therefore, imply that water shortage in the study districts is not really a problem.

The findings also show that there were specific years when the households experienced water scarcity ranging from being severe to very severe. This means that climate change contributed to this problem. The factors that compounded this problem were dry spells and droughts that caused lowering of water table due to little or low rainfall.

The respondents revealed that they were also having challenges in accessing to or fetching water due to long distances. The respondents provided estimated average distances in terms of kilometres that respondents especially women cover to fetch water. The long distances have a bearing on other productive activities related to resilient livelihood improvement and general sustainable development because most of their time is spent in trying to have access to water.

Theme 3: Water harvesting structures and technologies

The findings in chapter 6, section 6.3.3 show that some households in the study districts have land that has various water harvesting structures while many households stated that their land has no water harvesting structures. The water harvesting structures that were mentioned to be available on the land include box ridges, planted vetiver on contour lines, check dams, water harvesting tanks, and contour bands. This implies that most of the households have land that cannot retain water, and this means the productivity of their agricultural produce may not be maximised.

Water harvesting structures or technologies help in addressing water stresses where climate change is prevalent, and the water harvested can be used for domestic uses and irrigated farming. However, this is not the case in the study districts because there are no proper water harvesting structures and technologies. This in turn, compounds on the challenge of drought that bring about the water stress for both humans, livestock, and crop production.

7.2.3. Characteristic 3: Disaster preparedness.

Key findings

Theme 1: Sources of information for households

The findings in chapter 6, section 6.4.1 show that households in the study area have some sources of information on climate change and disaster preparedness in general. The respondents reported that their sources of information on climate change include radio, extension workers, community meetings, family and friends, newspaper, and television. According to the respondents, the findings of the study imply that the main sources of information for the households are radios, extension workers and community meetings.

For households to be equipped with knowledge and information, they should have access to reliable information and able to utilise that information for decision making. It is the same with climate change, disaster preparedness, adaptation, and resilience building. Households need to have access to relevant information for effective planning and implementation of various household and community adaptation strategies.

Theme 2: Household variables, opinions, and awareness to climate change

The study revealed that many households are aware of climate change and that they have heard about it (chapter 6, section 6.4.2). Overall, a few households indicated that they have never heard about climate change and that they are not aware of it, while many respondents reported that they have heard about climate change and that they are aware of climate change. According to the results, it implies that almost all the households in the study districts are aware of climate change and are able to comprehend its basic concepts. The households that heard about climate change reported that they heard about climate change through colleagues and friends, radios, school, newspapers, government agencies, extension agents, and television.

An enquiry to the respondents on indicators of differences in weather conditions in the study districts was done. The analysis also showed the responses from respondents on whether there are differences in weather conditions between the present and that of 30 years ago. The results revealed that most households believe that there are differences in weather conditions while a few of them believe that there are no differences in weather conditions between the present and the past 30 years. The respondents were also asked to provide responses on any indicators of differences in weather conditions. The results show that most of the respondents reported that indicators of weather differences between now and the past 30 years include late planting of various crops, strong winds, increased temperature, regular floods in a large

volume, poor precipitation distribution, early cessation of precipitation, late onset of precipitation, and precipitation amount has declined. A few households reported that early onset of precipitation, precipitation amount is the same, and that precipitation amount has declined are also indicators of weather differences. This means that a few households differed with most households who stated that the above elements are indicators of weather differences. However, most households revealed that aspects of early onset of precipitation, precipitation amounts being the same, and the increase in precipitation amounts are not indicators of the weather differences between the present and the past 30 years. It is important to note that increased temperature, strong winds, regular floods in large volume, poor precipitation distribution, and late planting of various crops are very prominent in the study areas. It is important to note that the indicators of weather differences between the present and the past 30 years are being used by local communities to understand climate change particularly by old people. They predict what can happen based on their experiences.

The study discovered that there are variations in the status of the climatic elements/variables particularly temperatures and precipitation over the past 30 years in the study areas. Most of the households reported that changes of these variables are becoming severe, and very few households indicated that there is a slow change of the variables, and some households stated that there are little visible changes observed, while some households said that there is no change of these variables. The results show that the respondents feel that both temperatures and precipitation have been changing or fluctuating over time. According to the respondents opinions, this signifies the prevalence of climate change.

Climate change has brought several consequences that impact on the lives of the people and one of these consequences is the occurrence of disasters associated with climate change. The findings also show that the disasters that are related to climate change include floods, erratic rainfall, prevalence of fall army worms, droughts among others. During

the study, very few households indicated that their areas have not experienced any disaster related to climate change, while most of the households reported that their areas experienced disasters related to climate change.

In addition, the households were asked to indicate types of disasters related to climate change that the districts experienced and these included floods, erratic rainfall, droughts, hailstorms, and prevalence of fall army worms. These disasters were mentioned across all the four districts of which what differed was the extent of their occurrence. The results show that floods are very prominent in Chikwawa and Zomba, erratic rainfall is very prevalent in Chikwawa and Karonga, droughts are very prominent in Karonga, Salima and Chikwawa, hailstorms are very prevalent in Salima and Zomba, while fall army worms are more prominent in Karonga and Salima.

The various disasters related to climate change highlighted above as provided by the study respondents clearly show their prominence in the respective districts and certainly, they bring about some impacts and damages to the population thereby affecting livelihoods of the same people. As such, the respondents reported that there are several damages that are caused by these disasters and they include crops washed away due to floods, soil erosion, livestock deaths, roads, and bridges damaged, death of people, infestation of pests and diseases, and house/property damage. According to the findings from the respondents in the study districts, the major damages that have been experienced by the population in the areas are washing away of crops due to floods, livestock deaths, damage to roads and bridges, and soil erosion. The respondents were also asked to provide multiple responses on the disasters which they know are prevalent in their respective areas.

In relation to the disasters and damages that are prevalent in the study districts as described above, the respondents were also asked about any coping mechanisms that they employ in times of disasters. The respondents were able to provide multiple responses based on what

they employ as far as their coping mechanisms are concerned. The coping mechanisms which were mentioned by the households in the study households include Government support, piece work, food relief and donations, petty trade, sale of family assets, sale of forest products, wage labour among others. It was discovered that generally, the major coping mechanisms for the study districts include piece work, government support, food relief and donations, and sale of family assets in that order.

Theme 3: Indigenous Knowledge Systems (IKS)

The study revealed some types of indigenous knowledge systems that are available in the study areas and are used for early warning systems to predict any eventuality amidst climate change (chapter 6, section 6.4.3).

The results revealed that various indigenous knowledge systems are prevalent in all the study districts of Karonga, Salima, Chikwawa and Zomba, and what differs is the scale on which communities understand and interpret them and also their utilisation. A good number of households from each district indicated that they have no idea of any indigenous knowledge systems. According to respondents' explanations, the systems help them in predicting and planning for weather and climate eventualities.

According to the results from the respondents, amongst all the indigenous knowledge systems that were identified, there are some that are the major ones. These include strong winds two months before the start of rainy season, high production of mangoes (fruits), white birds flying together in one direction, high multiplication of army worms, shading of leaves of some tree species, and extreme high temperatures during rainy season. According to the communities these signify less rainfall during the rainy season, dry spells, onset of rains, dry spells or low rainfall, onset of rains, and intense rainfall respectively.

Theme 4: Institutional arrangement and support to climate change

Institutions are very vital in implementing each and every socio-economic activity in a society be it at national or local level. As such climate change, disaster preparedness, adaptation and resilience building depend on viable and vibrant institutions because they form social capital that promotes working relationships among people. This is true to the fact that climate change affects and inconveniences the social sections more inexplicably thereby influencing local institutions on how they can get access to and utilise various assets and resources in adaptation and resilience building.

The findings (chapter 6, section 6.4.4) revealed that there are several local institutions that support planning and implementation of climate change, disaster preparedness, and adaptation interventions. The notable ones being Village Civil Protection Committees, Area Civil Protection Committees, District Civil Protection Committees, and other committees that oversee development related activities. These institutions work hand in hand with government agencies in enhancing adaptive capacity and resilient livelihoods. Their role is to implement policy actions as part of improving their livelihoods and well-being.

The Focus Group Discussion (FGD) participants, Key Informants and agriculturalists argued that these institutions help in coming up with indigenous knowledge, information and skills in planning and implementation of adaptation interventions. They discuss and share information on general climate change issues, how to tackle impacts of climate change, early warning systems and how to recover from shocks in times of disasters related to climate change. It was reported by the FGD participants that climate resilience is slowly being achieved because most of the local institutions are not strong enough to make informed choices and plans. In addition, these local institutions and the social groups were used to implementing incremental adaptation that focuses on building existing adaptation actions and knowledge attained. This involves using existing models/approaches in managing climate

change but aims at maintaining the present actions without focusing on future uncertainties and this affects resilience building. The advantage nowadays is that the communities are commencing to go for planned adaptation of which they plan for the present and the future in relation to adaptation practices. Some of the key informants attested to this by explaining that planned adaptation is transformative because the local institutions and the people ensure that they integrate new and innovative ideas/solutions for sustainable development and resilience building.

At national level, Malawi has several institutions implementing climate change related programmes, and all these are coordinated by Environmental Affairs Department under Ministry of Natural Resources, Energy and Mining. There are various technical and steering committees on climate change that oversee technical planning, implementation, and policy direction of climate change. The Government institutions are supported by the civil society and Non-Governmental Organisations of which some are into actual implementation of resilient livelihoods projects while some are involved in policy analysis and advocacy.

Despite having relevant institutions that support climate change management and programming in Malawi through coordination, there are still challenges that affect climate change governance in the country. For instance, there is lack of political will in ensuring that funding is available specifically for climate change programming, little or no allocation of resources in the national fiscal plan year in year out. The other challenge include non-availability of a designated entity or institution to spearhead issues of climate change from project identification to implementation, monitoring and evaluation and reporting even though the process of establishing a National Climate Change Fund commenced but at snail's pace. The establishment of the fund took time because the process of formulating legislations to govern it was long and needed political will from the Government.

Theme 5: Climate change trends in the study districts for the past 30 years

Various scientists have explained that the globe is warming up and that temperatures and rainfall patterns are changing. This study, therefore, tried to assess and triangulate or confirm if climate change is a reality in the study districts of Karonga, Salima, Chikwawa and Zomba and Malawi in general as indicated by respondents during FGDs and KIIs. The researcher assessed and analysed the meteorological data of temperature and rainfall patterns for the study districts for the past 30 years (1988 – 2018).

After analysing the data, the findings in chapter 6, section 6.4.5 show minimum and maximum average monthly temperatures for all the respective districts over the 30-year period. In addition, annual rainfall or precipitation of the respective study districts were also analysed. The results show different trends for minimum and maximum temperatures and rainfall for the respective study districts.

The findings of the temperature and rainfall data analysed from the study districts has led to a presumption or opinion that climate change is a reality in the four study districts of Karonga, Salima, Chikwawa and Zomba and Malawi as a whole. It is verified that temperatures are commonly and slowly warming up, mostly the minimum temperatures, nevertheless, throughout the duration analysed, there was a slight change in average temperatures. The seasonal data from the Department of Climate Change and Meteorological Services records that the rainy season seemed to be commencing late and ending early. In this regard, there is a general understanding on aggregate rainfall season changes. The FGDs' indications and other reports reviewed indicated that rainy seasons in all the districts are increasingly becoming shorter and unpredictable. In addition, rainfall is decreasing little by little but progressively specifically in March and April over the study districts.

This also means that climate change will deepen food self-insufficiency and insecurity as it escalates average annual temperatures and swing

the timing of and amounts of precipitation from the present patterns. Malawi is already facing increased frequency and intensity of existing climate hazards especially floods and droughts. Malawi has historically been prone to both droughts and floods arising from rainfall variability.

7.2.4. Characteristic 4: Peace and security

Theme 1: Continual enjoyment of peace and security

The findings in chapter 6, section 6.5.1 revealed that most households in the study districts are enjoying continual peace and security. This means that the communities in these areas can plan and carry out their livelihood improvement actions freely without any disruption. The study also confirms that peace and security is paramount for any community to achieve sustainable development.

Theme 2: Factors affecting peace and security of respondents

The results in chapter 6, section 6.5.2 show that out of six potential factors that affect peace and security, gender-based violence, theft and burglary, and political violence were mentioned to be affecting the peace and security of the communities. However, these were insignificant because there were very few households that indicated such as opposed to many households that reported that they do not affect the peace and security. This implies that peace and security in the study district of Karonga, Salima Chikwawa and Zomba is good and that communities in these areas are enjoying continual peace.

7.3. GAPS IDENTIFIED FOR FUTURE RESEARCH AND ACTION

Key findings

This study which focused on analysing resilience building of the vulnerable rural communities in the face of climate change. The study explored linkages of climate change adaptation and climate resilience

building, effects of disasters related to climate change and their effects on socio-economic development, and how communities in the study areas are adapting to impacts of climate change and build resilient livelihoods.

The study explored and identified some gaps that require future research (chapter 6, section 6.2.12 and 6.4.4) and they include the following:

- **Investigating climate related natural disasters and their impacts on socio-economic development and resilience building.**

  The study analysed the impacts of disasters to socio-economic development and resilient livelihoods of the communities. But it discovered that there are several parameters that have to be considered in understanding relationships between and/or among disasters, socio-economic development, and resilience building nexus. It requires a whole range of quantifiable data that can substantiate the problem at hand.

- **Exploring factors that impede climate resilience building of rural vulnerable communities.**

  The study also showed that communities are able to execute climate change adaptation and resilience building strategies and initiatives. However, climate resilience was not fully achieved despite all the efforts. There is a need to explore the bottlenecks and/or factors that impede communities to become resilient.

- **Assessing factors affecting policy implementation in least developed countries.**

  It is important to assess and understand the reasons why appropriate and meaningful policies are not fully implemented. This will give an indication of how countries plan their development plans and strategies.

7.4. CONTRIBUTION OF THE STUDY TO THE FIELD OF DEVELOPMENT STUDIES

7.4.1. The study has contributed to the field of development studies especially on climate change by identifying a new characteristic of a resilient community. The new characteristic of resilience according to the study participants which was not part of the literature review is education. Education was repeatedly mentioned by study participants as a characteristic of resilience. This entails that all children are able to complete primary, secondary, and tertiary education/school. Most of the assessments and studies in Malawi have not tackled issues of practical strategies of resilience building through implementation of various projects. This study, therefore, confirmed that education is one of the characteristics of resilience and this is a contribution of this study to climate change resilience discourse.

7.4.2. The study has also contributed to discussions on climate change because it has provided a platform of and linkages between climate change adaptation and resilience and whether this translates into improved community livelihoods and a resilient community.

7.4.3. Finally, the study has made an original contribution to the field of Development Studies by exploring and identifying effective strategies for building community resilience to climate change of which it is a learning point for development practitioners and other stakeholders for replication. This will enrich the development domain with additional knowledge on practical practices for climate change adaptation and resilience building.

7.5. RECOMMENDATIONS

These recommendations provided in this section are simply propositions that have been made based on the results of the study and can be considered in order to implement climate change programmes successfully at any level. They are presented in relevant headings and they need advanced and detailed research in the future.

7.5.1. Policy awareness, review, and implementation

Malawi is one of the countries with very good policy documents. For example, she enacted National Climate Change Investment Plan (NCCIP), National Climate Change Management Policy, National Disaster Management Policy among others (see chapter 6, section 6.6 for a discussion). Since their enactment they have never been disseminated to wider population particularly the local masses who are rights holders of any development. The local masses are not fully aware of the contents of these policies and are not able to participate in any interventions related to the policies or strategies let alone getting involved in citizen action planning. Some of the strategies/policies have not been reviewed to incorporate emerging issues hence making them lack some relevant elements of new ideas.

It is a common fact that the country is good at producing excellent policy documents, but the problem is their implementation. The failure in implementing policies is due to reasons such as lack of political will to support the process, little or no allocation of financial resources for effective implementation, and uncoordinated efforts among players (government and stakeholders).

There is need therefore, to deliberately explore ideas of how to deal away with these bottlenecks and establish an institution that can spearhead implementation of policies in an independent manner. This will ensure effective flow of information and ideas thereby increasing participation of all the stakeholders.

7.5.2. Institutional arrangements and support for climate change

National and local institutions are very key in addressing climate change issues because they provide socio-economic integrations at all levels through provision of human capital and financial capital. The strategies and policies made at national level institutions are transferred to local institutions for practical implementation. However, national level institutions like the National Technical Committee on Climate Change and National Steering Committee on Climate change have not done enough in supporting local structures in translating policies into action. A few agendas, minutes of meetings and reports of these committees were accessed during the study and they showed that there is some progress in implementing the policies and strategies. The role of the institutions is discussed in chapter 6, section 6.4.4. In addition, the country is failing to access global resources on climate change that could support adaptation, mitigation, and resilience building.

It is recommended that the Government should put commitment on the establishment of the National Climate Change Fund, a pool of resources that will solely support climate change programming for better adaptation and building a resilient nation through climate financing.

7.5.3. Enhance irrigation farming for climate change adaptation

Climate Change is a reality and has brought threats to all spheres of peoples' lives and this include effects on development sectors (see chapter 6, section 6.2.2). One of the key sectors affected by climate change is agriculture simply because it is sensitive to climate change. Nowadays, there is prevalence of increased and regular dry spells and droughts that are leading to lowering of the water table hence shortage of water resources. Climate change is also making rainfall unpredictable and unreliable and its distribution uneven and this results in shorter rainy seasons or normal rainy seasons but with little precipitation amount not enough for agricultural production.

Enhancing irrigation farming is perceived as one of the best strategies to adapt to climate change and resilience building. It is therefore, recommended that there is need to prioritise it by allocating more resources (human and financial) for implementation in order to supplement rainfed agriculture that is experiencing the harsh reality of climate change.

7.5.4. Full devolution of powers from central government to District Councils

The National Decentralisation Policy for Malawi was enacted in 1998 and the goal of this policy is to ensure that there is total devolution of powers on service provision and all functions from the central government to district councils for effective implementation of development projects. This meant that technical and financial resources and all the functions would be devolved to district councils or sub-national levels and/or local communities. But more than twenty years since the policy was formulated and enacted, nothing tangible has been achieved because power and functions are yet to be fully devolved. Currently, only 5% of the national budget is given to district councils and the rest is managed centrally and the budget does not even include any allocation on climate change (see chapter 6, section 6.6 for a discussion).

The government should be aware of the need to implement the decentralisation policy to its fullest by ensuring that all the powers and functions are devolved to district councils for effective and timely implementation of climate change related and general development projects and programmes. Government should also give a priority of including a specific vote in the national fiscal plan for climate change which is not the case as of now.

7.5.5. Promote crop diversification for climate change adaptation

The study revealed that the land tenure is a problem in the study areas because their land holding is small and that is why most of the farmers cultivate crops at a subsistence level and this affect innovative ways of adapting to climate change (refer to chapter 6, section 6.2.3 for a

discussion). Some of the respondent households indicated that they practice crop diversification so that they meet diversified livelihoods, however, it is difficult to diversify crops effectively since they use same crop varieties. It is recommended that various crops that can do well in the face of climate change are introduced to the farmers for production. For example, drought resistant crops and early maturing varieties can be introduced for diversification.

It is vital to also provide awareness and capacity building to the farmers on the production of those crops as part of adaptation to climate change. This will help them to plan properly in terms of how to diversify the crops in a small piece of land and produce more for livelihood sustenance while adapting to the effects of climate change. Crop diversification helps in improving food security thereby reducing hunger and malnutrition and increasing household income which is a result of sale of excess crop produce.

7.5.6. Use of improved agricultural inputs and modern technology for adaptation

The household respondents in the study areas complained of use of poor agricultural inputs like poor seed and fertilisers and these affect production and yield (see chapter 6, section 6.2.6). The low literacy levels and high poverty levels of the population also affect understanding of how they can use modern agricultural inputs and modern methods of farming/technologies for livelihood improvement. Most of the respondents indicated that most of their land is not fertile and requires use of manure or fertilisers for them to produce more.

In this regard, it is recommended that relevant authorities should help the farmers to have access to improved agricultural inputs by either facilitating their access to credit institutions that can help them access the inputs or directly give them a loan of the improved agricultural inputs for production. In addition, the farmers should be enabled to practise some modern agricultural technology that include conservation

agriculture, rainwater harvesting, and climate smart agriculture for climate change adaptation and climate resilience.

7.5.7. Reforming livestock production for income in the face of climate change

It was mentioned by the study respondents that livestock production is one of the strategies used to adapt to climate change since livestock provide meat for food and nutrition and household income. It was discovered that a few households have livestock in the study areas, and they are able to benefit from them. However, livestock production is facing several challenges in the study areas and they include inadequate grazing fodder/pasture, inadequate extension services, and pests and diseases due to lack of veterinary services. This means that livestock production in the areas is done at a low scale (see chapter 6, section 6.2.8 for a discussion). It is suggested and recommended that it is important to analyse challenges hampering livestock productivity and then formulate plans and strategies that will help farmers and communities produce more livestock that will enable them to adapt to climate change and ensure resilient livelihoods. This will also help all players in the livestock industry to restructure the industry and make it vibrant and viable.

7.5.8. Enhance water harvesting to adapt to drought and water shortage

Water scarcity is one of the major impacts of climate change in Malawi because of prolonged dry spells, droughts and erratic rainfall making the water table go down. As a result, water for domestic use and for irrigation farming is scarce and insufficient.

The land that many households own in all the four study districts have inadequate water harvesting structures as such the land does not retain water thereby making the land and soils dry. In the long run, the areas become dry and bring about water scarcity (see chapter 6, section 6.3.3 for a discussion). It is therefore, recommended that there is a great need to introduce new technologies for water harvesting and promote the

same during the rainy season. Introduction and promotion of water harvesting structures such as dams, water storage tanks, extraction of underground tanks using solar powered systems will go a long way in supporting community livelihoods through domestic use and irrigated agriculture.

7.5.9. Improve extension services to smallholder farmers

The high vacancy rate in the government system and use of old extension methodologies is affecting agricultural production and implementation of some important development initiatives (see chapter 6, section 6.6).

The government extension workers help in spreading extension messages of how farmers can achieve agricultural productivity and general development. But with the dwindling numbers of the extension agents, it is becoming difficult for communities to follow standard and innovative ways of implementing some good practices of development. It is recommended that the government should fill all the vacant positions which are believed to be at 80%. This will lessen the burden that is put on the already few extension workers and development practitioners. In addition, it will also make extension services to farmers and communities effective as there will be a good extension worker to farmer ratio.

7.5.10. Carry out further research related to climate change resilience

Climate change in Malawi has brought various impacts that include low agricultural productivity resulting in food insecurity, malnutrition and hunger; destruction of infrastructure like roads, buildings and bridges; low household income levels due to lack of alternative sources of income; strange diseases that prevail due to changing climate; environmental degradation as a result of people relying much on natural resources; and deaths of livestock and human beings. Malawi has spearheaded implementation of various projects and programmes aiming at addressing these impacts in the name of adaptation and resilience building, however, the levels of resilience vary from one

community to another. This study has discovered low resilience levels of the households in the study areas despite many of them participating in several development projects. Perhaps it is imperative to understand the need of analysing the role of climate resilience building in contributing to socio-economic development of a community and a country at large. It is a fact that climate change and its impacts will continue to compound on the livelihoods of vulnerable population in Malawi and elsewhere as projected by several assessments.

It is, therefore, important to conduct further research based on the gaps and empirical evidence within Malawi and beyond. The research should focus on areas such as “investigating climate related natural disasters and their impacts on socio-economic development and resilience building”; “exploring factors that impede climate resilience building of rural vulnerable communities”; and “assessing factors affecting policy implementation in least developed countries”.

7.5.11. Ensure co-operation and collaboration among stakeholders in resilience building

Malawi has several institutions implementing climate change related programmes. There are various technical and steering committees on climate change that oversee technical planning, implementation, and policy direction of climate change. The Government institutions are supported by the civil society and Non-Governmental Organisations of which some are into actual implementation of resilient livelihoods projects while some are involved in policy analysis and advocacy. The KIIs indicated that Malawi has faced drastic impacts related to climate change and these include low agricultural yield resulting to food insecurity and malnutrition, infrastructure damage, loss of lives, occurrence of new diseases, unavailability of water resources among others (see chapter 6, section 6.4.4). Despite having relevant institutions that support climate change management and programming in Malawi through coordination, there are still challenges that affect climate change governance in the country.

It is, therefore, recommended that all the different stakeholders such as the Government, private sector, non-state actors and NGOs should co-operate in a more synchronised effort/manner to assist vulnerable communities to build their climate resilience. This could avoid duplication of efforts and increase impact in a long-term climate change programmes instead of short-term projects.

7.6. IN CONCLUSION

Chapter 7 provided a description of conclusion of the study to highlight the brief background of the study, methodology, and key findings/results which are in reference to the data analysed in chapter 6 (analysis of climate change resilience). In addition, the chapter highlighted the contribution of the study to the field of development studies thereby making it relevant to development discourse. It also gave details on relevant recommendations which can be considered for implementation by the Government, Non-State actors, development practitioners, and other stakeholders.

The study conducted was about an analysis of climate change resilience building of vulnerable rural communities in Malawi and it was carried out in the four districts of Karonga, Salima, Chikwawa, and Zomba. The objectives of the study were to identify how climate variability and change are affecting the general livelihoods of communities in the four districts of Karonga, Salima, Chikwawa and Zomba, to identify climate change adaptation and resilience building strategies employed by communities in these districts, to establish the extent of climate change adaptation and community climate change resilience building in Malawi, and to identify gaps for future research. These objectives have successfully been achieved through the study.

This thesis for the study has seven chapters and they include chapter 1 (introduction: background to the study, problem statement and objectives), chapter 2 (an overview of climate change and climate change resilience), chapter 3 (models, approaches and conceptual

frameworks towards climate change adaptation and climate resilience), chapter 4 (study districts and areas, and this provides a description of study districts characteristics, chapter 5 (research methodology which is about approaches, procedures and tools for carrying out the study), chapter 6 (an analysis of climate change resilience of vulnerable rural communities which is a synthesis and analysis of the data collected to inform the findings), and chapter 7 (conclusions, findings and recommendations). The study managed to detail the key findings related to its objectives and characteristics of resilience thereby achieving the objectives and recommendations made.

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ANNEX 1: IMPACTS AND VULNERABILITIES TO CLIMATE CHANGE IN AFRICA

Impacts	Sectoral Vulnerabilities	Adaptive Capacity
Temperature - Higher warming (x1.5) through the continent and in all seasons compared with global average. - Drier subtropical regions may become warmer than the moister tropics **Precipitation** - Decrease in annual rainfall in much of Mediterranean Africa and the northern Sahara with a greater likelihood of decreasing rainfall as the Mediterranean coast is approached - Decrease in rainfall in Southern Africa in much of the winter rainfall region and western margins - Increase in annual mean rainfall in East Africa - Increase in rainfall in the dry Sahel may be counteracted through evaporation. **Extreme Events** - Increase in frequency and intensity of extreme events, including droughts and floods as well as events occurring in new areas.	**Water** - Increasing water stress for many countries. - 75 – 220 million people face more severe water shortages by 2020. **Agriculture and food security** - Agricultural production severely compromised due to loss of land, shorter growing seasons, more uncertainty about what and when to plant. - Worsening of food insecurity and increase in the number of people at risk from hunger - Yields from rain-fed crops could be halved by 2020 in some countries. Net revenues from crops could fall by 90% by 2100. - Already compromised fish stocks depleted further by rising water temperatures. **Health** - Alteration of spatial and temporal transmission of disease vectors including malaria, dengue fever, meningitis, cholera, etc. **Terrestrial Ecosystems** - Drying and desertification in many areas particularly the Sahel and Southern Africa. - Deforestation and forest fires. - Degradation of grasslands - 25 – 40% of animal species in national parks in sub-Saharan Africa expected to become endangered. **Coastal Zones** - Threat of inundation along coasts in eastern Africa and coastal deltas such as the Nile delta and in many major cities due to sea level rise, coastal erosion and extreme events. - Degradation of marine ecosystems including coral reefs off the East African coast. - Cost of adaptation to sea level rise could amount to at least 5 – 10% GDP.	Africa has a low adaptive capacity to both climate variability and climate change exacerbated by existing developmental challenges including: - Low GDP per capita - Widespread, endemic poverty - Weak institutions - Low levels of education - Low levels of primary health care - Little consideration of women and gender balance in policy planning - Limited access to capital including markets, infrastructure and technology - Ecosystems degradation - Complex disasters - conflicts

Adopted from: Boko *et al*. (2007), and Christensen *et al*. (2007).

ANNEX 2: ADAPTATION PATHWAYS

Adaptation to climate change can be done along three pathways: *coping*, *incremental* and *transformational*.

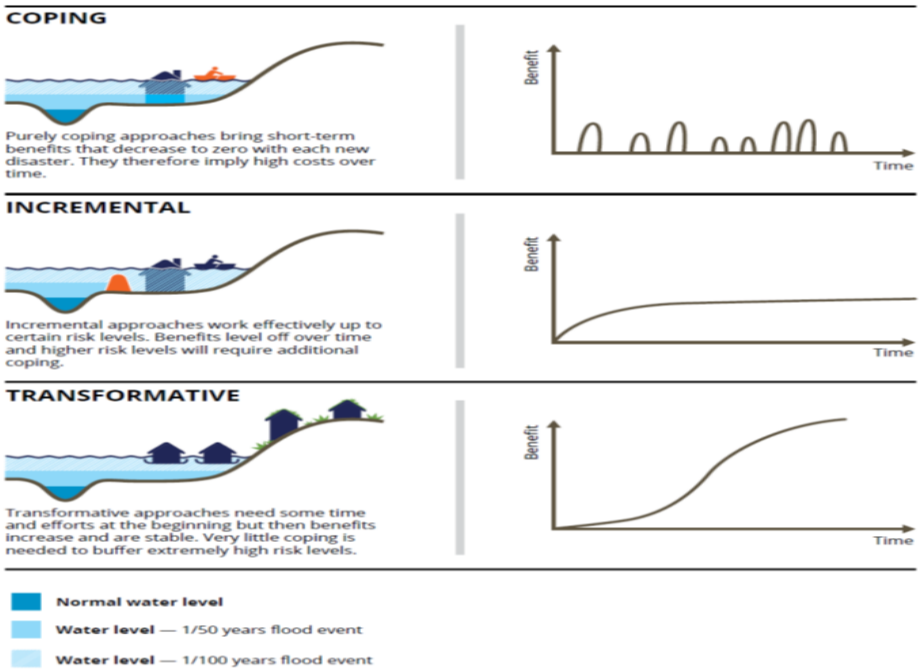
- People can opt to cope with the immediate impacts of extreme events once they appear or stresses become obvious (*coping pathway*). Coping is considered a reactive way of managing climate change and climate variability, with focus on existing conditions without making any improvements. Coping strategies offer short-term relief and do not protect people against future impacts of climate change and variability.

- The second option is to build on existing adaptation practices and knowledge gained by *incrementally* improving them and increasing their efficiency. Like coping, incremental adaptation considers existing approaches in managing climate change and variability, but it aims at sustaining the existing ways of adapting to climate change and variability, without much regard to future uncertainties.

- The third option, *transformational adaptation*, involves a fundamental alteration of the way people face climate change impacts by establishing new and innovative solutions that aim at developing opportunities that transform their areas to a new state of resilience and sustainability. Unlike coping and incremental adaptation pathways, transformational approaches question existing ways of adapting to climate change and climate variability, focusing on anticipating future uncertainty that guide new ways of adapting. Transformational adaptation is mostly collective and involves either new ways of adapting, large scale or intensity adaptation, or adaptations that transform or move locations. Transformational adaptation is often difficult to implement due to uncertainties about climate variability and change; uncertainties on the benefits of adapting; the cost of adapting and; institutional and behavioural barriers that prefer existing systems and policies.

The *scale* of change for incremental adaptation is often considered smaller, discrete, within systems, while transformational involve system wide change or changes across systems. Transformational adaptation is often associated with *limits to adaptation*, a scenario which occurs where existing adaptation approaches are no longer functional or cannot be sustained due to changing climate. Working from the perspective of an actor, Dow et al. (2013) define limits to adaptation as "a point at which an actor can no longer secure valued objectives from intolerable risk through adaptive action" (p. 306). The definition is linked to the categorization of responses to climate risks, which are acceptable risks, tolerable risks and intolerable risks.

The adaptation pathways using a flood case



Source: EEA, 2016, pp.28

ANNEX 3: CLASSIFICATION OF CLIMATE CHANGE ADAPTATION

Classification	Types	Meaning and examples
Based on intent/purposefulness:	*Autonomous adaptation:*	Adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. It is also referred to as spontaneous adaptation. Examples might include changes in farming practices, the purchase of air-conditioning devices and insurance policies taken out by individuals.
	Planned adaptation:	Adaptation that is the result of a deliberative policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, to maintain, or to achieve a desired state.
Based on timing:	*Anticipatory adaptation:*	Adaptation that takes place before impacts of climate change are observed. this is also referred to as proactive adaptation.
	Reactive Adaptation:	Adaptation that takes place after impacts of climate change have been observed
Based on agents:	*Private Adaptation:*	Adaptation that is initiated and implemented by individuals, households or private companies. Private adaptation is usually in the actor's rational self-interest.
	Public Adaptation:	Adaptation that is initiated and implemented by governments at all levels. Public adaptation is usually directed at collective needs.
Based on temporal scope:	*Short-Run Adaptation:*	The decision maker's response to climate change is constrained by a fixed capital stock, so that the principal options available are restricted to variable inputs to production.
	Long-Run Adaptation:	The decision maker can adjust capital stock in response to climate change.
Based on individual choice option	*Bear Losses:*	Where nothing is done to adapt, and individual accept the losses. This is often the case where adaptive capacity is very low.
	Share Losses:	This involves sharing the losses among a wider community, which can be through sharing with kins and other community members or taking private insurance. Sharing losses can also involve support from government, but also international humanitarian support in the event of disasters.
	Modify the Threat:	By exercising some level of control over the hazard itself, for instance by dredging rivers, constructing dams or dykes.
	Prevent (or limit) Effects:	Where measures are put in place so that the effects are not felt or minimized. Examples may include adopting irrigation systems, effect pest and disease management, planting of trees and natural vegetation along rivers to reduce flood water flow.
	Change Use:	Where adjustments are made to current practices to be more resilient to climate change effects, such as switching to more drought tolerant crops.
	Change Location:	Considered as a more extreme response to climate change, involving moving and settling away from places prone to climate change impacts, which can also be done for animal and plant species.

ANNEX 4: STRUCTURED HOUSEHOLD QUESTIONNAIRE

Research Questionnaire for Household Respondents

The questionnaire has been developed to help in gathering data for the study titled **"An analysis of climate change resilience of vulnerable rural communities in Malawi"** The questionnaire is devised to produce data that will be utilised for academic purposes related to this study only.

Section I: Background and Location

1. Name of a Village
   ……
2. Name of Traditional Authority
   ……
3. District: …… Region:
   …….
4. Elevation:
   …….
5. Wealth condition: i). Very Poor ii) Poor. Iii). Average iv). Rich
6. Name and initials of the interviewer
   ……
7. Date of interview:
   …….

Section II: Demography and Socio-economic Characteristics of Respondents

1. Name of a household: ……..
2. Sex of household head: i). Male. ii). Female
3. Marital Status: i). Married. ii). Not married. iii) widow iv) Widower. v) Divorced
4. Religion: i). Christian. ii). Muslim. iii). Other religion (specify)
   ……..
5. Language: ……
6. How many years have you been in the village?
   …….
7. What is your age as head of a household?
   ……..
   a. 16 - 35 years
   b. 36 - 50 years
   c. 51 - 60 years
   d. 61 years and above
8. Literacy level of a household/respondent. i) Primary education ii) Secondary education iii) Tertiary education (iv) Never went to school

9. Size of a household. i) Male ……. ii) Female …….. Total members ……
10. Occupation of the household (List them according to their significance)

Occupation type	**Priority Ranking**
Agriculture/Farming	
Trader	
Wage labour	
Piece work	
Fishing	
Formal employment	
Mining	
Other (Please specify)	

Section III: Land Tenure and Land Use

1. Do you own land? 1. Yes 2. No
2. If yes to 1, do you cultivate all your land? 1. Yes 2. No
3. If no to 1, how do you produce crops? (i) Renting land from others ((ii) Buying produce
4. If no to 2, how do you utilise the remaining land? (i). Rent it for financial gain (ii). Share cropping (iii) Other (Please specify) ……
5. Is the land enough for subsistence farming? (i) Yes (ii) No
6. If no, how do you satisfy your land requirement? Multiples answers are allowed (i) Renting the land (ii) Piece works (iii) Off-farm activities (iv) Other (please specify) ……
7. Do you have documentation for the land? (i) Yes (ii) No
8. Do you think the land belongs to you and the family indefinitely? (i) Yes (ii) No
9. If no, who owns the land ……..
10. How slope is your land? (i) Steep Slope (ii) Plain (iii) Medium
11. Does your land have water harvesting structures? (i) Yes (ii) No
12. Have you constructed any soil and water conservation structure on your land? (i) Yes (ii) No
13. How fertile are the soils in your land? (i) Low fertility (ii) medium fertility (iii) High fertility
14. What type of farming or agriculture do you practise? (i) Mixed (ii) Rainfed (iii) Irrigated
15. Is part of your land used for livestock grazing? (i) Yes (ii) No
16. If yes, what is the grazing system that you follow? (i) Stall grazing (ii) Free grazing.

Section IV: Crop Husbandry

1. Which crops do you cultivate on your land and why?

Crop Type	Food	Cash	Food/Cash
Maize			
Beans			
Groundnuts			
Millet			
Soybeans			
Cassava			
Paprika			
Tobacco			
Sweet potato			
Pigeon Peas			
Sugarcane			
Sorghum			
Others (Specify)			

2. What is your main source of food? Multiple answers allowed (i) Own production (ii) Buying (iii) Free distribution/relief food (iv) Piece work (v) Others (Specify)
3. What is the yield of the following major crops per harvest?

Type of crop	Yield per harvest/hectare in Qty
Maize	
Beans	
Groundnuts	
Soybeans	
Cassava	
Paprika	
Tobacco	
Sweet potato	
Pigeon Peas	
Sugarcane	
Sorghum	
Millet	
Rice	
Others (Specify)	

4. How do you use the crops/produce apart from using them as food and cash? (i) Exchanging with other items (ii) Feed for livestock (iii) Other (Specify)
5. What are the challenges you encounter during crop production in your area? Multiple answers are allowed. (i) Erratic rainfall (ii) Drought (iii) Lack of oxen (iii) soil infertility (iv) soil erosion (v) Inadequate labour (vi) Insect pests and diseases for crops (vii)

Weeds (viii) Small land size (ix) Lack of improved agricultural inputs (x) Others (Specify) …….

6. In times of cash and food shortage, what other strategies do you employ to meet your daily needs? Multiple answers are allowed (i) Practising petty trade (ii) Piece work (iii) selling livestock and/or household assets (iv) Other (Specify) ……
7. Does the government promote production of improved crop varieties? (i) Yes (ii) No

Section V: Livestock Production

1. Do you own any livestock? (i) Yes (ii) No
2. If yes, how many heard of livestock do you own, and the value (provide details below)

Type of Livestock	**Number**	**Estimated Value (USD)**
Goats		
Cattle		
Chickens		
Pigs		
Ducks		
Sheep		
Guinea Fowls		
Others (Specify)		

3. What is the main livestock grazing system in your village? (i) Stall feeding (ii) Free grazing (iii) Others (Specify)
4. What are the problems you face in livestock production in your area? Multiple answers are allowed (i) shortage of grazing land (ii) Shortage of pasture (iii) Livestock theft (iv) Others (Specify).

Section VI: Household Assets

1. Does your household own any household assets? (i) Yes (ii) No
2. If yes, provide their details below.

Type of Asset	**Quantity**	**Estimated Value**
Radio		
Bicycle		
Oxcart		
Plough/Ridger		
Sprayer		
Sewing machine		
Motorcycle		
Car		
Television		
House		
Others (Specify)		

3. How do you acquire these assets? Multiple answers are allowed (i) Buying (ii) Getting from relatives (iii) In exchange for labour (iv) Donations (v) Others (Specify ……
4. How do these assets in 3 contribute to your livelihood? Multiple answers are allowed (i) Bringing income (ii) Bring food after selling them (iii) Transportation (iv) For farming activities (v) Others (Specify) …….

Section VII: Organisational Influencing Factors

1. Do you have access to agricultural extension services in your village? (i) Yes (ii) No
2. Do you access information from the media? (i) Yes (ii) No
3. If Yes, from which channels or sources do you get information? Multiple answers are allowed (i) Newspaper (ii) Television (iii) Extension workers (iv) Radio (v) Others (Specify) ……
4. Do you have access to any credit? (i) Yes (ii) No
5. Mention the sources of your credit? Multiple answers are allowed (i) Relatives and friends (ii) Micro loan institutions (iii) Banks (iv) Cooperatives (v) Others (Specify) …….
6. Are there markets nearby your village? (i) Yes (ii) No
7. Do you have good roads that make you access cities and towns? (i) Yes (ii) No
8. Do you access and utilise improved production inputs and new technologies? (i) Yes (ii) No

Section VIII: Climate Change Appraisal

1. Have you ever heard of climate change? (i) Yes (ii) No
2. If yes, which medium did you hear about climate change? Multiple answers are allowed (i) Colleagues (ii) Radio (iii) School (iv) Newspapers (v) Government agencies (vi) Television (vii) Others (Specify) ……
3. In your own understanding, what do you think causes climate change? Multiple responses are allowed. (i) Human activities (ii) Natural processes (iii) Both human activities and natural processes (iv) No idea (v) God's rage
4. Are there any differences in weather conditions between nowadays and that of 30 years ago? (i) Yes (ii) No
5. If the answer to 4 is YES, mention the main indicators of the differences.

Climatic Element	Yes	No
Precipitation amount has increased		
Precipitation amount has declined		
Precipitation amount is the same		
Early onset of precipitation		
Late onset of precipitation		
Early cessation of precipitation		
Poor precipitation distribution		
Regular/periodic floods in large volume		
Increased temperatures		
Strong winds		
Late planting of various crops		
Others (Specify)		

6. What do you think is the status of these climatic elements/variables over the last 30 years in your area? (i) Changes are becoming severe (ii) Slow change (iii) Little visible changes observed (iv) No change
7. What is the trend of temperatures over the past 30 years in this village? (i) Increased (ii) Decreased (iii) Not changed (iv) changes in day tie temperature (v) increased droughts (vi) I have no idea (vii) Others (Specify)
   ……
8. What is the trend of precipitation over the past 30 years in this village? (i) Increased (ii) Decreased (iii) Not changed (iv) Changes in raining time (v) Increased droughts (vi) I have no idea (vii) Others (Specify)
   ……
9. Has the area experienced any disaster related to climate change? (i) Yes (ii) No
10. If yes to 9, name the disaster (s). Multiple answers are allowed (i) Floods (ii) erratic rainfall (iii) drought (iv) hail storm (v) Prevalence of army worms (vi) Others (Specify)
    ……
11. If the answer in 9 is yes, which years did the incident happened
    ……

12. What were the losses/damages occurred? Multiple answers are allowed (i) crops washed away due to floods (ii) soil erosion (iii) livestock deaths (iii) roads and bridges damaged (iv) deaths of people (v) infestation of pests and diseases (vi) Others (Specify) …… ……
13. What coping mechanisms do you employ in times of disasters? Multiple answers are allowed (i) Sale of family assets (ii) Government support (iii) wage labour (iv) climate insurance (v) sale of forest products (vii) Petty trade (viii) Migration to get employment (ix) Food relief and donations (x) Piece work (xi) renting family land (xii) Others (Specify) …… ….
14. What indigenous knowledge systems do people use in this area for early warning systems to predict any eventuality amidst climate change? For example, the shading of leaves by certain tree species signifies the onset of rains.

Number	**Type of Indigenous Knowledge**	**Meaning**
1		
2		
3		
4		
5		
6		
7		

15. Have you ever faced water scarcity in your family? (i) Yes (ii) No
16. If yes to 15, which years? ……. Years…… ……...
17. What was the condition of water scarcity over those years? Key = Less severe, severe, medium severe, or most severe
18. What distance were you travelling to access water for domestic and other uses?

Period	Distance covered

19. Have you ever encountered food shortage in your household? (i) Yes (ii) No
20. If Yes to 19, which years…… …….
21. What was the status of the food shortage over those years? Key = Less severe, severe, medium severe or most severe.

Period		Food shortage status

22. In time of livestock and crop failure, what coping mechanisms do you employ to cushion the effect of climate change? Multiple answers are required.
    a. Piece work
    b. Reduce number of meals per day
    c. Borrow money with interest
    d. Migration
    e. Begging from friends and relatives
    f. Wild fruits collection
    g. Fetching fuelwood for sale
    h. Sale of household assets including livestock
    i. Others (Specify) …….
23. What kind of assistance do you get from the Government and other stakeholders (NGOs) to supplement to food deficits? Multiple answers are required (i) Food aid (ii) Cash transfer (iii) Food for work programme (iv) Others (Specify) …… ……
24. Do you think climate variability and change has brought positive opportunities for you and your household? (i) Yes (ii) No
25. If yes, give an explanation…… ……

26. In response to changes in rainfall and temperature, what mechanisms have you employed to these changes? Multiple answers are allowed. (i) Planting drought resistant crops (ii) Utilise improved crop varieties (iii) Practise crop rotation (iv) Increase livestock production (v) Adopt and enhance irrigated agriculture (vi) Others (Specify)
……
27. What do you think are the negative impacts of climate change in your village that affect your livelihoods? Multiple answers are required (i) Low crop yields (ii) food insecurity (iii) Malnutrition (iv) Low livestock production (v) Insufficient household income (vi) Low fish stocks in rivers and lakes (vii) Drying up of rivers and lakes (viii) Increased incidences of new pests and diseases (ix) Environmental degradation (x) Others (Specify)
……
28. Has your household received any capacity building initiative related to climate change? (i) Yes (ii) No
29. If Yes, List them
……
30. In general terms, how do you support your livelihoods in times of climate change? Multiple answers are required (i) Use of productive assets (ii) Participating in development work (iii) Look for employment (iv) Access to improved markets for our goods (v) Others (Specify)
……
31. What strategies do you employ for you to adapt to climate change to build your own resilience? Multiple answers are required. The researcher to explain the concept before the question.
    a. Practising conservation agriculture
    b. Enhance crop production
    c. Enhance livestock production for income
    d. Tree planting for catchment conservation
    e. Enhance irrigated agriculture to supplement rain-fed farming
    f. Promoting crop diversification
    g. Cultivating drought tolerant crops
    h. Employment
    i. Migration for employment
    j. Income Generating Activities
    k. Aquaculture
    l. Practising agroforestry techniques
    m. Others (Specify)
    ……..
32. Which approaches, or models do you employ in enhancing your adaptation to climate change and resilience building? (The

Researcher to explain the approaches to the respondent before asking the question) (i) Community Based Adaptation (ii) Ecosystem Based Adaptation (iii) Others (Specify) …….

33. Do you think your household is resilient to climate change? (i) Yes (ii) No
34. If Yes, provide indicators for household's resilience. Multiple answers are required (i) Able to move out of poverty (ii) able to secure adequate food (iii) Able to cope and recover from shocks (iv) able to adapt to change (v) Able to access clean water (iv) Able to get stable income (v) Others (Specify) ……..
35. If No, give the reasons……

The end (thank the participant for participating in the interview)

ANNEX 5: INTERVIEW GUIDE TO GOVERNMENT MINISTRIES AND NGOs

Key Informant Interviews Guide for Government and NGOs

1. What do you understand by the term climate change?
2. What do you think are the causes of climate change in the area?
3. What are the impacts of climate change to the communities in Malawi?
4. Do you assess vulnerability to climate change? If so, how do you determine vulnerability and resilience of locations and people?
5. What are the main policy concerns relating to climate change impact on communities?
6. How do you describe the problem of climate change in relation to smallholder farming in your area?
7. Does the government have plans to support farmers to adapt to climate change? If yes, can you explain. How do you link development planning to climate change?
8. What are the challenges and constraints to adaptation to climate change by communities?
9. What coping mechanisms do farmers employ during disasters and shocks?
10. What adaptation strategies do people employ to resist the impacts of climate change?
11. How does the Meteorology Department help in adapting to climate change? Does the Department have strong institutional set up to provide adequate weather information?
12. How do you disseminate weather information to the local communities?
13. What is the nature of climate change financing in Malawi?
14. What approaches do you facilitate for communities to adapt to climate change and build their resilience?
15. What capacity building initiatives related to climate change do you provide to communities?

ANNEX 6: GUIDE FOR KEY INFORMANT INTERVIEWS

Guiding question for Key Informants (KII) in the Study Areas

1. What visible changes have you observed as related to rainfall, temperature, crop productivity, livestock productivity, river flow, occurrence of flooding, drought, during your life in the village?
2. How frequent does the drought occur in your area? And what are the likely causes?
3. How is the trend of the rainfall in the past 30 years? Is it rising, declining, coming on time, and ceasing at the right time?
4. What are the trends of the temperatures in past 10 to 30 years? Is it rising, declining, remaining the same?
5. What adaptation strategies have community members taken on board to avert challenges arising from climatic change/drought?
6. What impact has climate change caused on the livelihood of the local communities?
7. What development activities are implemented in the village to deflect the impact of climate change? (afforestation, water harvesting, irrigation, soil, and water conservation, off farm employment, aquaculture, livestock production etc.
8. What agricultural technology and meteorology information system do you access regularly and during climatic events?
9. Do you receive early warning information on short term variations and/or long-term climate change from any sources?
10. What should the government do in support of deflecting the impacts of climate change in the area?
11. How do people adapt to climate change and build their resilience?

ANNEX 7: INTEVIEW GUIDE FOR FOCUS GROUP DISCUSSIONS

Address (location) of the village: ……..

Focus group size: …….……

Focus group composition: Male headed households/Women headed households/Youth Group, Traditional Leaders Checklist of questions.

1. What visible changes have you observed as related to rainfall, temperature, agricultural productivity, livestock production, flow of streams/rivers, flooding incidences, incidence of droughts, river flow etc during your life in the village?
2. How is the trend of the rainfall and the temperature during the past 30 years? Is it rising, declining, coming on time and ceasing at the appropriate time?
3. What effects has climate change imposed on the livelihoods of the local people, and what coping, and adaptation mechanisms have community members taken on board to address challenges emanating from climatic change or drought?
4. Can you tell us the planting time of common crops some 30 years ago and what time of the year do you practice planting in recent years?
5. What services are provided to the communities to support in addressing climatic changes? And how do you assess the agricultural extension workers' role in motivating and mobilizing the community to enhance their adaptive capacity to climatic changes?
6. What agricultural technologies and meteorological information or early warning systems are provided to farmers to prevent climate shocks and risks? If yes, by whom?
7. What are the limitations or barriers to cope with adverse impacts of climate change?
8. What are your recommendations or suggestions on how to effectively improve climate resilience services?