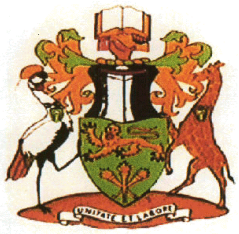

UNIVERSITY OF NAIROBI

INSTITUTE OF DIPLOMACY AND INTERNATIONAL STUDIES

CLIMATE CHANGE AND KENYA'S SOCIO-ECONOMIC DEVELOPMENT: A CASE STUDY OF VIHIGA COUNTY

BY

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SEPTEMBER, 2015

DECLARATION

This research project is my original work and has not been presented for any other academic award in any institution of learning.

Signed…… Date…….

KUYA CYRUS BERNARD

R50/68040/2013

This research project has been submitted for Examination with my approval as University Supervisor.

Signed…… Date……

DR. SHAZIA CHAUDHRY

DEDICATION

I dedicate this work to my family, my friends all the modest scholars and practitioners of International Studies and Diplomacy. But most importantly, I dedicate this work to the almighty God for this far He has brought me, through thick and thin.

ACKNOWLEDGEMENTS

It is with a great sense of humility and gratitude that I wish to acknowledge the many sources of moral and intellectual inspiration and encouragement I drew from in undertaking this study. My sincere appreciation goes to my supervisor Dr Shazia Chaudhry for her invaluable input, patience and endeavoured guidance throughout my researching period, and ensured that my work is possible. Lastly, I would like to thank all the entire teaching and administrative staff of the IDIS department for all the wonderful assistance will at the Institute. Thank you all.

ABSTRACT

Climate change and natural disasters have disrupted the socio-economic development of Kenya, witnessed through the concurrent drought seasons, flooding seasons and the changes in the rainfall and temperature variation. These effects have tremendously affected the socio-economic developments within the county levels as key economic pillars such as agriculture, tourism, mining and industrial sectors which depend mainly on climatic factors being affected. These are mainly attributed to the country's overdependence on rain-fed agriculture hence exposing the country to food insecurity as the majority of the economic pillars sectors are climate sensitive. Kenya has been significantly affected by climate change catastrophe with droughts and floods taking centre stage. According to statistics, the 1997/1998 El Nino floods and the 1999/2000 La Nina drought is estimated to have cost at least 14% of Kenya's GDP each year and it is predicted to have a negative impact in the near future if nothing is done to mitigate and adapt to future climate change events. This study examines the socio-economic impacts of climate change in Kenya, key challenges facing climate change mitigation and adaptation in the country and analyses how climate change has hindered major socio-economic development at the grassroots level. The study theoretical analysis is premised on the assumption of organisation, individuals and even countries to work on the good of the society at large by protecting the eco-system. This is geared towards the efforts of the government to educate the masses on the need to protect the environment and to implement workable environmental policies. The qualitative results have shown that Kenya's socio-economic development is heavily influenced by climatic conditions in almost all sectors, having a negative trend in the growth and development of the country. Human socio-economic activities such as deforestation, poor farming patterns, destruction of water catchment areas and emission of GHG are the key contributors to climatic changes. The key findings have indicated that Kenya socio-economic development is heavily influenced by changes in climatic conditions, evident through the over-dependence on rain-fed agriculture, with agriculture being the main socio-economic driver of the country. Moreover, the findings indicated that there is little/no knowledge about climate change adaptation within the public, hence the continuous environmental degradation. This is mainly attributed to the inactive role taken by the government towards mitigating and adapting to climate change, and also a lack of a proactive institution to champion for the same. Organisations and climate change stakeholders both regionally and internationally should take an active role in championing for climate change adaptation and mitigation.

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LIST OF ACRONYMS

ASDS: Agricultural Sector Development Strategy

ASAL: Arid and Semi-Arid Lands

CDF: Constituency Development Fund

CSR: Corporate Social Responsibility

ERS: Economic Recovery Strategy

FGD: Focus Group Discussion

GDP: Gross Domestic Product

GHG: Green House Gases

GoK: Government of Kenya

GSM: Global System for Mobile

ICT: Information Communication Technology

IFAD: International Fund for Agricultural Development

IPCC: Intergovernmental Panel on Climate Change

KARI: Kenya Agricultural Research Institute

KMS: Kenya Meteorological Service

LTMs: Long Term Means

MDGs: Millennium Development Goals

MOH: Ministry of Health

MEMR: Ministry of Environment and Mineral Resources

NCCAP: National Climate Change Action Plan

NCCRS: National Climate Change Response Strategy

NDDCF: National Drought and Disaster Contingency Fund

NDMA: National Drought Management Authority

NEMA: National Environmental Management Authority

PPP: Public Private Partnership

SEI: Stockholm Environmental Institute

UNEP: United Nations Environmental Programme

UNFCCC: United Nations Framework Convention on Climate Change

UNDP: United Nation Development Programme

WHO: World Health Organisation

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CHAPTER ONE

INTRODUCTION TO THE STUDY

1.0Introduction

In the recent years impacts of climate change have been felt and have been very devastating especially in the socio-economic development of countries like Kenya. This has been evidenced by the increased frequency of extreme weather events ranging from La Nina and El Niño phenomena, frequent cycles of droughts and floods. The rainfall pattern has also been affected over the years with late onset and early/late cessation. The distribution of this rainfall both temporally and spatially has also been observed to be very poor.[1]

The 2010 National Climate Change Response Strategy (NCCRS) acknowledged the importance of climate change impacts for Kenya's socio-economic development. The National Climate Change Action Plan of 2012 was the logical steps of enabling Kenya reduce vulnerability to climate change and therefore improving the country's ability to take advantage of opportunities that climate change offers. Ways to mitigate and adapt to the impacts of climate change is the key indicator determining the survival and sustainability of all the living creatures on the face of the earth.[2]

The socio-economic development of Kenya which is guided by Kenya Vision 2030 aims at transforming the country into an industrial, middle income economy with a clean and secure environment. This can only be achieved if this action will address sustainable socio-economic developments with a key focus on climate change. Kenya is dependent on rain fed agriculture and as such a shift in the normal distribution of the weather patterns implies a major cost implication which has a tremendous effect on the socio-economic development of the

[1]Stockholm Environmental Institute, Project Report; *The economics of Climate Change in Kenya*. (Oxford University Press, 2009).

[2]Government of Kenya/Ministry of Environment and Natural Resources. *National Climate Change Response Strategy.* (Nairobi, 2010).

country.[3] Kenya can overcome the challenges of weather related hindrance by adapting to both rain fed and irrigation agriculture in counties with fertile land that can support agriculture such as Vihiga County which has fertile land, with a tri-model rainfall characteristic that is a favourable climatic conditions for agriculture. Building for such possibilities will enable the country improves on its socio-economic activities to ensure it produces to its capacity thereby adding to the breadbasket of the country.

1.1Statementof the Research Problem

Vihiga county was significantly affected by the recent major droughts and floods that ravaged the country i.e. the 1983/1984, 1991/1992, 1999/2000,2004/2005 and finally the 2009 drought. Major flooding occurred in 1982, 1985, 1997/1998, 2002, and 2006 which greatly affected the western part of Kenya including Vihiga, and had a major impact on the economy of Kenya. As much as western province and therefore Vihiga is not majorly affected by droughts as other parts of Kenya this extreme event has a major impact on the rainfall temporal and spatial distribution of Vihiga therefore affecting the planting patterns of the residents. This continuous droughts and changes in the weather patterns affected agricultural activities, which led to hunger. Factories within the county such as Kaimosi and Mudete tea factory were greatly affected as tea plantations dried up. Diseases such as typhoid and cholera were rampant as drying up of wetlands and water sources implied that residents had to source for water from contaminated drying rivers sources. Tourism sector was also affected as these extreme events impacted on the Kaimosi forest with different monkey species migrating to other areas due to human and wild animal competition for food.[4]

Vihiga's economy being highly dependent on climate sensitive sectors such as agriculture, tourism and energy, climate change therefore potentially poses a great risk for the county and

[3]Government of Kenya, *Kenya Vision 2030*. (Nairobi,2007) pg. vii.
[4] Vihiga County Integrated development plan 2013-2017

Kenya at large if the proposed vision 2030 has anything to go about. If adaptive measures for mitigating climate change are not found, future impacts of climate change will gravely affect key sectors of the county's economy. This is due to a given fact that it has a higher vulnerability and lower adaptive capacity. Impacts could threaten past development gains and constrain future socio-economic progress. This study therefore examines the socio-economic impacts of climate change on Kenya's development agenda with a key focus on Vihiga one of Kenya's Cosmopolitan County and how it impacts various key sectors that hugely add to the country's economy. It is thus the purpose of this study to question, "How does climate change affect socio-economic development in Kenya and in Vihiga County?"

1.2 Objectives of the Study

The broad objective of this study is to determine the relationship between climate change and socio-economic development in Kenya with a focus on Vihiga County.

This was achieved through analysing the following sub objectives:

i. To provide an overview of socio-economic impacts of climate change in Kenya.
ii. To discuss key challenges facing climate change adaptation and mitigation in Kenya.
iii. To analyse major climatic changes and the posed socio-economic developmental issues in Vihiga County.

1.3 Literature Review

According to Schneider et al., the aggregate of Climate Change is highly uncertain. This is mainly attributed to the ever-changing global activities that impact differently on the economy. The effects of climate change on the economy are a potential shift on the way global actors relate on the international scene.[5] Desanker et al in his literature assessment

[5]Schneider, S. H., et al, *Assessing key vulnerabilities and the risk from climate change. Impacts,*

concluded that climate change in Africa, coastal facilities would result in sea-level rise, coastal erosion, saltwater intrusion and flooding. Thus he predicted that these changes would have a significant impact on African communities and their economies.[6] Smith et al argue that climate change can be measured as an economic cost. He concluded that climate change would increase income inequalities between and within country, as he said a small increase in the global mean temperature (up to 2 degree Celsius measured against 1990 levels) would result in net negative market sector impacts in many developing countries and net market sector impacts in many developed countries.[7]

Stern et al on the other hand argue that climate change is the greatest and widest ranging market failure ever seen, presenting a unique challenge for the economy. Stern review highlighted a 5% loss of global gross domestic product (GDP) each year, now and forever and the loss may rise further to 20% if the effects of climate change are not mitigated on time. The review proposed that 1-2% percent of the global GDP per annum should be invested to mitigate effects caused by climate change in order to enhance the economy of the universe. Africa is greatly affected by the effects of climate change as compared to other regions in the world, because most countries in the continent are prone to recurrent droughts, and drought episodes particular in Southeast Africa. Inappropriate policies, high population growth rates and lack of a significant investment methods and a highly variable climate have made it

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Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental panel on Climate Change. (UK; Cambridge University Press, 2007) PP. 790

[6]Desanker, P. et al, *Africa in Climate Change 2001: Impacts, Adaptation and vulnerability. Contribution of working Group II to the third assessment Report of the Intergovernmental panel on Climate Change*. (UK; Cambridge University Press, 2001) PP. 490

[7]Smith J.B., et al, *'Vulnerability to Climate Change and Reasons for Concern: A Synthesis* in *Climate Change 2001: Impacts, Adaptation and Vulnerability. Contribution of Working group II to the Third Assessment Report of the intergovernmental panel on Climate Change.* (UK; Cambridge University Press, 2001) PP 936-958

difficult for several countries to develop livelihood pattern that would reduce pressure on the natural resources base.[8]

1.3.1 The United Nations Framework on Climate Change

The United Nations framework Convention on Climate Change (UNFCCC) and the Kyoto protocol have set a significant precedence as a way of solving long term international environmental problem. In a way to mitigate on the effects brought about by climate change, the Kyoto Protocol has stimulated national and international policies and has enhanced establishment of new institutional mechanisms that are tailored to enhance an international platform for combating climate change.[9]

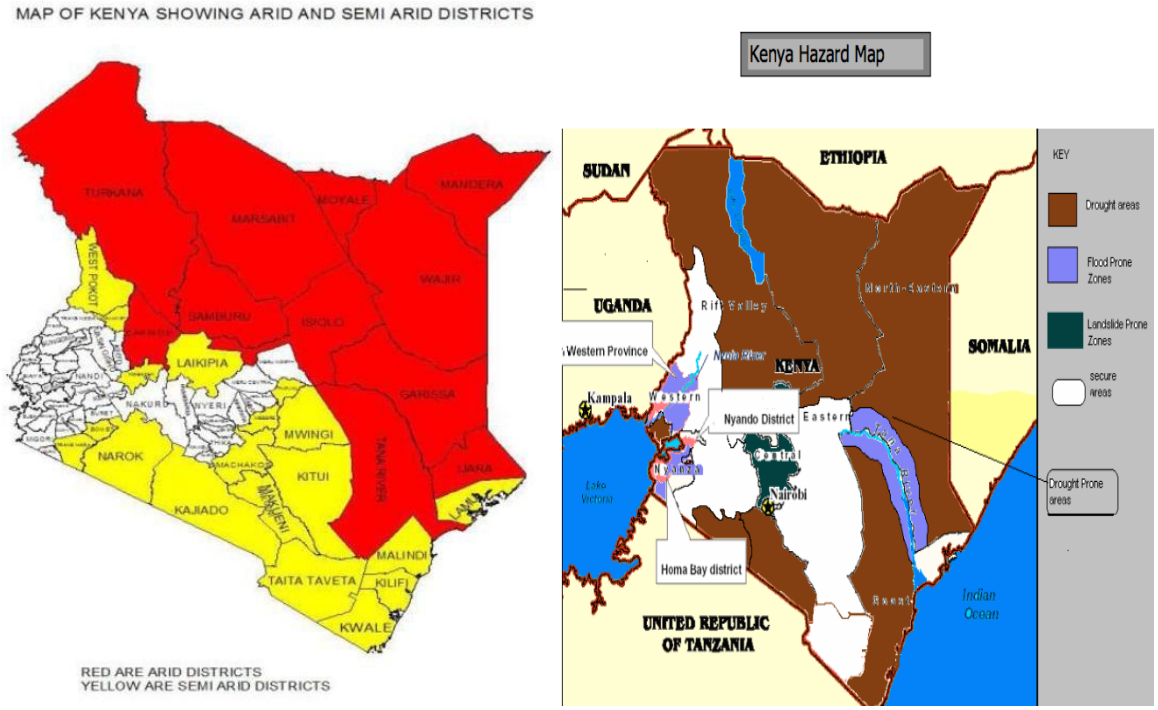
The 4th Assessment Intergovernmental Panel on Climate Change (IPCC) report clearly highlights that the mixed effects of climate change is continental and the most affected countries are the developing nations, with Africa bearing the greatest risk because their economies rely more on climate-sensitive activities. In Africa today, tropical forests and rangelands are under constant extinction because of population pressure and other system of land use. These effects have exposed Africa to loss of biodiversity, rapid deterioration in land cover and depletion of water catchment sources, which has impacted negatively on the socio-economic developments of Africa nations. Agriculture accounts to almost 55% of total value of African exports, and most farming activities entirely depends on rain fed agriculture making Africa to be more vulnerable to climate change hence posing a potential food security crisis.

[8]Stern, N. "*Stern Review on The Economics of Climate Change (pre-publication edition). Executive Summary" HM Treasury*, (London, 2006)
[9]Depledge, J., *United Nation Framework Convention on Climate Change (UNFCCC) Technical paper: Tracing the origins of the Kyoto protocol*: (An article-by-Article Textual History, 2000).

1.3.2 Kenya's modalities to curb climate change impacts.

Kenya's current population is 45,010,056 million, with an average per capita income of US$3, 138 and is ranked 147 out of 187 countries in the UNDP's Human Development Index. The World Bank estimates that 42% of income is controlled by less than 10% population while a majority of 45.9% of the population survive on less than $1 per day. Major socio-economic developments have been focused on major urban towns such as Nairobi and Mombasa. Areas stretching across the Rift valley, Mount Kenya and Lake Victoria have developed due to fertile densely populated highlands that support agriculture. 80% of land in Kenya is arid and semi-arid (ASAL)[10] as in Fig 1.1 (left panel) below.

Fig 1.1: Map of Kenya showing arid and semi-arid Regions (left panel) and Kenya's Hazard Zones (Right Panel)(Source: Kenya National Disaster Profile)



[10]Stockholm Environmental Institute, Project Report; *The economics of Climate Change in Kenya*. (Oxford University Press, 2009)

While the ASAL areas are prone to drought, western Kenya where Vihiga County is situated is prone to flooding as seen in Fig 1.1 Right Panel.[11]

According to the report released by Stockholm Environmental Institute on the economic costs of climate change in Kenya, in their assessment they found that existing climate variability has significant economic costs in Kenya which is brought about by periodic floods and droughts which impacts on the socio-economic developments in Kenya. Recent major drought witnessed in 1998-2000, 2004/05, 2009 and 2011 and major floods that occurred in 1997/98, 2006 and 2010 impacted negatively on the socio-economy developments in Kenya. The economic costs brought about by drought in the period of 1998-2000 was estimated to have cost the country $2.8 billion from the loss of crops, livestock, forest fire, damage to fisheries, reduced hydro-power generation, reduced industrial supply and reduced water supply, affecting key sectors that are the backbone to the Kenyan economy.

Subsequent drought events witnessed in 2004, 2005 and the recent 2009 affected millions of people leading to restrictions on water and energy. The 1997/98 floods affected almost 1 million people and had an estimated total economic costs of $0.8 to $1.2 billion arising from damage to infrastructure such as roads, buildings and communication apparatus, effects on public health like water borne diseases and fatalities and loss of crops. Therefore, the continued burden for these catastrophic events implies large economic costs will be incurred thus limiting long term socio- economic growth.

Kenya and its counties like Vihiga are not adequately adapted to deal with existing climate risks because of a higher vulnerability and lower adaptive capability mainly brought by socio-economic trends such as increase in population, urbanisation, increased value of assets in flood prone areas, changes in the terrestrial system such as deforestation and loss of natural

[11]UNDP, WMO, GOK, IGAD and DMCN, *Factoring Weather and Climate Information and Products into Disaster Management Policy, A Contribution to Strategies for Disaster reduction in Kenya*. (Nairobi, 2002.)

floodplain storage. Therefore, in the absence of adaptation measures, these extreme events are likely increase the economic costs by five folds come the year 2030 hence impacting tax payers close to $5-$10 billion . Thus, Kenya's key priority ought to increase the resilience to cope with these extreme events in order to mitigate impacts associated with climate change in the foreseen future to protect its population from these extreme events. This is because despite Kenya having a draft disaster management policy, it lacks an official policy or legal framework to guide on disaster management.[12]

The dominant floods in Kenya are riverine floods which mainly affect both rural and urban areas in form of flash and urban floods. Perennial floods in Kenya affect low lying regions of Kenya, such as river valleys, marsh areas, lakeshores and the coastal strip. The Lake Victoria basin in western Kenya and Tana River basin in south-eastern Kenya are the most prone flooding regions in Kenya, the Budalangi and Kano flood plains in western Kenya and Tana River floods are the worst affected areas by floods during both the short and long rain seasons of March-May and October-December respectively. Western Kenya is highly vulnerable to flooding patterns because of high poverty rates, poor land use patterns, deforestation, settling and cultivating along river banks, low education and illiteracy level and poor infrastructural levels. Hence this highlights Kenya's higher vulnerability and lower adaptive capability therefore highly prone to be affected by effects of climate changes and this poses a potential risk on the socio-economy developments in the near future.[13]

The country has lost billions from the loss of crops, livestock, forest fire, damage to fisheries, reduced hydro-power generation, reduced industrial supply and reduced water supply, affecting key sectors which are the backbone to the economy. Subsequent drought events

[12]Stockholm Environmental Institute, Project Report; *The economics of Climate Change in Kenya*. (Oxford University Press, 2009).

[13]Shongwe, M.E., van Oldenborgh and van Aalst, *Submitted to Journal of Climate. Projected changes in mean and extreme precipitation in Africa under global warming, Part II*: (East Africa. Nairobi, Kenya, 2009) pg.56.

witnessed in 2004, 2005 and the recent 2009 affected millions of people leading to restrictions on water and energy. For instances, the 1997/98 floods affected almost 1 million people and had an estimated total economic costs of $0.8 to $1.2 billion arising from damage to infrastructure such as roads, buildings and communication apparatus, effects on public health like water borne diseases and fatalities and loss of crops. Therefore, the continued burden for these catastrophic events implies large economic costs will be incurred thus limiting long term socio- economic growth. Kenya as a country is not adequately adapted to deal with existing climate risks because of a higher vulnerability and lower adaptive capability mainly brought by socio-economic trends such as increase in population, urbanisation, increased value of assets in flood prone areas, changes in the terrestrial system such as deforestation and loss of natural floodplain storage. In the absence of adaptation measures, these extreme events are likely to increase the economic costs by five folds come the year 2030 hence impacting tax payers close to $5-$10 billion . Thus, Kenya's key priority ought to increase the resilience to cope with these extreme events in order to mitigate impacts associated with climate change in the foreseen future to protect its population from these extreme events. This is because despite Kenya having a draft disaster management policy, it lacks an official policy or legal framework to guide on disaster management.[14]

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1.3.3 Vihiga County's Modalities to Curb Climate Change.

Vihiga County a cosmopolitan town in the western region of Kenya has a total population of 612,000 with an annual population growth rate of 2.51% with a projection population rise to 688,778 by the year 2017.Vihiga County lies within an area of 531.3 km square, having five constituencies namely Sabatia, Emuhaya, Hamisi, Luanda and Vihiga. Vihiga County experiences an annual average rainfall of between 1,800-2,000 mm, with an annual fertility rate of 5.1%, its average temperature is 24 Degrees Celsius with a hilly terrain which has a good amount of forest cover.

The main economic activity of the county is agriculture with crops such as maize, millet, tea, banana, avocado, papaya, sweet potatoes and cassava mainly planted. The locals also practise livestock rearing, with cow, chicken, goats and sheep the main animals being reared by the majority of the residents. The majority of residence are small scale farmers for local consumption. The highly vulnerable population of Vihiga County has an urbanisation rate of 31% within the major town like Luanda, Maseno, Mudete, Chavakali, Jeptulu, Serem, Jebrock, Mbale and Kilingili with a poverty level of 62% and having a dependency ratio of 100:90. [16]

[15]Shongwe, M.E., van Oldenborgh and van Aalst, *Submitted to Journal of Climate. Projected changes in mean and extreme precipitation in Africa under global warming, Part II*: (East Africa. Nairobi, Kenya, 2009) pg.56.

[16]Ministry of State for provincial administration and National Security.

Agriculture being the key sector in the county's economy is highly vulnerable to climate change effects hence impacting negatively on the socio-economy development of the country. Adaptive measures to overcome these impacts can be seen through responsive eco-cover with each household having at least 3-5 trees per hectare, hence the region is covered with plenty of trees. Fewer factories within the region, with Mudete tea factory being the only renown established firm hence limits GHG exposure within the region. Nkomo et al (2006) argues that Kenya being one of African countries has a high existing vulnerability and climate change will certainly affect it because of six main reason, the first being existing development challenges brought about by endemic poverty, complex governance and institutional dimensions, secondly being high population growth rate manifested by low literacy level, prevalence of malnutrition and a high burden of diseases, thirdly being limited access to capital, markets, infrastructure and current technology, fourthly ecosystem degradation and loss of natural resources, fifthly complex disasters and conflicts mainly being environmental disasters such as floods, droughts and forest fires. Lastly, poor governance, corruption, tribal and inter clans conflict and weak institution are the truly manifestation of African countries.[17] Therefore it is evident that Kenya is not adequately equipped to deal with existing climate change because of her low adaptive capability due to low financial resources, low technical know-how, weak institutions and limited awareness of the potential impacts of climate change brought about by ignorance and high standards of illiteracy levels. This is a characteristic of Vihiga County.

1.3.4 Literature Gap

As noted from the literature review, efforts to enhance climate change mitigation and adaptation in Kenya and Vihiga County as the study area in an aim to enhance socio-economic development in the country is still wanting. This is mainly attributed to poor

[17]Nkomo et al, *Climate Change: Impacts, Vulnerabilities and Adaptation in Developing countries* (Nairobi, 2006).

climate change action plan implementation policies and lack of climate change champions both nationally and in the county levels. As much as adaptation is needed to address the potential variability of future climate change, Kenya and therefore Vihiga county can only be able to mitigate the socio-economic impacts of climate change if it starts by educating its population on the need to preserve the environment, allocate supplementary budget to facilitate expanding of institutions that facilitates for early capacity building and early warning systems in the county levels, improve the living standards of the population by creating job opportunity and empowering her people, improve on the infrastructure and mode of technology both in rural and urban regions and more so come up with friendly environmental policies and advocate for the county authorities to enhance its formulation in the grass root level.

This study therefore attempts to fill this gap by examining the socio-economic impacts of climate change on Kenya and Vihiga County developments.

1.4 Justification of the Study

This study will be done to highlight the importance of preparing for future climate change scenarios with respect to understanding the socio-economic impacts it has on Kenya and Vihiga county developments. As much as it is not easy to predict with certainty, there is need to put up mitigation and adaptive measures and strategies to prepare for future, rather than using uncertainty as the reason for inaction. Early adaptation can reduce the socio-economic costs of climate change on the development. Kenya being a developing country is predicted to have greater impacts on climate change given the fact that it has a higher vulnerability and lower adaptive capability. Climate change impacts could threaten past developments and have an adverse effect on future socio-economic development, keeping in mind that some regions in Kenya have a high vulnerability. Vihiga County despite being located in the more fertile

western region of Kenya having a favorable weather conditions still faces a high risk of being affected because of lower adaptive capabilities to the changing weather patterns.

Therefore timely adaptive measures and strategies ought to be implemented in order to be more proactive when it comes to issues related to climate changes hence reducing its effects on the socio-economic development of county.

1.5Theoretical Framework

This study is premised on the social responsibility theory, which is an ethical theory that entitles organisation, individuals or even countries to act for the benefit of the society at large in order to maintain a balance between the economy and the ecosystem.[18] This theory propagates for individuals, organisations and even state as an entity to take into account the welfare of the society and the environment in order to limit the effects that these entities subject to the environment. The engagement can be either passive by avoiding engaging in social acts that affect the environment or be active by performing activities that directly benefit and advance on the social and environmental acts. This theory goes hand in hand with this study, as it enhances individuals, organisations and countries to give back to the society where it's due, by ensuring that their deeds do not impact on the environment and the society in general. Social responsibility theory propagates for corporate social responsibility (CSR) whereby companies and organisations try to create a positive niche to the society while doing its businesses in a way to give back to the society. CSR as defined by Lord Holmes and Richard watts is just a virtue of "making good business sense"[19]

According to this study, the government should come up with proper ways to propagate this social responsibility theory on those entities that are the key culprits in subjecting inhumane

[18]Kaliski, B., *Ethics in Management. Encyclopaedia of Business and Finance* (2nd ed. Vol. 1). (New York; Macmillan, 2001).

[19]Armstrong, J. Scott; Green, Kesten C, *Effects of corporate social responsibility and irresponsibility policies. Journal of Business Research.* (University of Pennsylvania, 2001)

acts to the environment, by coming up with adaptive and mitigating measures which should be followed by these entities. This is because, law is a command and it has to originate from a superior entity in which this case the government is the superior entity. Thus this theory applies to all states as they are the sovereign entity from whom the commands originate from.[20]

This theory is important in my study as it advocates for individuals, organisations and even countries to act on the benefit of the society by ensuring that any activities that they engage in does not have a negative implication on the environment. The theory propagates for CSR to be enforced by organisations to give back to the society, philanthropic activities for individuals such as planting trees, collection of garbage's and ensuring a conducive environment to all aimed at conserving the environment and for countries, to ensure it enforces laws and measures aimed at mitigating and controlling environmental pollution to both individuals, organisations and to other countries.

Social Responsibility Theory complements well with my study, as it makes every human being duty to safe guard and protect the environment, by giving back to the environment where it is due. The theory advocates for communal efforts towards conservation of the environment through proper waste disposal, afforestation where necessary, conservation of water catchment towers and forest reserves, zero tolerance to GHG emissions and so on , in an attempt to enhance a greener environment hence fully utilizing the benefits of nature.

[20]Raymond Wacks , *Philosophy of law; A very short introduction*. (Oxford University Press, 2006). Pg. 9

1.6Hypotheses

This study is premised on the assumption;

1. Climate change has detrimental negative effects on Kenya's socio-economic development.
2. Climate change has significantly impacted on Vihiga County's socio-economic development.

1.7 ResearchMethodology

The study used qualitative research methods that drew information from both primary and secondary sources. Primary data was derived from structured questionnaires that guided the researcher in data collection.

The researcher employed Focus group discussions (FGDs) in collecting Primary data, which brought together different partners in the business community who are affected mostly by climate change. The researcher identified five actors from different ten FDGs and administered an open-ended questionnaire to each one of them to fill. The researcher analysed the findings from their understanding of impacts of climate change on the socio-economic development of Kenya.

According to the findings, four out of five respondents from the different ten FDGs argued that Kenya socio-economic development is heavily influenced by changes in climatic conditions, as they attributed the over-dependence on rain-fed agriculture to spur our agricultural sector, hence this tend to affect the food security which in turn affect the country's socio-economic development. They argue that climatic impacts have negatively affected the Country's socio-economic development, as frequent droughts and floods havocs

have led to loss of lives, destruction of properties, damage in infrastructure sector hence hindering growth and development.

A majority of the respondent argued that human related activities such as deforestation, poor land use patterns and GHG emissions have been the key contributor to the drastic changes in climatic conditions. The respondents believe that all this is due to the inactive role played by the government in educating the public on the need to protect and safeguard our environment. Although some of the respondent argued that the government is doing a proactive role in encouraging planting of trees, protection of water catchment areas like the Mau, karura and Embobut forest and coming up with policies aimed at mitigating and adapting to climate changes.

The respondent argued that Kenya still has a long way to go in terms of adapting to climate change calamities. This is due to lack of enough climate financing to enhance climate related researches to facilitate quick and rapid preparedness to climate change calamities. The public lack proper information about climate change awareness, hence the continued environmental pollutions. With the only response mechanism as of now being in the form of policy, nothing much has been operationalized practically as these policies are just paper works hence the repeated changes in climatic conditions witnessed through the periodic floods, droughts and famine in the country year in year out.

The secondary data was mainly sourced from special collection and review of published and unpublished material, journals, periodicals, academic papers, government papers, electronic and print media. The study employed content analysis as means of analysis.

1.8Chapter Outline

This study is comprised of five chapter structured as hereunder:-

Chapter One: - Consists of the Introduction, Problem statement, Research Objectives, Justification of the Study, Literature Review, Theoretical Framework, Hypothesis, Methodology, Scope and Limitation of the Study**.**

Chapter Two: -The socio-economic impacts of climate change in Kenya.

Chapter Three: -The challenges facing climate change adaptation and mitigation in Kenya.

Chapter Four: - The climatic changes posed on the socio-economic developmental issues in Vihiga County.

Chapter Five: - Conclusion and Recommendations

CHAPTER TWO

CLIMATE CHANGE IMPACTS IN KENYA.

2.0 Introduction

This chapter is based on socio-economic impacts of climate change that has tremendously affected Kenya's socio-economic developments. In addition, this chapter examines the impacts that climate change has on the key sectors which are important for the country's growth and development and will also shed light on the possible solutions and ideas tailored at offering a mitigation and adaptive solution to minimize the effects brought about by climate change in the country's socio-economic developments.

Kenya is highly vulnerable to impacts of climate change, as only 20% of the territorial surface area in the country is classified as highly potential area receiving high amounts of rainfall to support agriculture productivity. The largest part 88% is arid and semi-arid lands (ASALs) having a minimal annual rainfall ranging from 200-850mm. Over 80% of the total population live within the potential areas while only 20% of the population lives in the vast ASALs comprising of ecological zones.[21]

2.1 Sectoral Impacts of Climate Change in Kenya.

In recent years, Kenya has witnessed its share of climate-related impacts which have greatly impacted on the socio-economic activities of its people. These climate-related impacts have ranged from prolonged droughts, frost in some of the productive agricultural hub, hailstorms, extreme flooding, receding lakes level impacting on the fishing industries, drying of rivers and other wetlands, leading to large socio-economic losses impacting directly on the food security. These extreme climate events have led to displacement of communities, resulting in conflict over natural resources, competition of scarce resources which has led to human-

[21]www.nema.go.ke

wildlife conflicts and so on. Kenya is vulnerable to climate change related impacts as witnessed recently with the (2010-2011)horn of Africa drought crisis. This provided the country with appropriate measures to develop response strategies and activities aimed at empowering the country to overcome climate-related impacts.[22]

Kenya has a complex existing climate, with wide variations across the country having a strong seasonality. Average temperatures show strong differences between the narrow and coastal strip, arid and semi-arid lands and temperate highland plateau. Rainfall is viable, having an annual cycle of bimodal, with two wet seasons; the long rains (March-may) contributing 70% of the annual rainfall and the short rains (October-December). The Western highlands and the coastal areas also receive rainfall during September –June. These complex patterns of climate variability brought about by factors such as El Nino and La Nina have huge effects on the country's key sectors including; agriculture, tourism, infrastructure, forestry, energy, health and water.[23].

2.1.1 Agriculture sector

The agricultural sector is the pillar of the Kenyan economy contributing directly 24% of the GDP with a total value of KES 342 billion, and another 27% indirectly valued at KES 385 billion, having 65% exports earnings. The sector accounts for 65% of informal employment in rural areas, and accounts for 80% of livelihoods and food security of the population. The main cash crop grown in Kenya is maize, although foodstuffs such as cassava, sweet potatoes,

[22]World Bank, *The Drought and Food Crisis in The Horn of Africa: Impacts and Proposed Policy Responses for Kenya. Poverty Reduction and Economic Management Unit Africa*. (Nairobi, 2011).

[23]Stockholm Environmental Institute, Project Report; *The economics of Climate Change in Kenya*. (Oxford University Press, 2009)

millet, rice, wheat, sorghum, vegetables, bananas just to name a few are planted in the country.[24]

Kenya depends on the 16% high and medium agricultural potential land mass, with the remaining 84% being ASALs predominantly used for ranching, agro-pastoralism and game parks. Due to this, Kenya has laid down Agricultural Sector Development Strategy (ASDS) in its Vision 2030 covering the period from 2009-2020, aiming at positioning the sector in the lead to deliver a 7% annual growth rate that will boost the rest of the economy into two digits (10%) as envisioned under the economic pillar of Vision 2030. Despite these efforts, Kenya still grapples with food security challenges, brought about by over dependence on rain-fed agriculture for food production.[25]

The agriculture sector is very sensitive to climate change, therefore agriculture systems in Kenya need to adapt to the ever-changing climatic changes to ensure provision of adequate food for a growing population, while increasing export crop production to generate foreign earnings hence boosting the economy. Agriculture in Kenya is a large sector and a growing GHG emitter, responsible for about 30% of Kenya's emissions. The Intergovernmental Panel on Climate Change (IPCC) has concluded that poorest countries would be hardest hit with effects of climate change on the agricultural sector, brought about by decreased water availability and increased GHG mainly attributed with lower adaptive capabilities.[26]

The changing rainfall patterns have affected the planting system hence affecting farmers who mainly depend on rain-fed agriculture. In some regions such as the Western parts of Kenya, the changing pattern of rainfall has affected the bi-annual planting system hence having

[24]Government of Kenya/Ministry of Environment and Mineral Resources. *National Climate Change Response Strategy*. (Nairobi, 2010).
[25]Government of Kenya, *Kenya Vision 2030*. (Nairobi, 2007) pg. vii
[26]Intergovernmental Panel on Climate Change. *Climate Change 2001. Synthesis report*. (Cambridge: Cambridge University Press, 2001).

implications on the countries food security. Climate-related impacts such as rising temperatures have led to increased evapotranspiration, resulting in reduced soil moisture hence affecting the soil moisture content. Rising temperatures have also led to greater destruction of crops and fruits trees by pests which thrive best in hot temperatures thus reducing quality and reliability of agricultural yields. Kenya over the years has experienced socio-economic impacts of climate change brought about by environmental degradation due to urbanisation, over-population, adoption of modern technologies, dumping and deforestation which has impacted on the agriculture sector leading to food insecurity.

Over ten million Kenyans suffer from chronic food insecurity and poor nutrition, and between two to four million people require emergency food assistance at any given time.[27]

Fig 2.1: ***Effects of Climate Change on Maize Plantation.***(Source: NEMA Publications)

[27]CARE International , Adaptation and Food Security. *Climate Change Brief, (*April, 2011).

Climate change has affected the productivity level of the countries agriculture sector with a global circulation model predicting that global warming will lead to increase in temperature to about 4degree Celsius which will cause variability of rainfall by up to 20% by the year 2030, which is likely to affect the bimodal rainfall that the country experience. Moreover, even with predicted climate change scenarios, unpredicted events such as high frequency of floods similar to the 1997-1998 El Nino rains may occur.[28] A good example is the April-May 2015 floods witnessed in Narok and Nairobi counties.

Therefore, for Kenya to attain vision 2030, it ought to ensure boost in food production by enhancing modern means of agricultural production that has limited effects on the soil, land and the environment. The government can achieve these through increased agricultural productivity and incomes by promoting small-scale farmers through provision of subsidized agricultural inputs to boost productivity, and ensuring proper market for goods for large-scale farmers to boost the morale of farmers hence ensuring more productivity. In addition, the government should enlighten farmers on the importance of irrigation agriculture, to reduce over reliance on rain-fed agriculture in the face of the limited high potential agricultural land. These can be achieved through setting up of irrigation farming schemes in the ASALs to boost food production in this area. The government should encourage diversification in food production into non-traditional agriculture commodities and value addition to reduce vulnerability. This diversification can be in terms of mixed farming and encouraging farmers to grow different species of crops, to ensure that when one species of crop is infested with pests and diseases, we still have other alternatives to feed the populations. Finally, the government should encourage private-sector development in the agriculture sector to boost

[28]Mendelsohn, R., W. Nordhaus, and D. Shaw. *"The Impact of Global Warming on Agriculture: A Ricardian Analysis"* (American Economic Review84: 1994) pg 753-771.

public-private partnership (PPPs) and also ensuring environmental sustainability hence spurring the sector assuring food security to the population.

2.1.2 Tourism Sector

The tourism sector is one of the leading drivers of Kenya's socio-economic development. It directly contribute KES 183.4 billion with a GDP growth rate of 4.8% in 2013 and was estimated to rise by 2.9% to KES 188.7 billion in 2014. This direct contribution of tourism is expected to grow by 5.2% per annum to KES 314.1 billion (4.7% of GDP) by 2024. The tourism sector has managed to employ directly 225,500 people, an equivalent of 4.0% of total employment. These include employment in hotels, travel agents, airlines and other passenger transportation services. It's estimated by 2024, tourism will account for 284,000 jobs directly, an increase of 2.3% per annum over the next ten years.

Kenya's major tourism activities are safari and beach holidays, restricted to key tourism destination areas such as coastal regions of Mombasa, South Coast and Malindi coastal areas, key national parks and reserves such as Masaai Mara National Reserve, Tsavo National Parks and Amboseli National Park. Recently other forms of tourism such as sports, adventure, cultural and business tourism have also been promoted to diversify the destination's product. Mostly due to the devolution of Kenya into county levels, each county tries to promote tourism by marketing their cultures, surroundings and environs in a bid to improve this sector.[29]

Tourism as any other sector in Kenya is faced by major impacts of climate changes which have affected the way tourism would have performed if all other factors remained constant. Kenya is most vulnerable to climate-related impacts such as rise in temperature, increased rainfall changing patterns, sea level rises, coral bleaching, increased storm intensity, saline

[29]Akama, J. S. (1999). The evolution of tourism in Kenya. *Journal of Sustainable Tourism*,(Nairobi, 1999)pg *7,* 6–24.

intrusion, food shortage and unemployment, which is mainly attributed to its lower adaptive capabilities.

2.1.2.1 Rise in Temperature

Global warming has affected glaciers leading to shrinking of snow covers in major mountains. For example Mt Kenya which is the second highest mountain in Africa (5199m or 17, 330ft) and one of the few mountain with ice glaziers, which attracts mountaineers, hikers and tourists has been affected by the extreme rise in temperature which has led to the decline in number of the tourists who used to tour those regions.[30]

Climate change has affected the vegetation and ecological zones of various game reserves in Kenya thus ultimately affecting the distribution of wildlife. Higher temperatures brought about by climate change have had a toll on the tourism sector in Kenya, affecting the vegetation, changes in lake levels and drying up of water sources hence leading to rampant migration of wildlife in search of water and vegetation. For example, flamingos have started migrating from their habitat in Lake Nakuru due to their sensitivity to environmental changes conditions. The annual migration of wildebeest, zebra and antelope from Serengeti which is one of the main attractions of the Maasai Mara Game Reserve is another indicator of extreme impacts of climatic conditions forcing the animals to migrate in search of water and pasture.[31]

[30]Mountain Club of Kenya, (4th ed) *Guide to Mount Kenya and Kilimanjaro*, (Nairobi, 1998).
[31]David .V, Maureen. A, *Climate Change and its Impacts on Tourism*, (UK: University of East Anglia, 1999)

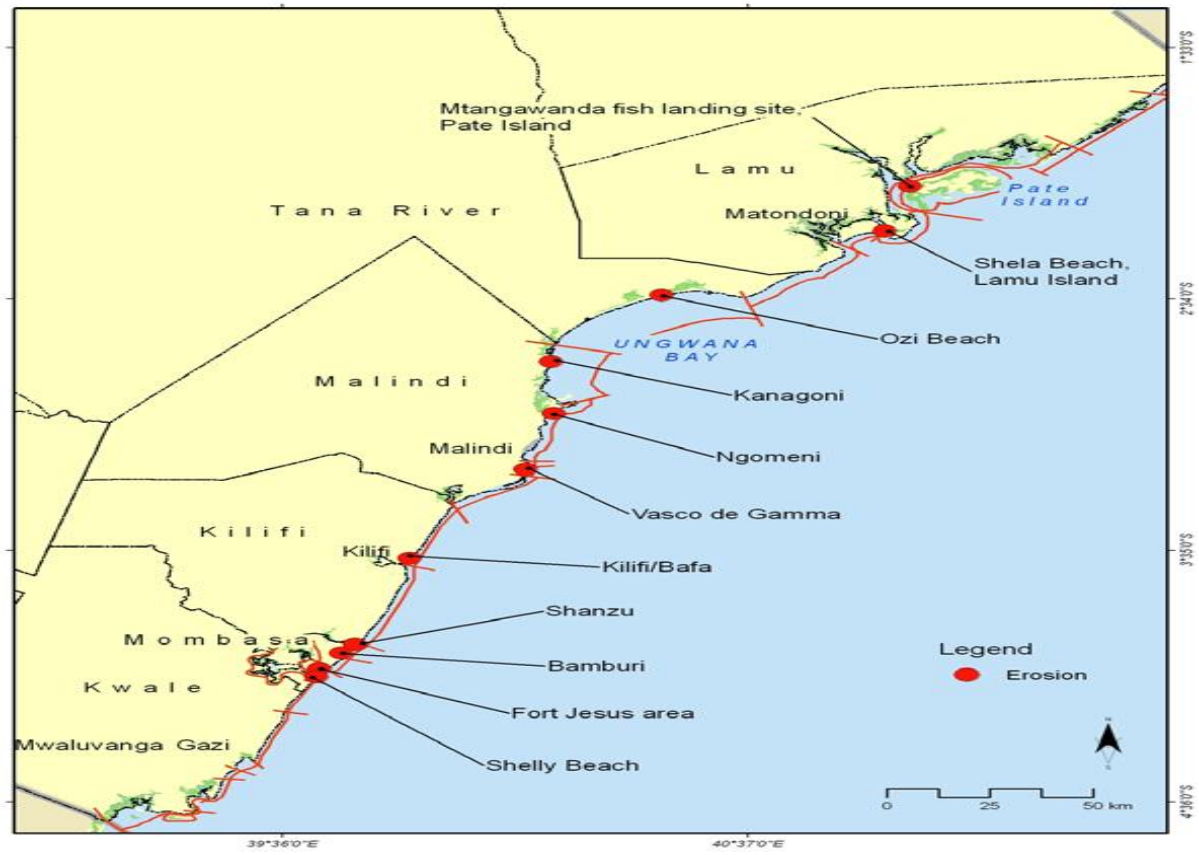
2.1.2.2 Beach Erosion

Beach erosion results from a number of factors such as inundation of the land by rise in sea levels, which may be as a result of warming temperatures which are causes more intense and extreme weather events such as heavy rain storms, flooding and tropical harsh storms such as El Nino which can ravage coastal lines intensifying the acceleration of erosion in the coastal area impacting in sea-level rise. Beach erosion is an extreme weather events and sea-level rise can lead to the destruction of coral reefs which normally absorbs the energy of the ocean swells, which is a major coastal management issue in Kenya and Tanzania coastal lines.[32]

Beach erosion occurs in several areas along the coast of Mombasa, Kilifi and Malindi affecting a number of shoreline activities such as; loss /damage to fish landing areas, damage to property both resorts, residence and commercial, endangering the life of sea turtles through erosion of turtle nesting beaches, loss of sand dunes and loss/damages to heritage sites. Human activities have also been attributed to beach erosion through construction of seawalls.[33]Figure 2.2 below shows beach erosion hotspots along the coastal line of Kenya.

[32]Magadza, C.H.D. *Climate change impacts and human settlements in Africa: prospects for adaptation*. (Environmental Monitoring and Assessment, 2000) 61: 193 – 205.
[33]Government of Kenya. *State of the Coast Report: Towards Integrated management of Coastal and Marine Resources in Kenya*. (National Environment Management Authority - NEMA,Nairobi, 2009). 88pp.

Fig 2.2 Beach Erosion hotspots in Kenyan Coastline (Source: KMFRI Database).



2.1.2.3 Ecological Imbalance

Extreme climatic conditions have destabilised the eco-system leading to ecological imbalance. Due to these extreme climatic events, Human-wildlife conflicts have been witnessed posing a threat to the balance of the eco-system. The frequent droughts witnessed in the country has increased pressure on the forest reserves as mainly pastoral groups invade these reserves for vegetation for their animals thus encroaching into the forest reserves. The competition for the scarce resources during these periods has led to human-wildlife competition. A good example is the periodical human-wildlife conflict in Kitengela, where wild animal have attack domesticated animals and destroy home grown crops. Ecological imbalance can be attributed to population increase, urbanisation, encroachment of forest reserves, encroachment on

natural water reservoirs and deforestation. Climate change has significantly altered the ecological biodiversity as species struggle to adapt in the changing climatic conditions thus having an effect on the tourism sector in Kenya.[34]

2.1.3 Infrastructure sector

The infrastructure sector in Kenya comprises of; transport system entailing road, rail, air and maritime, power system which entails power distribution and lighting system within the country, telecommunication systems and capacity building such as buildings development, school construction and so on. This sector is crucial in the promotion of socio-economic activities and development within the country. A good infrastructure channel for a country is a mainspring for rapid sustainable growth and development in terms of trade facilitation, poverty reduction and improvement of the populations' welfare.[35]

Climate change has impacted negatively on the infrastructural development in Kenya, as extreme high temperatures have led to damages of highways and road networks. Extreme expansions of telecommunication lines due to these high temperatures have severe impacts on the socio-economic development of the country. Climate related impacts such as effects of El-Niño has greatly affected infrastructural development as flooding events have led to soil erosions which have caused destruction of housing settlements, schools, power plants, power poles, roads and transport systems in the country. This in turn has affected the socio-economic development of the country, leading to massive displacements in areas such as Budalangi in Western parts of Kenya. For example the floods witnessed in April and May 2015 in Nairobi and Narok which affected infrastructure as road networks were impassable, drainage system blocked and electricity poles destroyed. Moreover, landslides witnessed in Central part of

[34]Lovett, J.C., G.F. Midgely, P.B. Barnard. *Climate change and ecology in Africa*. (African Journal of Ecology 2005) 43: 279-281.
[35]Ministry of transport and infrastructure. (Government of Kenya, 2014)

Kenya mainly in Othaya, Nyeri, Kihuri and Meru have witnessed loss of lives, destruction of properties causing a wanton impact on the infrastructure sector.[36]

In order for Kenya to achieve socio-economic development in the infrastructure sector, the government ought to come up with policies that are adaptive to mitigate the climate change impacts on the infrastructure, by having an early warning system that will prepare them for future climate-related impacts. This can be achieved through use of modern technology in the infrastructural sector that cannot be affected by extreme events brought about by climate change.

2.1.4 Energy sector.

The energy sector is one of the major socio-economic developers of the country as bulk of the energy is consumed in manufacturing, commercial, transport, residential, power generation and street lighting. Nationally, wood fuel and other biomass sources account for 68% of the total primary energy consumption, followed by petroleum at 22%, electricity at 9% and others account for 1%. Some of the major energy sources in Kenya include petroleum, coal, solar, hydroelectricity, biomass, geothermal and wind energy. Electricity access in Kenya is low despite government efforts to increase electricity connection from currently 15% to 65% by the year 2022.[37]

The impacts of climate change on the energy sector has been felt primarily through losses and changes in hydropower potential for electricity generation mainly caused due to extreme events such as droughts and high temperatures. These extreme events have resulted in drying up of water sources and rivers hence reducing the hydrogenation levels in key power plants hence forcing the country to import alternative power supplies from neighbouring countries,

[36]Republic of Kenya, *National Policy on Disaster Management (Revised Draft)*, (Nairobi, Kenya, 2004).
[37]Jumba, M.F, Nyaoro, J. *The Energy Sector. A case study of hydropower in Climate Change Impacts, Vulnerability and Adaptation*. (Association of African Universities, 1998).

thus impacting negatively on the socio-economic development of the countries. Climate-related impact such as floods and extreme rain periods have resulted in destruction of power plants and power equipment's. Collapsing and bursting of water dams have been witnessed during this period, as excess water from river sources flood the dams hence busting the dam's walls causing floods in the surrounding areas, and another cost incurred in maintenance. A good example is the 2010 Kenya Meteorological Service flood alert issued for Eastern Kenya, that led to Tana river swollen to dangerous levels leading to the overflowing of three dams; Masinga, Kiambere and Gitau dams. Kiambere and Gitau were filled past capacity hence flooding the surrounding areas.[38]

The energy sector should adapt to climate change through enhanced use of alternative energies that have little or no impacts to the environment to minimise GHGs emissions thus reducing global warming. Therefore, due to climate-related impacts, leading to reduced level of hydro-electric power generation, there is need for the government to diversify power supply and advocate for the use of renewable energy sources to satisfy the national power grid. These alternative power sources include use of biogas, solar, wind, bagasse, geothermal, coal, improved stoves, bio-fuels as well as up-scaling the use of other renewable energy sources.

2.1.5 Forestry Sector

Kenya has an estimated forest cover of 6.6% lying in about 3, 467,000 ha, and is aiming to reach 10% as required by the constitution.[39] The forest sector is an important element of Kenya's socio-economic development, contributing one percent to the overall GDP of the country, which has benefited both the formal and informal sectors. Although the forest sector's contribution to the socio-economic development of Kenya is largely unrecorded due

[38]Ministry of Environment, Water and Natural Resources (Kenya Meteorological services, 2010)
[39]Food and Agricultural Organization. 2010. *Global Forest Resource Assessment Country Report: Kenya. Rome*: (Food and Agricultural Organization, 2010).

to most forest products being used for subsistence purposes, it still contributes US$141 million or 1.3 % to the national GDP annually.[40]

The forestry sector in Kenya has created job opportunities both directly and indirectly. It is estimated to have provided jobs directly to over 18,100 people and indirectly to more than 300,000 people with one-tenth of all households living in a five-kilometre radius of forests depending on them to meet their livelihood and subsistence needs.[41] The forest sector also provides important attraction for the tourism sector, because it serves as important wildlife habitats as well as provides aesthetic and biodiversity benefits. Above all, the forest sector is an important ecosystem balancer as it reduces soil erosion, natural pest control, preservation of water availability and maintenance of water quality.[42]

Kenya's forestry sector is vulnerable to climate change, which has greatly impacted on the socio-economic development of the country. According to the Ministry of Environment and Mineral Resources (MEMR) and National Climate Change Response Strategy (NCCRS) reports that climate changes are expected to increase desertification and forest degradation, which has had adverse impacts on the socio-economic benefits and livelihood derived from the forest sector, as well as biodiversity and environmental services. Projected increase in average temperatures and protracted droughts will highly impact on the forest eco-cover, as magnitude of forest fires and increase of pests and pathogens that feed on forests vegetation's would be witnessed, which will impact on the socio-economic benefits that forest sector has on the growth and development of the country. Potential increase in temperature will also lead

[40]World Resources Institute, Kenya Ministry of Environment and Natural Resources, Kenya Ministry of Planning and National Development and International Livestock Research Institute. (2007).

[41]Ministry of State for Planning, National Development and Vision 2030. (2007). p. 70.

[42]Nasi, R., Wunder, and. Campos J.J. Forest Ecosystem Services: Cam They Pay Our Way Out (2002)

to water stress for plants leading to dominance of drought resistance species, as plants that are not able to cope with the rise in temperature may go extinct leading to loss of biodiversity.[43]

These extreme climatic events will lead to wildlife migration as animals which are not prone to such conditions will flee the ecosystem hence having dire consequences on the tourism sector at large hence affecting the socio-economic development of the country. Moreover, such climatic conditions would lead to changes in socio-economic drivers, working practices, cultural values, policies and use of land and other resources, as this would lead to conflict of interest between humans and wildlife, as they compete for the limited available resources.[44]

Climatic conditions such as extreme rainfall and cold seasons would lead to floods, weakened soil retention andlandslides, falling of trees and socked soils in the forest which will affect the land canopy, destroying forest species as weak trees will be uprooted by extreme windy conditions hence affecting the eco-cover. Moreover, these events will impact on the forest habitat as some birds and animal species will migrate and also these events will have effects on the tourism sector, hence impacting negatively on the socio-economic development of the country.[45]

The government through the forest sector should formulate and come up with forest policy and legislation aimed at educating the masses on the importance of protecting our forest cover and the need for maintaining good environmental conditions. The government should work with relevant stakeholders to facilitate sustainable forest management, conservation and enhance dissemination of forestry-related research. Finally, the government should come up

[43]Minister of Environment and Mineral Resources. *National Climate Change Response Strategy*. (Nairobi: Government of Kenya, 2010). pg. 31.
[44]Lovett, J.C., G.F. Midgely, P.B. Barnard. *Climate change and ecology in Africa*. (African Journal of Ecology 2005) 43: 279-281
[45]Malcolm, J.R., A. Markham, R.P. Neilson and M. Garaci. *Estimated migration rates under scenarios of global climate change*. (Journal of Biogeography, 2002) 29: 835-849.

with early response mechanism that will help in adapting for future climate change calamities.[46]

2.1.6 Health sector

Kenya has struggled to build a health system that can effectively deliver quality health services to the population. Access to health care varies in Kenya as close to 52% of the population are people living below the poverty line. According to World Health Organisation (WHO), in 2007 the average life expectancy for both sexes in Kenya was 54 years, compared to a global average of 68 years. Healthy life years are anticipated at 48, with 82% of lost healthy life-years attributed to communicable diseases.[47]

The prevalence of communicable diseases in Kenya is high with malaria being the leading killer disease in the country, with an estimated 13.6% deaths of children under five years. Other communicable diseases such as HIV/AIDS prevalence is estimated at 10% to urban adults and 5.6% to rural adults. Tuberculosis, typhoid and cholera are other major communicable diseases that have effects on Kenya's population at large. According to WHO, World Malaria Report 2014, nearly 28 million Kenyans live in areas of high malaria risk, with high prevalence rates being in children between 5-10 years. Malaria prevalence is higher in rural areas at 12% as compared to 5% in urban areas. The fight against malaria is estimated to cost the country KES 57 billion to completely eradicate the disease, of which it can only afford half the money.[48]

Among other factors, Climate change has greatly contributed to communicable diseases in Kenya. Rural areas in Kenya that experience two rainy seasons March to June and September to November are more prone to waterborne diseases such as typhoid, dysentery, cholera,

[46]Ministry of Forestry and Wildlife. *About Us.* Accessed at:http://www.forestryandwildlife.go.ke, (Nairobi, 2012)
[47]World Health Organisation. *World Malaria Report*, (Nairobi, 2014)
[48]World Health Organisation. *World Malaria Report*, (Nairobi, 2014)

bilharzia and other communicable diseases. Moreover, extreme hot temperatures, harbours parasites that cause excessive coughing, flu and running noses, yellow fever, Rift valley fever and above all being a conducive environment for mosquito larval-to-pupal development being accelerated.[49]

Fig 2.3: Catastrophic effects of floods in Western Kenya. (Source: *National Policy on Disaster Management***)**

Figure 2.2 above shows submerged huts in western parts of Kenya during the El-Nino flood. Such incidents brought about waterborne diseases like typhoid, amoeba, cholera and bilharzia. These diseases also have socio-economic impacts on the local population; eventually it costs the country on resources for medication and preventive measures to curb these ailments. Above all, many households incur about 10% of their monthly earnings for treatment per person infected.

[49]Kenya Red Cross and Red Crescent Societies , *Kenya Floods*, (Nairobi, 2010)

2.1.7 Water Sector

The water sector in Kenya is considered to be very sensitive to climate change, and currently, Kenya is considered a water scarce country with 647 cubic metres per capita. An estimated 50% of the population lacks safe reliable water and basic sanitation. Major water sources are threatened by excessive pollution, degradation, over exploitation which is the major factor that enhances climate change. The combined effects of rising temperatures, more and concurrent droughts and decreasing rainfall with fluctuating rain patterns have led to the lowering levels of rivers, lake, water catchments, and groundwater levels. For instance, the water level in Lake Naivasha has varied by about 12 metres in the last century. The country has also witness's disappearance of some seasonal rivers and falling levels of permanent rivers. Nyando River, for instance had low discharges for most of 2010 disadvantaging the viability of the rice irrigation schemes on the Kano plains impacting on the socioeconomic livelihood of the residents and the country at large.[50]

Climate change impacts have tremendously affected the water services sector, which has affected key socioeconomic sectors that boost the country's economy. Water scarcity impacts fisheries, agriculture and tourism sector which largely depends on availability of water. For instance, the 1998-2000 drought spell is estimated to have led to socioeconomic loss of about US$2.8 billion emanating from the loss of crops, livestock's, forest fires, damage of fisheries and enhanced reduced hydropower generation and other industrial activity.[51]

[50]Becht, R. *Environmental effects of the floricultural industry on the Lake NaivashaBasin*. (International Institute for Geo-Information Science and Earth Observation, 2007)

[51]Stockholm Environmental Institute, Project Report; *The economics of Climate Change in Kenya*. (Oxford University Press, 2009)

Fig 2.4*: A drying up community water pan on the Kano plains which is used for livestock watering and domestic needs.* (Source: NEMA Publications)

The government through the Ministry of water should come up with measures aimed at protecting our water sources and bodies in an aim to preserve our water bodies. The government should construct dams and water pans in various counties to boost water catchment areas. In ASAL the government should advocate for tapping of rain waters by building water reservoirs and underground water saving plants, dig boreholes and wells in a way to ensure there is enough water during dry seasons. The government should enlighten the public on the need to protect water towers, river banks and water bodies in order to build capacity for water quality improvement and awareness campaign to promote water efficiency measures.

2.2 Recent History of Natural Disasters in Kenya

Kenya has a well set up National Climate Change Action Plan policy that is tailored to mitigating and adapting to the climate change effects. But due to poor implementation methods and lack of climate change champions, the country has always been found unprepared to deal with such calamities, which occur year in year out as seen in the table below.

Table 2.1: Natural Disasters in Kenya since 1975-2004 (Source: *National Policy on Disaster Management***)**

Year	**Type of Natural Disaster**	**Area of Coverage**	**No. Of People Affected**
2004	Drought	Widespread	2-3 Million
2004	Landslides	Nyeri, Othaya, Kihuri	5 deaths
2002	Landslides	Meru Central, Muranga, Nandi	2,000
2002	Floods	Nyanza, Busia, Tana river Basin	150,000
1999/2000	Drought	Widespread	4.4 Million
1997/1998	El Nino flood	Widespread	1.5 Million
1995/1996	Drought	Widespread	1.41 Million
1991/1992	Drought	Arid and Semi-Arid districts of NE, Rift valley, Eastern and Coast	1.5 Million
1985	Floods	Nyanza and Western	10,000
1983/1984	Drought	Widespread	200,000
1982	Floods	Nyanza	4,000
1980	Drought	Widespread	40,000
1977	Drought	Widespread	20,000
1975	Drought	Widespread	16,000

Table 3.1 above shows a three decade natural disasters that have strike Kenya which are brought about by changes in climate which have affected millions of people living in the country. Almost 70% of Kenya's land mass is affected by drought as evident in table 3.1 above, which covers most parts of Rift Valley, North Eastern, Eastern regions and coast regions which are classified as arid and semi-arid land. With 75% of the entire Kenyan population depended on rain-fed agriculture, these frequent episodes of cyclic droughts has made Kenya vulnerable to food insecurity, hence influencing on the socio-economic

developments within the country.[52] Kenya has in the past recorded deficit of food due to drought resulting from shortfall in rainfall as evidence in the years 1928, 1933-34, 1937, 1939, 1942-44, 1947, 1951, 1952-55, 1957-58, 1984-85 and 1999-2000, which have resulted in loss of human life and livestock, heavy government expenditure to facilitate response and general high economic losses. In Kenya, areas affected by floods are Nyanza region of Kano plains, Nyakach area, Rachuonyo and Migori, Western region in Budalangi, Coast region in Kilifi, Kwale and Tana river basin, North Eastern areas of Garissa, Wajir and Ijara and Urban settelements such as Nairobi, Nakuru, Mombasa and Kisumu. These floods generally occur as Flash floods, river floods or Coastal floods along the coast due to wave activity resulting from tropical cyclones, tsunamis and storm surges.[53]

2.3 Conclusion

Climate change in Kenya have had adverse impacts on Kenya's socioeconomic sectors, and more projections indicate that such impacts will worsen in the near future if the world does not implement measures to cut down on the excessive GHG emissions responsible for climate change. Temperatures have risen throughout the country, rainfalls have become irregular and unpredictable and when it rains, downpour is more intense. The adverse impacts of climate change in Kenya are compounded by local environmental degradation such as illegal encroachment and settlements, logging and livestock grazing which have aggravated land degradation and deforestation at large.[54]

[52]Republic of Kenya, *National Policy on Disaster Management (Revised Draft)*, (Nairobi, Kenya, 2004). p.4

[53]UNDP, WMO, GOK, IGAD and DMCN, *Factoring Weather and Climate Information and Products into Disaster Management Policy, A Contribution to Strategies for Disaster reduction in Kenya*. (Nairobi, 2002.)

[54]Ministry of Environment and Mineral Resources. *National Climate Change Response Strategy,* (Nairobi,2010)

Extreme climatic events such as temperature rise, droughts and recurrent floods have affected the countries socioeconomic development, impacting on key sectors such as Agriculture leading to reduced production of staple food crops leading to food insecurity. Climate change has affected energy sector, with reduced hydropower potential due to destruction of water catchment areas and reduced water levels in the generating dams brought about by prolonged droughts. Further extreme weather events such as prolonged rainstorms and hailstorms will destroy the energy generation and distribution systems. Excessive rains accompanied by floods have destroyed road networks, bridges, railway lines and other transportation and communication infrastructure which impacts on the socioeconomic development of the country. For instance, the damage caused by the eight month 1997/1998 El-Nino rains impacted on the country's transport and telecommunication infrastructure was estimated at one billion US Dollars.[55]

In order for Kenya to fully attain socioeconomic development, it ought to come up with adaptive measures aimed at mitigating impacts associated with climate change, through provision of weather-related information aimed at enlightening the public on impacts of climate change. Empower local farmers by provision of subsidised farm in-puts to increase food production to boost food security. In ASAL the government should encourage practise of irrigation-agriculture and planting of drought resistance crop species that can survive in those areas. The government should also ensure protection of water catchment areas and water sources in an aim of conserving water bodies. Boreholes and wells should be dug in ASAL to ensure safe reliable and basic sanitation is available to all. In the energy sector, the government should encourage green energy by educating the publics on the importance of biogas energy, wind energy, solar energy that are not harmful to the environment. In the

[55]Stockholm Environmental Institute, Project Report; *The economics of Climate Change in Kenya*. (Oxford University Press, 2009)

health sector, the government should intensify the fight against communicable diseases that are the major killers and derailleurs in achieving socioeconomic development, through enlightening the publics and pumping in money to fight such diseases. All is not lost in the fight against climate change as long as the government put in place measures that are adaptive to mitigate the impacts brought about by climate change on the socioeconomic development of the country.

CHAPTER THREE

ANALYSIS OF THE CLIMATE CHANGE ADAPTATION AND MITIGATION IN KENYA.

3.0 Introduction

The 2010 National Climate Change Response Strategy (NCCRS) recognises the importance of impacts of climate change on the socioeconomic development in Kenya. The National Climate Change Action Plan developed in 2012 is the logical steps in enabling Kenya reduce climate change vulnerability aimed at improving the country's ability to overcome climate change impacts.[56]Kenya Vision 2030 is the long term socioeconomic development blueprint for the country which is aimed at transforming the country into an industrialised, middle-income country aimed at providing a high quality life that offers clean and secure environment to the citizens.[57]

The previous chapter discussed that Kenya is extremely susceptible to climate related events such as periodic floods, prolonged droughts and extreme high temperatures which pose a serious threat to the socio-economic development of the country. The Government of Kenya (GoK) is taking climate change and its impacts on socioeconomic development serious, this is seen through the GoK 2005-2015 efforts in committing KES 37 billion while development partners have committed KES 194 billion aimed at mitigating impacts of climate change on the socioeconomic development. Despite these efforts, Kenya is still susceptible to climate change impacts which have hindered her performance on the international scene.[58]Therefore this chapter seeks to examine key policies that the government has come up with aimed at

[56]Ministry of Environment and Mineral Resources. *National Climate Change Response Strategy,* (Nairobi,2010)
[57]Government of Kenya. *Kenya Vision 2030*. Nairobi: (The Government of Kenya, 2007) P. vii.
[58]Government of Kenya/Ministry of Environment and Mineral Resources. *National Climate Change Response Strategy. (*Nairobi, 2010)

mitigating and adapting to climate change impacts. Above all, this chapter looks at key challenges that face the government in its efforts to try and mitigate climate change related impacts and try to propose solutions to these challenges.

3.1 Nationals Policies and Legislation for Mitigating Climate Change.

The government of Kenya has come up with relevant key policies, plans, strategies and initiatives which try to provide relevant framework aimed at implementing climate change responses. Some of these initiatives include;

3.1.1 National Environmental policy

The draft NEP of 2008 treats climate change as an emerging environmental issue that the government need to tackle through proper mitigation and adaptation. It recognises that many of the natural disasters in Kenya are prone to re-occur and they have socio-economic impacts in key sectors of the economy, thus it is for the government to enhance mitigation and adaptive mechanism to tackle future climate catastrophe. The policy advocated for the creation of the NCCRS which was enacted in 2010 to enhance quick response to current and future climate change warnings. It raised awareness for adaptation measures and enhances use of appropriate technology and capacity building. The policy routed for development of an improved early warning systems for climate and disaster risks with a clear means of disseminating climate related information to the grassroots level. Finally it called for building and strengthening of research capacity on climate change and environmental issues.[59]

However, poor policy implementation has hampered climate change adaptation and mitigating thus leaving climate change issues underrepresented, hence exposing the country to continuous effects of climate related calamities thus affected its socio-economic development.

[59]Stephen,M. Samuel, M. Peterson, O. and Kristen, W. *Climate Change Vulnerability and Adaptation Preparedness in Kenya.* (Nairobi, 2010)

3.1.2 The Constitution of Kenya (2010)

The government has managed to enact the Climate Change Bill, 2014 through an Act of parliament to provide the legal and institutional framework for the mitigation and adaptation to the effects of climate change. This Act is aimed at facilitating and enhancing response to climate change and provide for the guidance and measures to achieve low carbon climate resilient development. This Act paved way for the establishment of the National Climate Change Council, mandated with the responsibilities of advising the national and county government on legislative and other measures needed for mitigating and adapting to effects of climate change, provide coordination among various stakeholders dealing with climate change related matters, advise the national and county government on regional and international conventions, treaties and agreements on climate change to which Kenya is a party.[60]

Through this Act of parliament, the government has been able to receive early warning reports of climate change, although it has proved difficult for the reports to be implemented because of poor disaster preparedness curtailed by the inadequate availability of ready funds to be tailored to cater for these emergencies.

3.1.3 The Vision 2030

The government has come up with Vision 2030, which is the countries development blueprint which covers the period 2008-2030 aimed at transforming the country into a middle income economy providing a high quality life with clean and secure environment to its citizens. Kenya has tried to increase forest cover in order to reach 10% as required by the constitution and lessen by half all environmental-related diseases, in an aim to provide a sustainable secure environment. Under the Vision flagship projects for the environment, Kenya is to rehabilitate five water catchment towers i.e. Mau Escarpment, Mt. Kenya, Aberdare's Range, Cherangany

[60]Government of Kenya/Ministry of Environment and Mineral Resources. *National Climate Change Response Strategy. (*Nairobi, 2010)

Hills and Mt. Elgon, comprehensively mapping of all land use patterns in the country and development of solid waste management systems within the country. Moreover, the country under the flagship projects for water and sanitation, the country aims to conserve water sources and start new ways of harvesting and using rain and underground water in a way of providing safe water and clean sanitation in both rural and urban areas.[61]

Through this measures, the government aims at coming up with adaptive measures aimed at mitigating seasonal droughts and water shortages, by rehabilitating water catchment areas and above all harvesting rain and underground waters, which can be used for agriculture, and household consumptions. Mapping of all land use patterns under the Vision flagship programme is aimed at ensuring proper land use in an aim of protecting soil erosions and enhancing food production.

3.1.4 The National Policy for the Sustainable Development of Arid and Semi-Arid Lands

The National Policy for the Sustainable Development of Northern Kenya and Arid Lands was launched in 2013 aimed at directing more resources to the development of the ASALs which have in the past suffered neglect due to inadequate resource provisions curtailed with poor infrastructure. ASALs in Kenya covers nearly 90% of the country's land mass which are home to nearly 30% of the population, holding approximately 70% of the national livestock herd and are home to most of the country's national parks which is the backbone of Kenya's tourism sector. Despite all these endowments, the ASALs have not received policy attention, and have been marginalised in terms of resource allocation, infrastructure development, social service delivery and economic transformation. However with the publication of the Economic

[61]Government of Kenya. *Kenya Vision 2030*. Nairobi: (The Government of Kenya, 2007)

Recovery Strategy for Wealth and Employment Creation 2003-2007 (ERS) by the NARC government that is when focus shifted to ASALs because of its vast unexploited resources.[62]

The main objectives of this policy is to strengthen national integration, cohesion and equality among the people of Northern Kenya and other Kenyans, lay foundations for development in terms of infrastructure, human capital, security and the rule of law and strengthening climate resilience and ensuring sustainable livelihoods through establishing National Drought Management Authority (NMDA) and the National Drought and Disaster Contingency Fund (NDDCF) aimed at managing emergency drought reserve areas, encourage the development of buffer areas of crop and forage production, mainstream climate change foresight and adaptation for strengthening community strategies for adaptation to climate change and disaster risk reduction. The government aim under this policy is to protect and increase forest cover, riverine forests and critical water catchment areas in the ASALs and promote water-technology with an emphasis on water harvesting to enhance the socio-economic development of the ASALs.[63]

Despite all the efforts put in place by the government to effectively mitigate and manage the effects brought about by climate change, the policies, plans and strategies have not been fully implemented due tothe countries higher vulnerability to climate related impacts and lower adaptive capability, curtailed by poor implementation strategies, political interference and high level of corruption within key departments.

3.2Challenges facing Climate Change Adaptation and Mitigation in Kenya.

Kenya like other countries in the world is experiencing the adverse effects of climate change, which has caused major negative socio-economic effects across most sectors which thrives

[62]Republic of Kenya, *Economic Recovery Strategy for Wealth and Employment Creation, 2003-2007*. (Nairobi: Ministry of Planning and National Development, 2003)

[63]Republic of Kenya, *Sessional Paper No. 8 of 2012 on the National Policy for the Sustainable Development of Northern Kenya and other Arid Lands*. (Nairobi: Ministry of State for Development of Northern Kenya and other Arid Lands,2012)

our economy. Despite various measures and adaptive efforts being put in place to mitigate the effects brought forward by climate related fatalities, Kenya still faces a big challenge in its quest to secure her population from climate related effects because of her higher vulnerability and lower adaptive cost. To date there has been limited (though increasing) understanding of climate change in government, with priority being given to support the development of clean energy in Kenya in order to reduce energy production and reduce costs. Some of the challenges that the country has faced in her quest to mitigate and adapt to climate change include the following;

3.2.1 Corruption

Corruption has been a thorn in the backbone of Kenya's socio-economic development, swindling millions of shillings from tax payers coffers allocated in different government projects. Kenya is ranked 139th out of 176th in the corruption perceptions index, and its estimated that average urban Kenyan pays 16 bribes per month.[64] Corruption in Kenya has hindered climate finance as funds set aside to mitigate effects of climate change such as droughts and frequent floods have been embezzled and mismanaged because of poor governance and lack of transparency and accountability within different governmental departments. Moreover, no national framework for reporting on climate change is in place, as majority of climate change financing is not yet sufficiently earmarked or captured in the national budget thus creating loopholes for corruption related discrepancies as it is difficult to track and monitor how the funds are used.

The total costs estimates for addressing the impacts of climate change in Kenya both immediate and in future have been estimated by Stockholm Environmental Institute (SEI) at $500m per year from 2012 onwards, with an adaptive costs aimed to increase by 2030 from

[64]Hicks, Bill,*Transparent International*. (Pinkindustry.com, 2010).

$1 and $2 billion per year.[65]Corruption has hindered climate finance in Kenya, as donors aligned to climate change support have shun away because of lack of government effort to curb this vice. Corruption remains to be the major challenge in climate change mitigation and adaptation, as it's arguable that the focus of Kenya as a country has not been in the area of funding adaptation to potential impacts of climate change but rather to finance key national projects. This in turn has hindered the government efforts in mitigating and adapting to current and future climate change, therefore making the country to be highly vulnerable to climate related impacts.[66]

Therefore, for Kenya to effectively adapt and mitigate climate change effects, the government ought to come up with measures aimed at curbing the ever growing menace of corruption, this can be achieved through coming up with relevant institutions aimed at fighting corruption, implement corruption sensitive policies, develop institutions to track and monitor on how climate finances are utilised in the country and encourage internal and external donors to invest in climate financing in order to mitigate climate change related impacts.

3.2.2 Poor Policy Implementation

Kenya as a country has managed to show total commitment to protect the climate system for the benefit of the present and future generations by supporting the United Nations Framework Convention on Climate Change (UNFCCC) process; ratifying the Kyoto Protocol in 2005; and contributing to continental and regional climate change initiatives.[67] Furthermore, the country's Constitution has set out a legal commitment to attain ecologically sustainable

[65]Stockholm Environmental Institute, Project Report; *The economics of Climate Change in Kenya*. (Oxford University Press, 2009)

[66]OECD, *Climate Change and Development: Key Principles to Inform Climate Change Financing,* (2009)

[67]Depledge, J., *United Nation Framework Convention on Climate Change (UNFCCC) Technical paper: Tracing the origins of the Kyoto protocol*: (An article-by-Article Textual History, 2000).

development; hence providing a basis to address the challenge of climate change while striving to attain its development goals through the Kenya Vision2030.[68]

Despite all these efforts Kenya is still fighting against climate change due to poor policy implementation. In spite of Kenya having good policies that can transform the country into a world power, policy implementation has proven to be the major problem for the country's socio-economic development. Poor policy implementation in Kenya is brought about by poor policy implementation and formulation institutions, high levels of corruptions in key departments, inadequate funds to finance the policy implementation and formulation, lack of a key policy monitoring body tasked with monitoring key policy implementations and formulations, political interference and ignorance to some levels have hindered effective policy implementation in Kenya especially in the climate change mitigation and adaptation sphere.

For instance, in the year 2013, the government come up with a National Climate Change Action Plan aimed at finding ways of adapting and mitigating climate change impacts. The NCCAP (2013-2017) policy acknowledged the vulnerability Kenya is to the impacts of climate change, so it come up with a five year action plan aimed at adapting and mitigating impacts of climate change. The objectives of this policy was to distribute clean energy to the population, enhance improved water resources management and access to clean water to all, restoration of forests, enhance climate-smart agriculture and agroforestry aimed at enhancing food security to the population, improved infrastructural development and source for climate financing from various willing donors.

These was tailored towards achieving sustainable development at the forefront of all climate actions, reduce vulnerability to avoid or cushion the impacts of climate change by enabling

[68]Government of Kenya/Ministry of Environment and Mineral Resources. *National Climate Change Response Strategy.* (Nairobi, 2010)

the population respond to the climate risks by moving towards a climate resilient society and taking actions where possible by lower GHG emissions that are lower and move toward a resource efficient economy with as low carbon as possible.[69] But due to poor policy implementation and formulation, three years down the lane, the country has not achieved the objectives that the policy had, this is curtailed by increased drought seasons with extreme increase in temperatures level notable in the northern parts of Kenya, where the countries livestock sector has been greatly affected with the dying of thousands of cattle's, goats and sheep's in these periods, flash flooding in each rainy seasons has also been witnessed the recent one being in Narok County and Nairobi County, where infrastructure developments were affected and families displaced due to these impacts brought about by climate change.

Hence, it's the duty of the government to establish mechanisms for the review and evaluation of the implementation and formulation of climate-related policies to enhance its workability to curb the ever-growing impacts of climate change vice.

The government in collaboration with the County governments should expedite the implementation of climate change related policies to enhance climate change awareness in the county level to enlighten the population on the effects of climate change and the need to safe guard our environment. The government should set an institution tasked with monitoring and evaluating climate change policies within a given period of time to see its workability or not, in which they would advise the government on the next legitimate step. Finally, the government should partner with key private partners (public-private partnership) aimed at reviewing key climate change policies in order to enhance climate financing from these partnerships.

[69]Government of Kenya/Ministry of Environment and Mineral Resources. *National Climate Change Response Strategy.* (Nairobi, 2010)

3.2.3 Inadequate Funds

Climate change adaptation and mitigation in Kenya has been greatly affected because of lack of adequate funds tailored to mitigate climate change related impacts. With the economy dipping and the shilling losing value in the international stock market, is greater reason for the country to focus more on certain sectors amidst others. Moreover, high levels of corruption, poor policies implementations and high standards of politics have dealt climate financing a major blow as eligible donors shun away and others terminating their contracts. With the total cost for addressing climate change impacts in Kenya both immediate and in the future lying at about $500m per year, as from 2012 onwards with adaptive costs aimed to increase from $1 and $2 per year by 2030, is enough doubt if the government will be able to handle the impacts of climate change.[70]

The socio-economic costs of climate change in the past two decades have dealt the country a great deal amounting to billions of shillings arising from loss of crops, livestock's, damage of properties and displacement of people. For instance, the 1998-2000 droughts that ravaged the country witnessed socio-economic costs worth $2.8 billion from the loss of crops and livestock, forest fires, damage to fisheries, reduced hydro-power generation, reduced industrial production and reduced water supply. The drought is estimated to have resulted in a 16% reduction in the GDP in those financial years. The 2004/2005 and 2008/2011 droughts affected millions of people with an impact costs of $12.1 billion experienced slowing down the economy by an average 2.8% leading to major socio-economic costs from restrictions on water and energy leading to an increase in food insecurity within the country.

The 1997-1998 El Nino floods on the other hand affected almost 1 million people and were estimated to have total economic costs of $0.8-$1.2 billion arising from damage to

[70]Stockholm Environmental Institute, Project Report; *The economics of Climate Change in Kenya*. (Oxford University Press, 2009)

infrastructure, public health effects with rampant spread of waterborne diseases, and loss of crops. For example, the 2006-2007 floods witnessed from late October into January particularly in Western parts of Kenya, near Lake Victoria, the Budalangi division of Busia County were severely affected, with floods bursting the dikes along river Nzoia leading to massive displacement of the locals, cropland along the river banks were flooded and irrigation infrastructure destroyed. The water level in Lake Victoria was increased leading to breaking of the lake banks. The impacts of this floods apart from death and displacement of people, led to long term food insecurity and outbreaks of diseases such as Rift Valley fever spread by mosquitos.[71] The recent floods witnessed in Nairobi and Narok County, affected infrastructure and led to displacement of people and properties worth millions of shillings destroyed.[72]

The continued annual burden brought about by climate change impacts is attributed to the government inadequate availability of funds to mitigate climate related impacts. In the near future, the government is estimated to lose billions of shillings to effects of climate change, if it does not seek alternative ways of funding climate change mitigation and adaptive efforts. With the influx rise in population, change in land use patterns, excessive carbon emissions are key indicators that the country should be prepared for more and more future climate risks. Kenya being inadequately adapted to deal with existing climate risks ought to set aside funds for future climate risks, sought for climate financing from relevant donors and be in the forefront in spearheading fight against climate change impacts.

3.2.4 Illegal logging and Deforestation

[71]World Bank (2004). *The Republic of Kenya: Towards a Water-Secure Kenya – Water Resources Sector Memorandum*. (Report No. 28398-KE,April 2004)

[72]Republic of Kenya, *National Policy on Disaster Management (Revised Draft)*, (Nairobi, Kenya, 2004).

Kenya has an estimated forest cover of 6% having five distinct classes of indigenous closed canopy forests, indigenous mangroves, open woodlands, public plantation forests and private plantation forests and it is projected to attain 10% forest cover under the flagship of Vision 2030. Despite this, Kenya experiences an annual deforestation rate of between 0.3% and 0.35% over the past two decades.[73] Forests in Kenya are unique in their contribution to environmental balance and bio-diversity, despite being victim to increased demand for timber and competition with other land uses. Despite the Kenya Forest Service Strategic Plan 2009-2013 aimed at sustainably manage the forests through the combined use of ecological, economic and social approaches, guided by the Forest Act No.7 of 2005, the government still has failed to control the increasing deforestation and illegal loggings, exposing the country to excessive impacts of climate change due to inadequate funds to implement climate conservative policies, corruption, poor government policies and ineffective institutions and enforcement agents.[74]

Illegal logging and deforestation present a real challenge to Kenya's efforts of mitigating and adapting to climate changes impacts. Forest degradation impact on socio-economic development of Kenya through reduced biomass energy, soil erosion and siltation, reduced water infiltration in the soil leading to diminishing groundwater quantities and changes in precipitation levels. The drivers of forest degradation in Kenya include; Land encroachment due to influx population increase, unsustainable production methods and consumption patterns for charcoal and illegal logging for timber purposes.[75] For example, in over the past

[73]Food and Agricultural Organization. 2010. *Global Forest Resource Assessment Country Report: Kenya. Rome*: (Food and Agricultural Organization, 2010).

[74]M. Kihu, *Kenya using Constitution to Reverse Forest Loss, available at http://newsciencejournalism.com/ blog/09/2010/kenya-using-constitution-to-reverse-forest loss/ and Kenya Forest Service, Strategic Plan 2009-2013* (Nairobi: Kenya Forest Service, 2009), p. 8.

[75]Government of Kenya. 2010. *Revised REDD Readiness Preparation Proposal. Submitted to the Forest Carbon Partnership Facility*. (Nairobi: Government of Kenya, 2010). p. 26.

two decades, a quarter of Mau forest has been lost to excisions and encroachment through illegal extraction of the forest resources for commercial purposes especially timber, wood-fuel, charcoal, cattle grazing, land resettlements and unsuitable use of forest resources. The Mau forest provides ecosystems services essential to crops and agroforestry products supporting local communities and grazing land for wildlife. Above all, Mau forest is a water tower for Sondu and Mara rivers from East and South West Mau forest reserves. Therefore the forest degradation witnessed in Mau forest risks destroying the water catchments and towers found in this forest above all affecting the forest eco-cover hence affecting the production of tea and rice and moreover the production of hydropower generation.[76]

The government ought to come up with forest policy and legislation, which should be reviewed yearly to enhance its effective formulation and workability. The government should enhance good working conditions for stakeholders to facilitate sustainable management and conservation. The government through the NEMA should promote conservation education programmes on forestry and environmental issues. Above all, since the forestry sector contributes to Kenya's socioeconomic development, the government should be ready to finance the sector to ensure that it reaches its desired capacity. Through these efforts, the government would be a step forward in trying to mitigate and adapt to effects of climate change.

3.3 Conclusion

[76]Kenya Forest Service. 2012. *About Kenya Forest Service*. Accessed 14 June 2012 at: http://www.kenyaforestservice.org/aboutus/.

Climate change mitigation and adaptation has been the major undoing for Kenya in the fight against climate change. Poor policy implementation, corruption, inadequate funds, deforestation are the key challenges that the Kenya is facing. The continued impacts of climate change have seen the country lost billions of shillings which have greatly affected the socioeconomic development of the country limiting the country growth by a big percentage. Adaptation and mitigation of climate change remains the top priority to reduce vulnerability and enhance resilience to people, communities and experts, if Kenya is to ever achieve the flagship programme of Vision 2030.

Therefore, it is empirical for the government to be in the forefront in the quest for mitigating and adapting to climate change impacts through putting up measures to enhance disaster preparedness by utilising early warning system from experts to be able to be prepared for future climate changes. Moreover the government should avail funds to enhance implementation of climate conservation projects and policy, which will act as a framework in dealing with matters associated with climate change. Because of the country vulnerability to climate change effects due to its inability and low adaptive capabilities, the government should create a conducive environment for climate-related financiers and donors to come and invest in the country in order to enhance the fight against climate change.

CHAPTER FOUR

CLIMATE CHANGE AND SOCIO-ECONOMIC DEVELOPMENT OF VIHIGA COUNTY.

4.0 Introduction

The previous chapter discussed the country's regional and international policies and legislations that are aimed at adaptation and mitigation to climate change calamities and events. Despite Kenya being part to many climate change policies, it is still affected by impacts of climate change which has a negative effect on the socio-economic development of the country. This is mainly attributed to poor implementation of these policies both nationally and at the county levels hence Kenya still being affected by climate change catastrophe year in year out. This Chapter seeks to examine hoe climate change has affected socio-economic development in the county level, and seeks to analyse the efforts put forward by county government in order to ensure that they adapt and mitigate current and future climate change events.

4.1 An Overview of Vihiga County

Climate change impacts have tremendously affected the socio-economic developments of Vihiga County, which depends mainly on agricultural practises with crops such as tea, maize, millet, bananas, avocado, papaya, sweet potatoes and cassava are planted. Livestock rearing is also practised in the county. Vihiga County has got five sub counties namely; Vihiga, Emuhaya, Luanda, Sabatia and Hamisi, making it the most densely populated rural habitat in Kenya with a population density of 618,742 with an average population density of 1,165 persons per sq. km, having a high poverty level of 62% with a dependency ratio of 100:90.[77] Above all Vihiga County has a hilly terrain with a good amount of forest cover, making the area conducive for farming given the modified equatorial type of climate with high reliable

[77]Kenya National Bureau of Statistics Report (Vihiga,2013)

bimodal rainy season of 1800mm-2000mm, showing two distinct seasons of long and short rains that has enhanced the double planting season in the region.

The temperature in the region ranges between 14-32 degree Celsius having a mean temperature of 23 degree Celsius, with an altitude ranges between 1300m and 1500m above sea level and slopes gently from east to west.[78] Poverty has led local residents to exhaust all agricultural land especially through poor agricultural practices. This has led to encroaching on forest reserves, cultural sites and ecologically fragile areas like swamps, sloppy and hilly areas and dams to earn a living through agriculture. Therefore, this chapter will be looking at the climatic impacts on the socio-economic drivers of development and the factors undermining socio-economic development of Vihiga County.

Agriculture is the major source of income in Vihiga, however other activities tailored at reducing the poverty levels include; the jua kali sector, brick making, mineral mining, cultural practises and the bodaboda operations. All these socioeconomic activities have negative effects on the eco-system, hence posing threats to the environment. For instance, the jua kali sectors have effects on the environment through excessive emissions and noise pollution. Above all the coffin making business which thrives in the region has led to rampant cutting of trees exposing the country to extreme global warming and climate related impacts.

Brick making and mineral exploitation is leading to many open pits being dug in the area, which have led to increased cases of accidents, insecurity and destroying the land terrain and enhancing soil erosion. The county has also an exemplified cultural practises and heritage sites which have enhanced tourism in the area. Among these include the prowess of rain making among the Abasiekwe of the Nganyi Clan from the Ebusiekwe sub tribe of the Banyore, the Tiriki and Maragoli circumcision rites and various traditional foods and dance. The various tourism sites include the Ebusyekwe hills of the rainmakers, Mungoma caves

[78]GOK: *Vihiga District State of Environment Report* 2004

believed to be the origin of the Maragoli Luhya sub tribe, Maragoli hills, the Table Mountain in Kima Bunyore and the Kibira forest in Tiriki an extension of the Kakamega forests.[79]

The high population density, and a potential increase in population by the year 2017, has put pressure on the land leading to uneconomical sub-division of land, threats of food security and frequent land disputes. Unemployment has also led to high dependency ratio, with a majority of the unemployed being the youth, hence making them to indulge in drug and substance abuse and theft, hence contributing negatively on the socio-economic development of the county, as seen in Table 4.1 below.[80]

Table 4.1: Sub County Population Projections(Source: KNBS, Vihiga, 2013)

Constituency	**Area km^2**	**Pop 2009**	**Density**	**Pop 2012**	**Density**	**Pop 2015**	**Density**	**Anticipated Pop 2017**	**Density**
Hamisi	156.4	148,259	948	156,594	1001	165,399	1058	174,698	1117
Emuhaya	94.5	89,147	944	94,150	996	99,453	1052	105,044	1112
Vihiga	90.2	91,616	1016	96,767	1073	102,208	1133	107,954	1197
Sabatia	110.9	129,678	1169	136,968	1235	144,670	1305	152,804	1377
Luanda	85	95,923	1132	101,316	1192	107,012	1259	113,029	1329
County	531	554,622	1044	585,795	1103	618,742	1165	653,529	1231

As shown in Table 4.1 above, in 2012 projections Sabatia had the highest population density of 1,235 persons per Km2 followed by Luanda with 1,192 persons per Km2, Vihiga 1,073 persons per Km2, Hamisi at 1001 persons per Km2 and Emuhaya 996 persons per Km2. In 2015, the population densities will increase to 1,235 persons per Km2 for Sabatia, Emuhaya

[79]GOK: *Vihiga District State of Environment Report* 2004
[80]Kenya National Bureau of Statistics Report (Vihiga,2013)

1,052 persons per Km2, Vihiga at 1,133 persons per Km2, Luanda 1,259 persons per Km2 and Hamisi 1058 persons per Km2. In 2017 they are expected to increase further to 1,377 persons per Km2 in Sabatia, Emuhaya 1,112 persons per Km2, Vihiga 1,197 persons per Km2, Luanda 1,329 persons per Km2 and Hamisi, 1,117 persons per Km2.

4.2 The Socio-Economic Developments Drivers in Vihiga County

Vihiga is a pro-active county that despite the high poverty level has endeavoured to empower its population socially and economically. Due to the abundance of rains, favourable climate and plenty of socio-economic activities which has ensured that the majority of the people are socio-economically viable, ensuring that the county add up to the socio-economic development of the country at large. Apart from agricultural activity that is mainly practised in the area, Vihiga County has also ensured that sectors such as tourism, industrial activities, mining and quarrying to supplement on the socio-economic development of the county.[81]

4.2.1 Agricultural Sector

The County receives adequate amount of rainfall, which is evenly distributed in most good harvest seasons. The bimodal rainy seasons with favourable and good arable land have ensured that the county is able to feed itself with utmost ease, with agriculture contributing about 64% of the total county's income. Despite agriculture being the main socio-economic activity practised by 90% of the locals, it is still not that viable, because most farms in the County are not mechanised and are used for subsistence farming. An average agricultural farm size is about 0.5 hectares which is too small for any substantial farming and human labour is mostly utilised in crop production.

[81]Vihiga county integrated development plan 2013-2017.

Moreover, with the usage of organic farming being pegged at 30%, with low fertilisers and certified seeds being utilised, low yields have always been harvested hence non-achievement of agricultural potential in the region. Tea is the main cash crop planted in the area, which is estimated to earn an average farmer close to KES.12, 000 a month which is not enough to guarantee the county's future well-being. With an estimated 16,000 farmers pegged on tea farming with only Mudete tea factory as the only tea factory in the county, farmers have ended up being paid peanuts forcing others to opt for subsistence farming, planting crops such as maize, beans and bananas, with maize and beans production annually in the county being estimated at 90,000 and 20,000 bags respectively with a majority of the farmers planting these crops as food crops. This is attributed to the small sizes of their lands, hence, majority of farmers in Vihiga County experience low yields productions.[82]

Fig 4.1: A tea farm in Kaimosi-Vihiga County. (Source: KNBS, Vihiga, 2013)

To address the issue of food insecurity, the agriculture department in the county has introduced a variety of crop species such as new imported cassava and sweet potato varieties, high yielding banana suckers, introduction of tested short season and long seasoned maize

[82]Vihiga county integrated development plan 2013-2017.

seeds and advocating for alternative high values cash crops for local consumption and "export" to other counties E.g. traditional vegetables, Asian vegetables, improved bean varieties and so on. Sub-County initiatives have been adopted to boost the agricultural sector in the County. Luanda and Emuhaya Sub-County under their strategic plans have seen the need of starting agricultural depot and establishing banana value addition factory in the area to enhance buying, processing and storage of produce, to enhance substantial rather than subsistence farming to boost food security.[83]

The main livestock bred in the region include dairy cow, goats, sheep, poultry, rabbits, pigs and quills. Most farmers in the region practise mixed agriculture. The region has more indigenous cattle as compared to grade cows because of the small land sizes that cannot accommodate zero grazing practices for grade cows, and also farmers keep some for cultural and traditional functions. The dairy industry in the county produces an average of 8 litres of milk per day for grade cows while the indigenous cows produce 4 litres per day, fetching 18.4-18.2 million litres of milk from these cows respectively, which is estimated to fetch the locals KES.570 million annually with most of this milk being sold through hawking and contractual verbal agreements. Emuhaya dairy cottage continues to produce and buy milk from other farmers and process it into products like yoghurt, mala, milk shake, fresh milk as well as providing artificial insemination services to the farmers at a fee. In the poultry industry, exotic layers produce a total of 5.6 million eggs, with indigenous birds producing 15.6 million eggs totalling to 21.2 million eggs, fetching KES.106 million with most farmers preferring indigenous poultry due low initial capital and high returns.

Above all, the county engages in fish farming, having more than 1,634 farmers engaged in fishing activities mainly in established fish ponds. Most of the fish ponds were started under the economic stimulus programmes in 2011. These fish ponds cover a total area of 44.5 ha

[83]Emuhaya-Luanda Constituency Strategic Plan 2014-1019

with tilapia and cat fish being the main fish species to be bred. The county government intends to establish at least one hatchery in every constituency as a source of fingerlings, and freezers to preserve the fish in order to enhance fish farming in the region. Thus, agriculture, livestock rearing and fish farming are the key socio-economic development in the region as a majority of the locals depends on agriculture for their livelihood.[84]

4.2.2 Tourism Sector

Vihiga County is endowed with many tourism sites that have enhanced its socio-economic development. It's hilly and stones settings have provided it with very good scenery which has enhanced both local and foreign tourism with experts coming to study the rocks, with abundant of tree species which are home to different kinds of birds and other cultural practises common with the Luhya people of Vihiga.The county having a tropical rain forest covering a total area of 4, 160.9 hectares consisting of indigenous and exotic tree species which are cultural sites for certain community are indeed key tourism site in the region.[85]

Vihiga being the smallest county in the country has embarked on events to market itself globally for potential investment opportunity and also get people to know the county as a safer tourism destination. Some of the key tourism attraction areas in the county include; the Maragoli hills, the Nganyi hills of ebusyekwe mainly for the rainmakers, Mungoma caves which is the origin of the Maragoli community, Kibiri forest where the Tirikis conduct their circumcision ceremony and the table mountain in Kima. The county partnership with the Ministry of environment and natural resources under the meteorological department through the stewardship of the area Member of Parliament of Emuhaya Hon Wilbur Ottichillo has

[84]GOK: Vihiga District Development Plan 2002 –2008
[85]Vihiga County integrated development plan 2013-2017.

been able to start an ICT resource centre and a radio station (Nganyi-Ranet Radio Anyole) at the foot of the Esibila hills, which is a step forward for future tourism ventures in the region.[86]

The County is endowed with Guenno Congolian rain Forest which has a variety of wildlife that inhabits the forest area. Kibiri forest has mainly the coloobus monkeys although other species of apes are also found. The forest has more than 400 bird species, reptiles and many insect species. Kibiri forest being an equatorial forest is home to rich variety of trees and shrubs that are found nowhere else in Kenya, making it a suitable site for tourism activities.[87]

Fig 4.2: A section of the dense equatorial forest of Kibiri.(Source: KNBS, Vihiga, 2013)

But despite of Vihiga County having major key attraction sites, it still cannot account for most revenue collected from those sites. This has been attributed to lack of set standards and gazettement of these sites as Vihiga County tourism attraction points. Therefore most of these sites have been left under community ownership hence little revenue collected goes to the hands of individuals, hence it cannot be accounted for at the county level. More so keep in

[86]Emuhaya-Luanda Constituency Strategic Plan 2014-2019
[87]Kenya National Bureau of Statistics Report (Vihiga,2013)

mind tourism sector is a new department in the county, so a lot has to be done to enhance income revenue generation for the county government.[88]

4.2.3 Industrial Sector

Vihiga as a County is not endowed with many industries as many people in the region engage mainly in subsistent agriculture. The few industries in the County are agricultural based, with some few informal jua kali industries specialised in making household furniture, metal and motor vehicle garages. The main industries in Vihiga Country include the Mudete tea factory in Sabatia Sub-County, a jaggery in Luanda Sub-county and a dairy cottage in Emuhaya Sub-County. The County is initiating efforts to revive a coffee factory in Hamisi Sub-County to promote coffee farming and cooperatives in the region. Brick making is another industry that is springing up with a majority of the locals engaging in it.[89]

Most of the industries in the county fetch little revenue as most of them are yet to employ modern means of technology to spur there level of production, thus majority of their produce is consumed locally and has massive impacts on the environment. Total tea production in Mudete tea factory is estimated at 10.6 million Kgs annually, with milk production being at 2.7 million litres which doesn't meet the county's demands hence need to expand milk production. With the decline of coffee farming in the region, the county plans to revive a coffee factory in Hamisi sub-county to improve on the processing and marketing of the coffee. For example, Mudete tea factory heavily depend on wood fuel as a source of energy. These impacts negatively on the environment through air pollution and deforestation. Therefore there is need for all these industries, be it tea, jaggeries, jua kali establishments, garage and

[88]Vihiga County integrated development plan 2013-2017. pg. 39
[89]Vihiga County integrated development plan 2013-2017. pg. 40

brick making individuals to carry a yearly environmental impact assessment to limit on the environmental pollutions.[90]

Above all, industrial development in the area has been greatly hampered by inadequate availability of land to further development, as majority of the land in the County is owned communally or by individuals who have inherited them from their ancestors. So issue of cultural beliefs has hindered industrial growth and development in the region having a negative impact on the socio-economic development of the county. More so, due to heavy capital required to set up businesses and factories in the region, many of the local populations have shy away hence lack of potential investor to stir the industrial sector of the region to another level. Therefore for the County to fully achieve the envisioned Vision 2030, it must empower its locals through the devolved funds by wooing on potential investors to come and invest in the region in order to create employment opportunities. And above all, the locals should be sensitised on the need to utilize the loans and funds being given by the banking institutions in the area, youth funds, community development funds (CDF) and so on in order to be able to boost the economy of the region and stop depending on subsistence farming for their survival so that they enhance socio-economic development of the county.[91]

4.2.4 Mining and Quarrying Sector

Vihiga County has a potential for mineral exploitation, with gold deposit once discovered in 1930s has left small scale gold exploitation along the river valleys of Edzava, West Maragoli, Chavakali, Luanda and Shaviringa locations. Most of the gold bearing rocks in Vihiga County is mined using local technologies leading to low outputs. Rugged granitic hills dominate the southern part of the county, with Kavirondian and Nyanzian rock system which are highly exploited as building stones, ballast and ornament stone have dominated the geological

[90]GOK: Vihiga District Development Plan 2002 –2008
[91]Emuhaya-Luanda Constituency Strategic Plan 2014-2019

formation. Currently, the abundantly available granitic rocks are exported outside the county for processing and then re-imported back as building materials such as ballast, terrazzo chips and ornamental stone due to lack of technology and equipment to mine and process the available minerals economically. Therefore the county government intends to seek partners to establish quarrying factories within the country to process the rocks.[92]

Murram mining is high all over the region due to the brick making industry, pottery and house making activities which are common with the locals due to the availability of the weathering of Kavirondian sediments leading to formation of micaceous clays suitable for pottery and brick making, which is usually used for commercial purposes, going at KES 5/- per brick. These quarries which haven't been rehabilitated poses a risk to human life as they may cause unnecessary accidents or being a breeding site for mosquitos, hence increasing malaria risk in the county. Sand harvesting is also done on small scale in the region, with the Yala River, Garagoli River and South Maragoli being the main sources of sand harvesting in the larger Vihiga County[93]

Despite mining and quarrying being part and parcel of the locals, it is still being done in small scales being untaxed hence generating few to no revenues to the county government, hence, no positive change on the socio-economic development of the region. Therefore it's for the local government to sensitise the locals on the need to do large scale production of mining and quarrying activities in order to market the region as potential for these activities, which in turn can attract investors who will in turn create employment opportunities for many benefiting the locals and the county government at large.

[92]Vihiga county integrated development plan 2013-2017. pg. 38
[93]GOK: Vihiga District State of Environment Report 2004

4.3 Factors Undermining Socio-Economic Developments of Vihiga County

Vihiga County being the most populous rural setting county in Kenya faces numerous challenges in its attempt to secure its socio-economic development. This may be attributed to the high number of people per Sq. Km living in poverty within the five sub counties, with a dependency ratio of 100:90.[94] Moreover, Vihiga County being in rural setting issues of illiteracy level, shortage of land, population pressure, poor infrastructure, corruption, poverty and insecurity dominates the daily lives of the locals in the region.

4.3.1 Illiteracy Levels

The county has 396 primary schools with an annual enrolment of 180,112 pupils, 117 secondary schools with an annual enrolment of 36,413 students, 2 universities Kaimosi University College and Ebunangwe Campus a constituent of Masinde Muliro University of Science and Technology, several training college's i.e. Eregi teachers college, Kaimosi teachers college, and Emukunzi training institute, several youth polytechnics such as Mago polytechnic, Lotego Youth Polytechnic, Mbale Youth Polytechnic, Hamisi Youth Polytechnic and Keveye Youth Polytechnic, several theological colleges at Kaimosi for the Friends Church, Nyang'ori for the Pentecostal Assemblies of God and Kima institute of Theology for the Church of God Ministries and finally there are about 72 adult literacy centres of which 20 are active and having five full time teachers enrolled by the government.[95]

But despite the availability of learning institution, school dropout is high in the region, with a majority of it happening after primary school educations due to lack of school fees from parents and guardian to further their education. Primary school dropout stands at 3% boys and 1% girls with a majority of boys tend to enrol in technical institutions where they learn

[94]Kenya National Bureau of Statistics Report (Vihiga,2013)
[95]Emuhaya Strategic Plan 2008-2018

technical skills such as masonry, plumbing, and tailoring, whereas others start indulging in drugs and substance abuse hence putting the region generation into doubt. The teacher pupil ratio is 1:42 in the county with a total of 4,237 teachers who are unevenly distributed with some school grossly understaffed in the primary level. In the secondary level, boys exhibit a higher dropout rate than girls, having a teacher student ratio at 1:28 indicating need for more teaching staffs in order to enhance the level of education in the county.[96] According to Education and Policy Data Centre on Vihiga County education profile, it highlighted a massive enrolment of children in primary schools over the region, but there is a massive decline of the student's number enrolling to secondary schools and the number drops further on those who sit their final secondary exams.[97] This highlights a negative trend towards socio-economic development in the region, with less than capacity enrolment in tertiary institutions due to high drop outs. Therefore the buck stops with the county government to empower its population to ensure they attain proper education for them to be dependent in the future to reduce the dependency ratio and poverty in the region. This can be done through empowering the population by allocating more funds on education through the various constituency development funds (CDF), avail bursaries for all, and develop information technological centres to equip the public with relevant ICT knowledge in order to reduce the illiteracy levels and finally enrol more teachers in schools to reduce the teacher pupil ration

4.3.2 Shortage of Land

Most land ownership in the county is communal and inherited from one generation to another, making land a scarce commodity in the region. This is because most lands are ancestral land that is passed from one generation to another, with only 28.3% of the land owners having title deeds so they have a sentimental value to majority of the locals. The average farm size in the

[96]Vihiga County integrated development plan 2013-2017.
[97]Education And Data Policy Centre 2007

county is 0.4 hectares for small scale farming and 3 hectares for large scale. The fertile land in the region has influenced the dense settlement even in the rocky areas of the Maragoli hills and the flat swampy parts of Luanda leading to shortage of land hence witnessing rural-urban migration. Due to shortage of land, farming activities have been disrupted, encroachment into gazetted forest reserves and tourist designated areas have been witnessed leading to human wildlife conflict which has had effects on the fauna and flora in the eco-system leading to changes of weather patterns hence having effects on the agricultural sector practised by a majority of the population.

The land use pattern in the region is 98.7% is under farming mainly subsistence, such as livestock keeping, crop farming, tree planting and fish farming while 1.3% is under housing. Other land activities in the region are soil mining for brick industry, house making and pot making, sand and stone harvesting are also practised. Despite most people in the county own land, 3% of the total population are landless, which has led to invasion and encroachment of Gazetted forest reserves such as Maragoli and Kibiri for settlement, having a negative impact on both the socio-economic development and also the environment, putting the county in climatic consequences. [98]

Figure 4.3 below shows a section of the Maragoli forest that has been encroached by human habitat for settlement, timber and firewood, leaving the hill with bare rocks due to high population growth rate leading to negative impact on the environment, climate and food security.

[98]Vihiga county integrated development plan 2013-2017

Fig 4.3: A deforested section of the Maragoli Hills for timber and firewood. (Source: KNBS, Vihiga, 2013)

Therefore, the county government should advocate for family planning measures to address the issue of the ballooning population growth in order to curb the effects of land shortages. More so, the county government should empower the locals through provision of education for all to prevent land inheritance dependency, to enhance more rural-urban migration of the locals, whereby they can buy lands in neighbouring counties such as Kakamega, Kisumu, Nandi, Trans-Nzoia and Siaya to reduce pressure on the limited land available in the region.

4.3.3Population Pressure

Vihiga County is the most populous rural setting in Kenya with a total population of 618,742 people with a projected rise in population to 653,529 by the year 2017. The rate of population growth in the county exceeds wealth accumulation rate, therefore this high population exerts pressure on the land leading to uneconomical sub-divisions of the land.[99] The percentage population of Vihiga County is 47% males and 53% females contributing to 1.44% of the

[99]Vihiga county integrated development plan 2013-2017. pg. 46

national population, with a population growth rate of 5.3%. More people means more pressure on the environment as demands for food, land, clean water and energy solution increases hence conflict and competition for the scarce resources emerges impacting negatively on the socio-economic development. Therefore due to competition for the scarce resources, rural-urban migration will be experienced, human-wildlife conflicts will emerge and this will affect the fauna and flora found in the forest hence having a catastrophic impact on the environment which may brought about effects of climate change.[100]

4.3.4Poor Infrastructure

The county has a poor state of roads and other forms of communication infrastructure. With a total road network being at 1,058.2 Km, with paved roads making up to 16.6%, bitumen surface covering 201.5 Km, gravel surface being at 372.7Km and earth surface being at 483Km. The county has a rail length of 20 Km and has one railway station at Luanda which at the moment is not functioning. Heavy rainfall received in the county has destroyed the road networks leading to high maintenance cost hence hampering the movement of farm produce to the market. Information Communication Technology (ICT) centres are minimal in the county due to lack of proper telecommunication network coverage associated with the land terrain of the county. The county lacks an airstrip and relies on the neighbouring counties for flight services, however the county government plans to revive an airstrip at Kaimosi in Hamisi sub-county to enhance quick transportation of agricultural produce.

The county has only five financial institution namely Kenya commercial bank, equity bank, commercial bank, post bank and Barclays bank with other micro-finance institutions such as Kenya women financial trust, FOSA, Bunyore financial services association, platinum credit and Khaviem village bank. Despite the large number of banking institutions, most are located

[100]Kenya National Bureau of Statistics Report (Vihiga,2013)

in urban and large market centres, having high interest rates discouraging locals from access credit services.[101]

Therefore in order to acquire sufficient socio-economic development in the county, the county government ought to invest in proper infrastructural development in order to empower the locals through improved transport system, both road, rail and air transport for transportation of agricultural produce, improved ICT technology and improved interest rates in the local banking sector to enhance borrowing from financial institution to boost their business.

4.4Climate Change and Rainfall Performance in Vihiga County

Rainfall is abundant in Vihiga County like other synoptic rainfall station over the western part of Kenya, but in recent years the rainfall patterns has been on a declining trend attributed to the changes in the climatic conditions within the region. According to Table 4.2 below, the Western part of Kenya has been recording long rains in the periods ranging from March-April-May, which has been a general trend all over the country with majority of the areas such as Western Kenya, North West, North East and parts of Highlands East of the Rift Valley as well as North Coast and parts of Southeast lowlands recording more than 125% of their seasonal Long-Term Means (LTMs) for March to May. This has resulted to flash floods as well as landslides in most parts of the country. However only a few stations in western Kenya and south-eastern lowlands have recorded enhanced rainfall above 125% in the period October-December as compared to other parts.

[101]Vihiga County integrated development plan 2013-2017.

Table 4.2 Western Kenya Rainfall Patterns. (Source: KMS Database.)

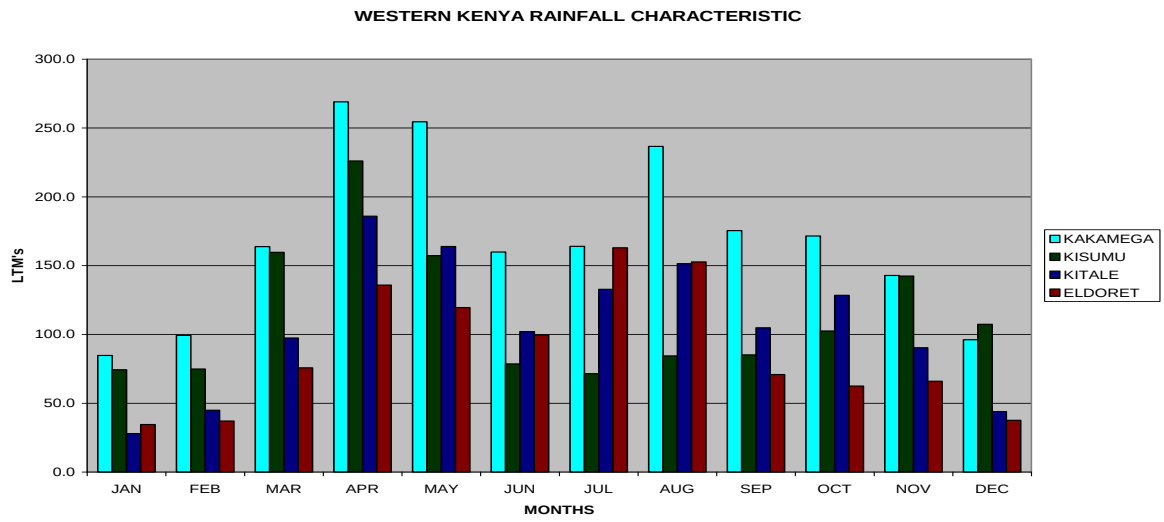


Table 4.3 Vihiga County Rainfall Patterns for the last 13 years.(Source: KMS, Vihiga)

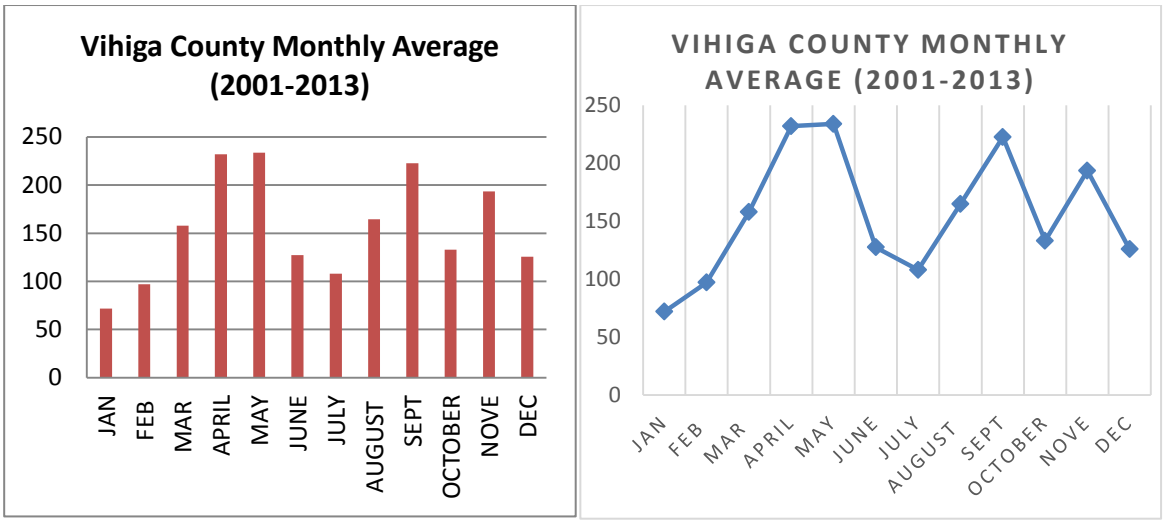


Table 4.3 above shows the monthly average rainfall pattern of Vihiga County for the last thirteen years and it highlights a constant flow of rainfall characteristic for the county, with March-May recording high rain patterns as compared from August to December which is considered a short rain season. But these trends have been changing in the last two years with long rains delaying up to mid-April and ending as early as June, hence forcing the locals to plant short season's plant species as compared to those other years. Short rains which were normally expected to start as from late July to early August, has been pushed forward up to

early September and ends in November, hence implying a longer dry period from December-March hence implying a negative trend in the socio-economic development of Vihiga County which mainly depends on rain-fed agriculture.

Table 4.4 Mean Average Rainfall for Vihiga County (2001-2013) (Source: KMS, Vihiga)

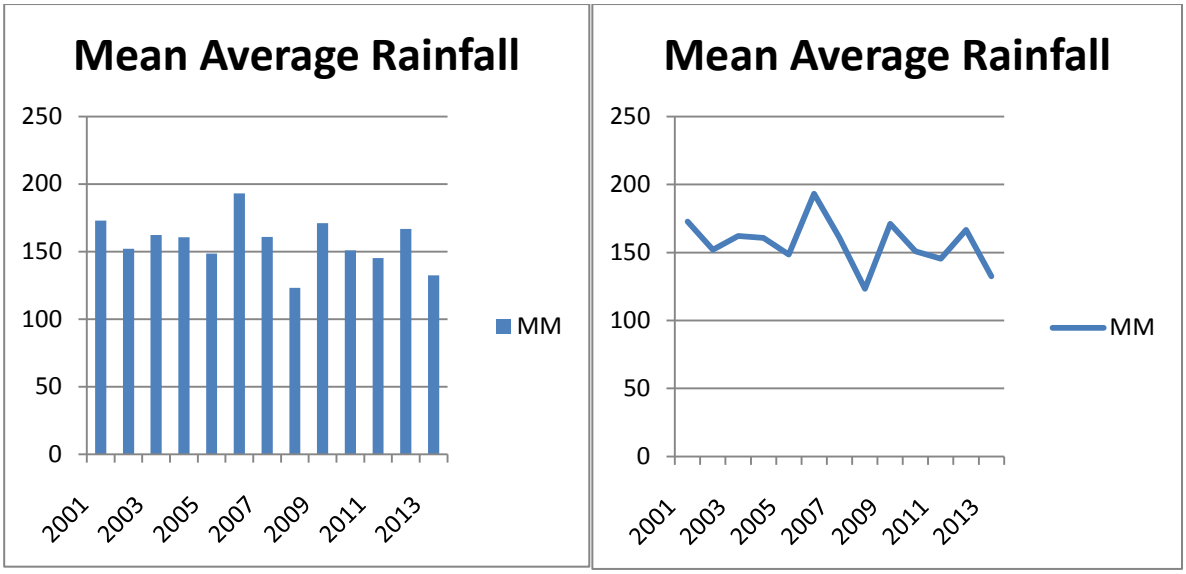


Table 4.4 above highlights the shifts in mean average rainfall patterns in Vihiga County for the last thirteen years, and the trends has shown a decline to below 150mm in the recent years which are a negative trend towards the socio-economic development of the County.

4.5 Conclusion

Vihiga as county has had its share of climate change effects associated with the human settlement in forest reserves and frequent deforestation for wood for firewood and timber, which has had a negative impact on the socio-economic development of the county hence hindering maximum achievement of its production capacity. Climate change related impacts such as excessive rains have destroyed infrastructural networks within the county with gravelled roads being drained away and power lines being tampered with hence incurring

local authorities more costs in repairs and maintenances slowing down on major development in the region.

In order to effectively address the issue of climate change related impacts on the socio-economic development of the county, the county government should enhance use of family planning methods to have a control on the population growth rate, hence limiting settlement into forest reserves by the ballooning population hence securing the gazetted forests from continuous human exploitation. Empower the locals with soft business loans to enable them acquire necessary farm inputs and buy certified seeds which may be more productive with the small lands available in the region. Enhance regular training of farmers concerning farming methods and practices to minimize the excessive soil erosion and poor land use methods witnessed within the region to enhance food security within the region.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter contains the summary, key findings, recommendations and scholarly suggestions of other areas for further research of the study under research.

5.1 Summary of Key Findings

The overriding purpose of this study was to determine impacts of climate change on Kenya's socio-economic development. To accomplish the goal of this research, it was essential to identify the causes of climate change in Kenya and how it adversely affect major socio-economic development within different regions in the country with a major focus being on Vihiga County. Therefore in order to reach an understanding of the topic, it was critical to understand the relationship that climate change has on the socio-economic development of the country, and how any negative impact on the climate change would impact to the country's economy. Once these fundamental steps were achieved, the research was able to go forward. Hence, this chapter will report the findings, conclusion and try to come up with relevant recommendation tailored to meet the needs of other researcher's in the field, various stakeholders in the climate change related spheres and the government at large.

The data used for this research was mainly derived from secondary and primary sources, which involved the use of in-depth information gathering and document analysis, surveys and questionnaires. The finding of this study suggest that at the national level, the efforts aimed at mitigating the impacts of climate change on the socio-economic development are on wayward low, hence impacting on the various county government as they depend on the

nationalgovernment for assistance. Therefore this study highlighted that Kenya as a country is highly vulnerable to impacts of climate related calamities because of its low adaptive and high dependency ratio hence little to no focus is subjected at ensuring climate change related activities are mitigated. Thus the combined efforts of poor land use patterns, increased climatic uncertainty will have much more implication on the people and the ecosystems throughout the country in the future years to come.

5.2 Key Findings

According to this study finding, there has been some form of influence from the international community aimed at enhancing climate change adaptive and mitigation policy in Kenya with an aim at reducing the future expected climate change related catastrophe in the country, Africa as a continent and the entire world. Climate financing an effort aimed at financing climate resilient development by the World Bank has been fostered to enhance nations to be climate resilient by financing their efforts in mitigating and adapting to climate related changes. The world bank has enhances a strategy for climate resilient development in sub Saharan Africa aimed at adaptation and disaster risk reduction aimed at creating climate variability through adaptive measures of floods and droughts, mitigation and adaptation synergies aimed at fostering better land, water and forest management, enhance use of green energy, advocate for knowledge, capacity building and new technology aimed at improving climate knowledge and scaling up financial support. However, the study found that Kenya is highly vulnerable to climate change related impacts because of lack of vibrant institutions championing climate change adaptation and mitigation, poor urban-rural planning, poor land use methods, lack of climate knowledge sensitisation mechanism, rapid population increase and poor government policies regarding climate change.

The study finding has estimated the potential for low carbon growth in Kenya, with the largest emitting sector being agriculture, mainly from livestock emissions, followed by energy consumption primarily from consumption of oil products in transport and industry. However, emissions are expected to increase by 60% by the year 2030, this is mainly attributed to the strong growth plan as projected in the vision 2030 blueprint, as well as other changes from population and urbanisation.

The study finding has shown that the country is faced with poor policy implementation hence hindering climate change related policies from being implemented in the grass root level. Despite Kenya's commitment under the United Nations Framework Convention on Climate Change (UNFCCC) process by ratifying the Kyoto Protocol in 2005, and contributing to continental and regional climate change initiatives, the country lacks the technical manpower to advance the objectives in the United Nations Convention in the grass root level hence exposing the country to mirage effects of climate change catalysed by the frequent environmental degradations.

5.3 Recommendations

Kenya faces a potential high risk climate change impacts which if not mitigated on time will have a huge environmental catastrophic for the future if not the current generation. Excessive environmental degradation witnessed in recent time in the country is key evidence for mirage effects of climate change if not mitigated and adapted on time. Therefore this study has outlined a number of recommendations and future priorities aimed at advancing climatic mitigation and adaptive measures for the government, researchers and future scholars.

First, there is the need for the government to get ready and act now if anything to do with current or future climate change mitigation and adaptation is to be achieved. Most importantly, the government has to establish and empower institutional and policy

development facilities aimed at forecasting, advancing and fostering climate change related agenda within the country and the East Africa region at large. This can be achieved through empowering existing climate change related institutions such as Kenya Meteorological services, NEMA, Kenya Agricultural Research Institute (KARI) and revisit further on analysing vision 2030 to advance for low carbon growth paths in the face of industrial growth and revolution in the country and the predicted increase in population.

Secondly, there is need for regional collaboration towards climate change mitigation and adaptation. This can be achieved through having a common agenda towards climate change within the East African community, Common Market for Eastern and Southern African Nations aimed at mitigating and adapting to current and future impacts of climate change. Kenya being the centre for United Nations Environmental programmes (UNEP) should be at the forefront in spearheading regional collaboration towards climate change adaptation hence having a common goal towards climate change mitigation hence cost sharing towards on climate financing thus reducing on carbon emissions and securing our future generations.

Thirdly, there is need for periodically sourcing for climate financing from relevant climatic sensitive institutions such as world meteorological organisation, United Nations and so on to finance on projects tailored at mitigating climate related impacts in the country. This can only be achieved if there will be equal representation on the usage of the funds in relations to climatic risks and accountability should be paramount to enhance transparency in the usage of the funds hence enhancing more funding from relevant willing bodies.

Lastly, there is need for the government, climate sensitive institutions and learning institutions to enhance research activities tailored at advancing climate change related ideas which will be instrumental in advocating for future methods of adapting to climatic changes at the same time coming up with new mitigation methods. Currently, Kenya has a weak mechanism for collecting information on climate change, with an unconsolidated and scattered agencies and

departments tailored at enhancing the fight against climate change. This fragmented framework makes it difficult for key stakeholders to track progress, share results and access information. Therefore, the government, higher learning institutions and climate sensitive institutions should enhance a holistic and adequate resourced monitoring system aimed at enhancing a free flow of information through research based initiatives.

5.4 Conclusions

Climate change is a major hindrance towards socio-economic development both nationally and in the county levels which require a high level political goodwill and support to effectively address the risks associated with climate change impacts and more so maximize on the opportunity present that climate change comes forth with. For Kenya, adaptation to climate change remains the top priority to reduce vulnerability and enhance resilience of the socio-economic developments especially for the vulnerable communities and groups within the country.

The country should enhance mitigation actions that will deliver sustainable socio-economic development tailored at enhancing a national socio-economic development as set out in the Vision 2030 and still instil the virtue of low GHG emission in an aim of enhancing climate smart strategies by promoting use of clean energy technology for improved and sustainable livelihoods.

Climate change stakeholders too should be encouraged to mainstream climate proofing and climate change responsive activities in their daily routine activities to enhance climate change awareness and preparedness in the face of future climate related catastrophe. Therefore for climate change to be addressed effectively, a collected effort from the government, climate change stakeholders, public and private sectors stakeholders and the general public should be harmonised to enhance climate change mitigation and adaptation.

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APPENDIX

Questionnaire

Dear Respondent,

My name is Cyrus Kuya, a student at the University of Nairobi undertaking a Master's Degree in International Studies As part of my master's thesis titled"**Climate Change and Kenya's Socio-Economic Development: A Case Study of Vihiga County",** I am hereby seeking your views and experience on climate change impacts on the socio-economic development of your county.

This questionnaire will focus on the impacts of climate change on the Socio-economic development of Kenya with a key focus on Vihiga County.

Once the questionnaire is complete, kindly send it to ***ckuyah901@gmail.com*.** In case of any clarification do not hesitate to use the same address.

These questionnaires will be treated with confidentiality and the data gathered will only be used for academic and scholarly purposes.

PART I: BIO DATA.

Please tick the most suitable response.

1. Sex: [ ] Male [ ] Female
2. Age: [ ] 18-24 [ ] 25-34 [ ] 35- 44 [ ] 44-54 [ ] 55-64
   [ ] 65 and above
3. Highest level of education attained:
   [ ] Certificate [ ] Diploma [ ] Degree [ ] Masters
   [ ] Doctorate [ ] Other (specify)

4. **Profession**:
   i) [ ] Environmental expert
   ii) [ ] Economic expert
   iii) [ ] Devolution expert
   iv) [ ] Other (Specify)

PART II: RESEARCH QUESTIONS.

1. In your opinion, is Kenya Socio-economic development heavily influenced by the changes in climatic conditions? [ ] Yes [ ] No Please qualify your answer

   _____

2. Do these impacts have a negative trend in Kenya Socio-economic development both nationally and in the county levels in the 21st C?

   _____

3. Do human activities have anything to do with the changes in climatic conditions in Kenya and Vihiga County?
   [ ] Yes [ ] No

   Explain_____

4. Does the Central/County government do anything towards Mitigating and adapting to current and future climatic changes? [ ] Yes [ ] No

   _____

5. In your opinion, how has climate change affected the socio-economic development of Vihiga County?

   _____

6. Is Kenya/Vihiga County well adapted to respond quickly to climate change calamities? [ ] Yes [ ] No
   Explain_____

7. Does increase in population and encroachment into forest reserves by the human population in Vihiga County has any impact on the climate? [ ] Yes [ ] No

   explain_____

8. In your opinion, where do you see Kenya /Vihiga County in the next Decade in the Climate Change spectrum?

   _____