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Responding to Impacts of Climate Change: A case study of
Kenya.

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Sincerely, Dan Oluoch Owino.

DECLARATION

I, Dan Oluoch Owino, declare that this thesis is as a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This research has not been previously submitted to any other educational institution for award of any type of academic degree.

Signature..........

Date.....15/11/2022.....

ABSTRACT

Climate change is a global emergency and a pressing issue globally and therefore need for effective response. This paper aims to understand the response strategies to climate change. I use Kenya as a case study to answer the questions: How has the Kenyan government responded to impacts of climate change? Where is the priority given between adaptation and mitigation; and what are the capacity concerns in coping with climate change? I apply the theoretical perspectives of climate change mitigation options, adaptation strategies and institutional capacity approach as a guide. The research questions are investigated through interviews and document analysis. The interview forms part of the primary information while document analysis is considered secondary information. Together I did five interviews where various representatives from different public agencies were interviewed on response strategies to climate change in Kenya. The first main finding of the thesis is that mitigation options such as forest conservation and afforestation, and different types of renewable energy sources and different adaptation strategies are practiced in Kenya as a response strategy to climate change. However, Carbon Capture and Storage as a mitigation option is not being practiced in Kenya because of lack of technology involved. Another main finding is that adaptation is given more priority than mitigation by the Kenyan government because of the vulnerability of different pastoralist communities living in arid and semi-arid areas. The last finding of the thesis is that despite Kenya having limited institutional capacity on climate related actions, it has responded well to climate change through mitigation and adaptation. Although there is support from the international community as per the Paris agreement, what is provided is not enough to mitigate the effects of climate change and help communities adapt to a changing environment. Given the emphasis is put more on adaptation than mitigation, there is an urgent need to increase allocation for adaptation in Kenya especially on water sector and disaster risk management.

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CHAPTER 1. INTRODUCTION

Responding to the effects of climate change on the environment is the focus of this study. The study aims to find out the response strategies by the Kenyan government in combating the impacts of climate change on the environment. The study will use the concept of climate change mitigation options, adaptation strategies and institutional capacity approach to conduct the study.

Climate change mitigation options, one of the study's focal points, refer to efforts to reduce or prevent greenhouse gas emissions, according to the United Nations Environment Programme. The goal of climate change mitigation is to avoid significant human interference with the climate system and stabilize greenhouse gas levels in a timeframe long enough to allow ecosystems to naturally adapt to climate change, ensure food production is not jeopardized, and allow economic development to proceed in a sustainable manner (IPCC, 2014). The study would use mitigation concept to see the kind of mitigation measures undertaken by Kenyan government in response to impacts of climate change on the environment

Similarly, the study will use the adaptation concept to study the adaptation strategies implord by the Kenyan government in responding to impacts of climate change on the environment. According to the report of 2014 of the Intergovernmental Panel on Climate Change (IPCC), climate change adaptation refers to the process of adjusting to actual or expected climate change and its effects. It is the response to the effects of climate change that is taken to reduce risks, losses, and damages or to capitalize on new opportunities (Leichenko & O'Brien, 2019). The goal of climate change adaptation is to reduce people's vulnerability to the harmful effects of climate change (Leichenko & O'Brien, 2019). Using adaptation concept would guide this study to see the kind of adaptation strategies put in place by the Kenyan government in responding to impacts of climate change on the environment.

Apart from being the response strategies in addressing climate change, this study has a focus on both mitigation and adaptation strategies because of the following reasons. To begin with, mitigation addresses the causes of climate change, while adaptation addresses the effects of climate change; thus, a combination of the two is required for the study (Locatelli, 2011).

Secondly, mitigation and adaptation are interdependent. For example, even with strong mitigation efforts, the climate will continue to change in the future, necessitating adaptation to these changes

(Locatelli, 2011). Likewise, adaptation to climate change will not be able to eliminate all the negative impacts and therefore mitigation is crucial to limit the changes in the climate system (Locatelli, 2011). Consequently, in terms of scale, mitigation is largely an international issue with global advantages, whereas adaptation is primarily a local issue with local benefits (Tol, 2005). As a result, combining the two is required to realize the benefits in terms of geographical scale. The preceding considerations explain why this study integrated mitigation and adaptation.

Finally, this study would investigate the notion of institutional capacity on climate-related actions in order to carry out the research. An institutional approach based on capacity evaluations can provide important insights on the required steps for climate action at both the national and international levels (Willems & Baumert, 2003). Climate-specific and climate-relevant institutional capacities are required in an institutional approach to climate change (Willems & Baumert, 2003). Climate-specific capacity is dedicated to climate change challenges, whereas climate-relevant capacity supports the huge range of "non-climate" acts that may help to prevent or adapt to climate change (Willems & Baumert, 2003). The study would examine if Kenya has the institutional capacity to successfully respond to climate change using an institutional capacity approach on climate-related actions.

1.1 Research Objectives

1. To identify the response strategies to climate change.
2. To advocate for climate justice
3. To help institutions achieve climate resilient development

The first objective of this study is to identify the response strategies to climate change. At the end of the study, the study would be able to identify various response strategies to climate change by the Kenyan government. Different mitigation options and adaptation strategies put in place by the Kenyan government would be known after this study.

The second objective aims to ensure climate justice. As envisaged by Simon Caney (2014), there are two theoretical perspectives of climate justice, that is, Harm avoidance justice and Burden-sharing justice. Harm avoidance justice is concerned with averting climate change, and also concerned with potential victims, that is, present and future generations (Caney, 2014). On the other hand, Burden-sharing justice is focused on how the burden of countering climate change

should be shared fairly among the duty-bearers, and the responsibility of a country is to do their fair share (Caney, 2014). In the local context, the study would be able to determine how Kenyan government has ensured Harm avoidance justice to her people at the end of the study. Also, the study would equally determine how burden sharing justice has been met in the global scale.

The last objective is to help institutions achieve climate resilient development. The context within which development takes place is constantly changing as climate change affects people's vulnerability and development status (Leichenko & O'Brien, 2019). The study would recommend for the adoption of the best response strategies to be incorporated into institutional development.

1.2 Research Questions

Having established the research objectives, in this sub-section, I present the three research questions. A research question indicates what the research is about and is critical in forming the direction of the research and fieldwork (Cohen, Manion & Morrison, 2018, pg. 165). Therefore, the following forms the research questions for the study.

1. How has the Kenyan government responded to impacts of climate change on the environment based on Climate mitigation options and the adaptation strategies?
2. Has the emphasis in responding to impacts of climate change on the environment been 'mitigation' or 'adaptation', or has there been a balanced combination?
3. Does Kenya have the capacity to respond to climate change?

These research questions reflect my own interest in exploring the main question as to how the Kenyan government have responded to the ravaging effects of climate change. Beginning with the first research question, I will use mitigation and adaptation strategies as a framework. Using this approach, I will be able to learn how the Kenyan government have responded to climate change in terms of mitigation and adaptation strategies. As a result, the study's second research question will determine where the emphasis has been placed between mitigation approaches and adaptation techniques, or whether there has been a balanced blend of the two.

Finally, the third research question will seek to determine Kenya's institutional capacity to deal with climate change, as well as institutional limits when responding to climate change consequences. To answer this question, the human resource capacity, financial capacity, and technology capacity will be examined.

1.3 Why Kenya as a case-study?

It is globally accepted that climate change is one of the greatest challenges facing humanity in this century. In Kenya, for instance, climate change is intensifying at an alarming rate, and this is evident with countrywide increase in temperature and rainfall irregularity and intensification (Government of Kenya, 2010). As per the Global Climate Modelling data, it is projected that the mean annual temperature in Kenya, will increase by 0.8°C and 1.5°C by the year 2030 and 1.6°C to 2.7°C by the year 2060 (Government of Kenya, 2016). Consequently, in 2018 for instance, the results of torrential rains in Kenya led to low crop production as the associated floods swept away all the crops in the farms (Government of Kenya, 2016). Moreover, the melting of glaciers in highland areas of Mt. Kenya is a clear evidence of climate change (World Bank, 2019). Indeed, UNEP notes that only ten out of the eighteen glaciers that covered the mountain's cap a century ago remains (World Bank, 2019).

Kenya has been experiencing a general warming trend since the mid-90s, a trend that is expected to continue over the coming years (Government of Kenya 2018). Other than the rise in temperatures, the rainfall patterns have changed drastically in the last few years. For example, the long rainy season has become shorter and dryer while the short rainy season is now longer and wetter (Government of Kenya, 2018). Data has shown that annual rainfall is low compared to previous years while the frequency of rainfalls resulting into floods has increased. Besides, droughts have intensified in terms of severity, frequency, and coverage over the past few decades (Government of Kenya, 2018). Sea level rise witnessed at the Kenya Indian Ocean coast is another reason to worry about and a justification of warming oceans caused by climate change. In fact, research shows that the Indian Ocean water levels might rise higher than the global average of 26-28 centimeters by 2080s (Government of Kenya, 2018). These findings ascertain the extent of climate change concern in Kenya.

While all these climate concerns emerge, Kenya's economy continues to suffer a major hit in revenue collection and productivity. According to Mwirigi (2014), Kenya's economy is heavily dependent on rain-fed agriculture and tourism, both of which are currently susceptible to the impacts of climate change and extreme weather events. Moreover, the rising amount of heat as well as longer droughts directly contribute to severe livestock and crop losses, leading to displacement of persons, famine, and other adverse impacts on human wellbeing and health. At

the ocean, Kenya's fish stocks and breeding grounds are also bearing the brunt of climate change impacts. Since the country is largely dependent on agriculture, climate change has made it difficult for food security to be realized making many go hungry, especially in Northeastern Kenya where temperatures are high almost throughout the year. Interestingly, the same agricultural practices are believed to be a huge contributor to the climate change menace since it is one of the primary sources of greenhouse gas emissions, primarily due to the enteric fermentation from livestock production (Mwirigi, 2014). On the other hand, waste from livestock production is an excellent source of biogas, which aids in lowering our reliance on petroleum goods.

Due to the aforementioned issues, as well as Kenya's intention to become an industrialized country by 2030, there is a need to improve climate resilience initiatives while growing local energy output. In turn, this will mean Kenya shifts much of its energy supply towards renewable sources which are more climate friendly than fossil fuel and other petroleum products. But as has been noted by the government's Ministry of Environment and Forestry, climate change will definitely negatively impact Kenya's future development and realization of the goals and objectives enshrined in the Vision 2030 long-term development blueprint (Government of Kenya, 2018). Therefore, Kenya is in a paradox of development versus climate change resilience, which is what makes climate change studies about the country interesting. With the myriad of challenges facing the country, it remains to be seen how the government will work on adaptation and resilience strategies.

Based on the issues outlined, it is clear that climate change is already wreaking havoc in Kenya. If global and national attention efforts are not increased, the negative effects of climate change will deepen and become more concerning in the future. In this context, I chose Kenya as a case study to examine how the Kenyan government has responded to the devastating effects of climate change. Furthermore, Kenya is the home of the United Nations Environment Programme, and it would be interesting to examine how a country that hosts UNEP headquarters has responded to the environmental effects of climate change.

1.4 The Significance of the Study

The aim of this study is to find out different response strategies implored by the Kenyan government in responding to impacts of climate change on the environment. It is hoped that the findings of this study will provide some information which if taken up could be used to improve knowledge of young people especially students in understanding and dealing with the implications

of global warming, motivates them to adjust their behavior, and aids in adapting to what is already a worldwide emergency. This is necessary because the context within which development takes place is continually changing due to the effects of climate change on people's susceptibility and development status. An effective response to the environmental impacts of climate change would assist institutions in achieving climate resilient development and maintaining development trajectories despite the ever-increasing effects of climate change.

Also, another significant of this study is to anchor the importance of limiting our emissions to well two degrees Celsius as stated in the IPCC report. In various forums organized by IPCC to push for climate change response, nearly all nations in the world undertook to limit global warming to a maximum of two degrees Celsius (Benjaminsen & Svarstad, 2021). Therefore, all countries, must do their part to prevent further loss and damage that comes due to climate change impacts. The proposed study has come at a time when climate change impacts continue to cause the major humanitarian crisis, coupled with the COVID-19 pandemic, the world especially the developing world is at its most vulnerable condition. It is in this backdrop that the study has embarked on research to a certain how Kenya has responded to impacts of climate change.

Finally, this study is significant because one of its objectives is to advocate for climate justice. Climate justice is a fundamental aspect of climate change mitigation and adaptation because it aims to create a level playing field for the vulnerable in society and poor countries. It is hoped that at the end of the study the findings will show how various response strategies to climate change has taken care or protected the potential victims of climate change like pastoralists communities. Nearly half of Kenya is arid or semi-arid making life in those areas difficult. Pastoralist communities who mostly live in semi-arid places, do suffer the severe environmental conditions of those areas making them to explore for ways to adapt. Harm avoidance, one of the components of climate justice as argued by Caney (2014), is concerned with potential victims, persons or areas that are threatened, and assigns duty to others in order to protect or keep possible victims safe. The devastating drought in arid areas in Kenya is as a result of climate change and therefore it is the duty of the Kenyan government to keep pastoralists who are the victims safe by providing better ways for adaptation. The findings on adaptation strategies by the Kenyan government will therefore offer insight on how the government has protected or keep pastoralists communities safe from climate change.

1.5 Outline of Thesis

As this chapter introduced the basic goal of the study, Chapter 2 involves the study's backdrop, which presents and discusses the history of climate change, evidence of climate change, climate change in Kenya, and concludes with climate justice. The third chapter is the Literature Review and Theoretical Framework, which offers climate change discourses, mitigation choices, and adaptation strategies before concluding with an institutional capacity approach. Research Methodology is covered in Chapter 4 and highlights research methods employed, ethical considerations, and potential methodological problems. The fifth chapter discusses the findings and analyses of climate change response strategies. The findings on mitigation options and adaptation strategies are addressed and analyzed in this section. The findings and analyses of climate change action capacity are presented in Chapter 6. Chapter 7 which is the last chapter discusses the conclusions, limitation of the study, recommendation for further research, reflection on climate justice and finally concluding remarks.

CHAPTER 2: BACKGROUND OF THE STUDY

In this chapter, I first present a brief background about climate change, its evidence, and why climate change matters. Finally, I will briefly describe the climate change in Kenya and the climate justice concept.

2.1 Background of Climate Change

As defined by the United Nations, Climate Change is the long-term shifts in temperatures and weather patterns (United Nations, 2021). These shifts, according to the United Nations, may occur naturally through variations in the solar cycle, or through human activities like burning of fossil fuels (United Nations, 2021). The burning of fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping sun's heat, and raising temperatures (United Nations, 2021). The major greenhouse gas emissions that are causing climate change are Carbon dioxide and Methane, and they majorly come from burning of fossil fuels (United Nations, 2021).

The issue of climate change captured the world's attention around the 1980s following the publication of the Brundtland Report, commonly known as "our Common Future" (Shockley, 2012). Mainly, the report alluded to various environmental concerns including climate change and associated it with increasing concentrations of greenhouse gases (GHGs) in the atmosphere. Consequently, the United Nations Environment Programme (UNEP) and the World Metrological Organization established the Intergovernmental Panel on Climate change (IPCC) in 1989 to offer broad and balanced information about climate change (Adger et al, 2015). Additionally, the body brought global attention to the impacts of climate change on the environment and the people, eventually mobilizing the nation's actions toward the phenomenon.

Following its emergence at the global stage, climate change has become of the most controversial topics in the world. There are those who argue that the world's climate is always changing after all and there should not be a need to be concerned. On the other hand, others posit that climate change is a serious issue that calls for a change in human behavior to curb the impacts that have already been mentioned like rising sea levels, extended droughts, irregular rainfall patterns, and melting ice caps. According to Howe (2017), assertions that the world's temperatures are always increasing is misleading and humans need to take responsibility of riing global temperatures because they are largely a product of anthropogenic activities. In fact, science has established that the Earth's climate is complex and is often influenced by many other things, especially changes in

the planet's orbit in relation to the Sun which has affected the ice ages cycles in the past. Therefore, saying that humans have not played a role in climate change is a misleading argument.

Climate change is largely attributed to the rise in carbon dioxide amounts in the atmosphere. This is evident in highly industrialized nations like China, United States, and Russia where companies emit lots of carbon dioxide and other greenhouse gases to the atmosphere. Although carbon dioxide makes up a tiny component of the Earth's atmosphere, it has a huge influence on the planet's climate (Bristow & Ford, 2016). Greenhouse gases like carbon dioxide absorb so much heat causing a resultant heat warming effect on the Earth. The other significant greenhouse gas is water vapor, which occurs naturally but with rising temperatures there is a high likelihood that water vapor will increase because of the evaporation from lakes, rivers, oceans, and seas (Bristow & Ford, 2016). As a consequence, there will be irregular instances of heating and cooling. It is estimated that prior to industrialization carbon dioxide was only 0.03 percent of the atmosphere or 280ppm. Currently, that amount has risen to 385ppm due to human influence resulting in an average global temperature rise of 0.74 degrees Celsius (Bristow & Ford, 2016). Thus, climate change is a grave concern that has to be addressed at the local and global level.

Over time, climate change modelling using computers has emerged as an effective way of predicting what the future might look like. Studies have established that contemporary climate change modelling have become increasingly precise in showcasing how climate works in real life. For instance, it is now possible to use computer simulations to reproduce the overall course of climate patterns in the last century including how various components work, behave, and interact (Howe, 2017). However, it is imperative to appreciate that computer models' prediction of the future might not be entirely accurate because there are numerous unknowns about the things that could happen to the world in future. The assumptions used in modelling are also not a guarantee that the world will experience those events (Howe, 2017). Even so, what computer simulations have done regarding the past is a scientific revelation that the future may be worst if humans do not stop more greenhouse gas emissions into the atmosphere. Therefore, climate change is a monumental subject that cannot be ignored if the future of humans is to be guaranteed.

2.2 Evidence of Climate Change

In this section, I present the physical and statistical evidence of climate change. Earth's climate system has changed throughout history and direct observations made on and above Earth's surface

shows the planet's climate is significantly changing (NASA, 2021). These changes have been attributed to human activities as the primary drivers of climate change (NASA, 2021). The following are some of the evidences of climate change.

2.2.1 Global Temperature Rise

As documented by NASA, the Earth's average surface temperature has risen with 1.18°C since the late 19th century, and this has been occasioned by increase in Carbon dioxide emissions into the atmosphere because of human activities (NASA, 2021). Statistical data and graphics on global average temperature changes over time gives the impression that temperatures are rising at the same rate all over the earth (Leichenko & O'Brien, 2019, pg. 41). However, a closer look at regional patterns reveals that the distribution of temperature change is spatially uneven, meaning that an increase in 1°C entails larger temperature increases in some places, and smaller changes or even cooling in some places (Leichenko & O'Brien, 2019). The effect of rise in temperature has implications on crop yields, human health, and also high temperatures can lead to extreme weather conditions such as wildfires and drought (Leichenko & O'Brien, 2019).

In recent years, 2021 was termed as the sixth warmest year based on data from the National Oceanic and Atmospheric Administration (NOAA). The 2021 surface temperature averaged 0.84°C warmer than the 20th century average of 13.9°C and 1.04°C warmer than the pre-industrial period (Lindsey & Dahlman, 2022). These statistics are a testament of rising global temperatures and climate change as a whole. Given the massive sizes and heat potentials of world oceans, it takes a considerable amount of heat energy to raise the Earth's average annual surface temperature even by a miniature amount (Lindsey & Dahlman, 2022). Therefore, when temperatures rise by the averages presented by NASA and NOAA then there is a cause for alarm because that eventually leads to melting of ice caps that result in sea level rise. Notably, much of the Earth's warming has occurred predominantly on land areas than ocean areas with the Arctic warming up faster than other regions of the world (Lindsey & Dahlman, 2022). All these are evidence of climate change.

2.2.2 Warming Oceans and Acidification

The Ocean covers about 70% of the Earth's surface and plays a major role in the Earth's environment. With global temperature rise, the water in the Ocean finds it difficult to absorb all the heat making it warmer and posing a serious threat to the lives of aquatic species (NASA, 2021). Even though oceans help in controlling climate change by regulating temperatures, storing large

amounts of carbon dioxide changes the chemistry of ocean waters making them more acidic (NASA, 2021). As a result, that acidity interferes with the aquatic species such as the shellfish and corals who find it difficult to build their shells and skeletons. In turn, these effects could have dire consequences in the biodiversity and productivity of ocean and sea systems. Thus, ocean acidification emanating from climate change is a concern that cannot be ignored.

On the other hand, since the beginning of the industrial revolution, the acidity of the surface of ocean waters has increased by about 30% (NASA, 2021). The increase has been associated with human activities that emit carbon dioxide into the atmosphere and most of it is absorbed into the ocean (NASA, 2021). Too much carbon dioxide into the ocean leads to ocean acidification, which is harmful to the lives of millions of aquatic species (NASA, 2021). The more the greenhouse gases trap energy from the sun, the more heat the oceans absorb causing a rise in sea level and an increase in sea surface temperatures. Warmer waters have been proven to cause stronger storms in the tropics, a phenomenon that leads to loss of lives and poverty (NASA, 2021). Thus, the increasing instances of warming ocean and acidification as a proof that climate change is here with us.

2.2.3 Shrinking Ice Sheets, decreased snow cover, glacial retreat, and declining Arctic Sea Ice

Ice sheets refer to large bodies of ice on land that cover thousands of square miles on Antarctica and Greenland. It is estimated that Antarctica's ice sheet is nearly three times that of Greenland. Together, the two major ice sheets hold approximately 70% of the world's fresh water (NASA, 2021). When the climate gets warmer, the ice sheets disintegrate, especially from the impact of warmer ocean waters and air. In particular, warmer air causes melting of ice more rapidly to the oceans, mostly in regions close to the edges of the ice sheets. Besides, warmer seas and oceans also weaken the ice shelves floating on the water. According to data from NASA (2021), the Greenland and Antarctic ice sheets have decreased in mass. Data from NASA's Gravity Recovery and Climate Experiment show Greenland lost an average of 279 billion tons of ice per year between 1993 and 2019, while Antarctica lost about 148 billion tons of ice per year (NASA, 2021). The decrease has been attributed to rising temperatures that makes ice to melt (Leichenko & O'Brien, 2019). This is a clear evidence of climate change.

A glacier is a term used to refer huge mass of snow and ice that has amassed over many years and is available all year round. Interestingly, a glacier flows naturally like a river, but much slowly given the mass and viscosity of the glacier. Glaciers are important because they provide ecosystems and communities with reliable source of drinking water, stream flow late in the summer and in times of extended droughts when seasonal snowpack has melted away (NASA, 2021). Observing key changes in the physical attributes of the glaciers enables scientists determine the extent of climate change in an area. Satellite observations reveal that the amount of spring snow cover in the Northern Hemisphere has decreased over the past five decades and the snow is melting earlier (NASA, 2021). Also, glaciers are retreating almost everywhere around the world — including in the Alps, Himalayas, Andes, Rockies, Alaska, and Africa (NASA, 2021). Snow Cap from Mt. Kilimanjaro and Mt. Kenya have been observed disappearing, and the cause has been attributed to rising temperatures (World Bank, 2019).

Sea ice is a central component of the Arctic Ocean as can be seen during dark winter months where the sea ice literally covers the entire Arctic Ocean. In contrast, the warm weathers of summer causes some of the ice to melt. The extent of area covered by the Arctic sea ice is usually regarded as a key indicator of climate change because warmer temperatures and warmer air are responsible for the reduction of the amount of ice present. Therefore, there is a clear connection between the amount of Arctic Sea ice and climate change impacts. Arctic Sea ice minimum extent has declined significantly since satellite measurements began in 1979, with the lowest values observed since 2012 (NASA, 2021). Arctic sea ice reaches its minimum in the month of September each year (NASA, 2021). Data from NASA shows that records of Arctic Sea Ice taken in September yearly, is declining at a rate of 13.1 percent per decade, relative to the 1981 to 2010 average (NASA, 2021). The decline has been attributed to rising temperatures, indicating a clear evidence of climate change.

2.2.4 Extreme Weather Events

It is not only the average climate conditions that are changing, but there are also changes in climate variability, frequency, and magnitude of extreme weather events (Hansen, Sato, & Ruedy, 2012). Record-shattering temperatures, rainfalls, winds, storms, wildfires, and floods reflects a dynamical changing climate system (Leichenko & O'Brien, 2019). There are several reasons to say that climate change is contributing to increasing frequency of extreme weather events. For instance,

changes in physical processes such as warmer air and ocean temperatures, influence the intensity of rainfall and heatwaves (Fischer & Knutti, 2015). Indeed, extended periods of dry conditions often lead to more wildfires, and changes in the path of jet stream can lead to record of cold spells (Leichenko & O'Brien, 2019). All these are evidences of climate change.

The rising average global temperatures is linked to widespread alterations in weather patterns across the world. Scientific research and simulations point to an increase in extreme weather events like huge storms, heat waves, and flooding, and much of that is attributed to human instigated climate change (Leichenko & O'Brien, 2019). Heat waves have particularly become common in the last decade affecting various regions including the United States, Greece, and Australia. In the United States, heat waves now occur three times more than they used to in the 1960s with the average heat wave season lasting longer by at least 47 days (Fischer & Knutti, 2015). On the other hand, flooding has been witnessed in various African countries, China, India, and other South East Asian countries. In Africa, droughts periods have become longer causing famine and compromising the ability of the affected countries grow food. Therefore, these extreme weather events are primary indicators of climate change.

2.3 Why Does Climate Change Matter?

The question of 'why climate change matters' leaves many people struggling to articulate the significance of climate change. Some feel that climate change is not a thing to worry about, because, according to them, it does not affect them in any way through their lifetime (Leichenko & O'Brien, 2019, pg. 23). Others sees it as one of the many pressing social challenges like poverty, diseases, homelessness, unemployment, terrorism among many others (Leichenko & O'Brien, 2019, pg. 23). Owing to its controversy, climate change is undeniably a test of human ability to recognize, comprehend, and act on environmental issues on a global scale. As such, climate change issues continue to test the ability and willingness of humans to work together on a common goal across professional and academic borders. As has been mentioned, climate change impacts on food production, weather patterns, food supply chains, and other aspects of the environment cement the need to consider climate change as an issue that requires urgent solution (Leichenko & O'Brien, 2019). To that extent, individuals, countries, and the world have a responsibility to initiate climate change mitigation and adaptation efforts to enable humans cope with the changing climate. For

example, there is a need for humanity to make a shift toward renewable energy sources to reduce pollution and reduce the amount of greenhouse gases getting into the atmosphere.

Climate change matters for very practical reasons that Weather and Climate are fundamental to our every day's lives (Leichenko & O'Brien, 2019). When the weather becomes very unpredictable, we have to live with greater uncertainties and risks. Extreme weather events like floods, forest fires and heat waves, raises questions of what the future will look like, putting people vulnerable to future uncertainties and risks (Leichenko & O'Brien, 2019). The consequences of climate change impact our lives directly determining where we live, how we eat, how we travel, and how we work. For instance, the extreme floods and droughts regularly destroy farms and crops globally, leading to dire consequences to farmers and consumers. In Africa, extreme weather events have caused a major challenge to governments to provide sufficient foods to the citizens given that most African countries belong to the developing world and resources are limited (Leichenko & O'Brien, 2019). In most parts of the globe, food prices are skyrocketing while food supplies are plummeting, but what most people do not appreciate is that such phenomenon is directly linked to the impacts of climate change. The more the situation persists, the worse the global food supply chains are likely to get, which means there will be more people struggling to meet their food and nutritional needs.

Similarly, at personal level, Climate change matters because it affects things we value. Most people care about access to clean water, better healthcare, fresh food, and experiences like skiing, ice fishing, or bird watching (Leichenko & O'Brien, 2019). Values and identities are influenced by climate change as it transforms conditions and experiences that matter to individuals, communities, and nations (Leichenko & O'Brien, 2019). More so, safety, prosperity and a sense of place are among the many things that people care about and are affected by climate change (Leichenko & O'Brien, 2019). Although climate change largely affects people depending on where they live, there is a general consensus that its impacts are so widespread that they are global in nature. For example, a person in Australia and California is more likely to experience wildfires but a person in Greenland or Iceland is more likely to experience a rise in temperatures, but not to a level capable of starting a fire. Therefore, climate change interferes with the things we value because it alters the environment we are used to and makes it difficult for us to adapt to the new normal. In areas where people rely on sea foods, communities have reported a reduction in fish catch partly

due to warmer oceans that have changed the way fish breed and utilize the aquatic environment (Leichenko & O'Brien, 2019). Thus, climate change alters human value system.

Another reason why climate change matters is because socio-economic systems are organized around a preference for stability and predictability (Leichenko & O'Brien, 2019). Climate change alters the fundamental rhythm of nature, and this has consequences in agriculture, fisheries, manufacturing, tourism, and many other sectors of the economy where activities depend on predictable weather patterns (Leichenko & O'Brien, 2019). High temperatures have not just been recorded on land, scientists have established that oceans are literally “boiling.” The socio-economic systems are hugely suffering from the impacts of climate change. It is estimated that half of the globe’s coral reefs have died in the last three decades taking with them a multitude of marine life that live on the reefs (Leichenko & O'Brien, 2019). Worse still, it is projected that close to 90% of the available coral reefs could go extinct in the next 20 years (Leichenko & O'Brien, 2019). In terms of oceans and their associated islands, the rising sea water levels are claiming parts of certain islands like the Pacific Islands. Such a phenomenon is interfering with the species that live on those islands and compromising human habitation of the islands, some of which are endowed with numerous resources.

Consequently, as stated by Leichenko & O'Brien (2019), climate change means that the past can no longer serve as the reliable guide for the future. Considering its adverse effects, water resource managers are facing difficult decisions about how to plan for future increases in water demand because of climate change (Leichenko & O'Brien 2019). Also, as argued by Leichenko & O'Brien (2019), a warming ocean can affect fishermen by determining what types of fish are available, when to catch them and how much to harvest. Furthermore, climate change has an effect to the local economies as well as global supply chain. For instance, coastal storms can affect global supply chain by damaging port facilities, and lack of winter snow can have dramatic repercussions for local economies as it affects ski tourism (Leichenko & O'Brien 2019). Significantly, these issues show the reason as to why climate change matters, and therefore need for drastic steps towards its mitigation.

Climate change represents a monumental challenge for governments and people worldwide due to human activities yielding higher than normal levels of greenhouse gases in addition to natural sources of greenhouse gas emissions. According to Leichenko & O'Brien (2019), it is imperative

for governments, non-governmental actors, and business enterprises to come together to combat climate change. Humans are relatively lucky because we have proven through science that climate change mitigation and adaptation strategies can work. It is possible to address global warming through the adoption of renewable energy sources and channeling massive investments toward other sustainable living practices. As individuals, humans must come together to protect the earth's resources to ensure the future generations can utilize the same resources we have, a concept enshrined in the sustainable development agenda. Therefore, climate change and its associated impacts is a topic that cannot be ignored; instead, a lot of focus should be geared toward addressing its consequences.

Moreover, climate change not only affects humans, but it also poses existential threat to plants and animals, increasing their risk of local or global extinction (Leichenko & O'Brien, 2019). For instance, as explained by Leichenko & O'Brien (2019), a warming and acidifying ocean influences marine ecosystem, as it affects coral reefs as well as the entire food chain. Therefore, climate change matters and to avoid its ravaging effects, there is need for effective response. It is only through effective response that we can achieve climate justice. Most plants and animals are adapted to live in regions with specific climatic conditions. Obviously, when that climate is altered, the lives of such animals and plants is heavily compromised. With animals, some species respond warmer or colder climates by moving to other locations, but with plants, the result is almost always death and extinction. Notably, climate change has been proven to alter life cycles of plants and animals. For instance, as temperatures get warmer, numerous plants are beginning to grow and bloom earlier in the spring and survive longer in the fall. On the other hand, certain animals wake up from hibernation much sooner or migrate at different times (Leichenko & O'Brien, 2019). Since animals cannot implement adaptation strategies, they only rely on natural adaptive mechanisms, but whenever they are overwhelmed, animals migrate to areas where they can live comfortably.

It is worth noting that there is a direct correlation between climate change and urbanization. It is estimated that four billion people currently live in urban centers and that number could rise to 6.7 billion by the year 2050 (Leichenko & O'Brien, 2019). But while the urban population increases, cities are not exempt from the impacts of climate change. At the same time, urbanization comes with lots of manufacturing industries which emit a lot of greenhouse gases contributing to climate change. Most urban centers rely on rural areas for the supply of food and water, but if climate

change affects the ecosystem functioning of rural areas, urban centers are going to be hugely affected in the future (Leichenko & O'Brien, 2019). Similarly, natural disasters like flooding could increase in areas with more built environment like cities and towns. Therefore, climate change matters because it affects humans regardless of where we live.

2.4 Climate Change in Kenya

Kenya is a country located in East Africa and with coastline on the Indian Ocean. It encompasses savannah, Lakelands, the Great Rift Valley, and mountain highlands. It is also home to wildlife like lions, elephants, and rhinos. The country's geography is represented by low coastal plains on the Indian Ocean to plateaus and mountains in the interior lands. Although most Kenyans live in the highland areas and along the Great Rift Valley, there is significant population in other parts of the country like the coastal lowlands and Northeastern parts. Kenya is endowed with many lakes and rivers, with the country being home to the second largest freshwater lake in the world, Lake Victoria. Other major lakes in the country include Lake Turkana, and Rift Valley lakes of Naivasha, Nakuru, Elementatita, and Baringo that have witnessed receding water levels, attributed largely to climate change.

Due to Kenya's geographic, political, and social factors, the country is recognized as highly vulnerable to impacts of climate change, ranked position 152 out of the 181 countries in the 2019 ND-GAIN Index (World Bank, 2020). Comparatively, Norway is ranked 1st, an indication that the Nordic country is less vulnerable to climate change. Kenya is also extremely vulnerable to seasonal variability as well as long-term climate change. An increase in that variability is expected to cause more impacts across the economic, social, and environmental systems to an extent that is likely to reverse the positive development progress that the country has made in the last decades (World Bank, 2020). Environmental degradation, biodiversity loss, altered water resources are major obstacles in the development of the vibrant East African nation. It is worth recognizing that changes in precipitation patterns can have unmatched consequences for biodiversity and ecosystems, rivers, the water industry, and food production (World Bank, 2020). Thus, Kenya's climate change status is one worth studying to come out with suitable data that can inform policy direction.

Kenya, like any other country in the world, bears the brunt of climate variability and change. To begin with, in the year 1963 when Kenya attained independence, the percentage of forest cover in

the country was 10%, but by the year 2009, the percentage of forest cover had dropped to 6% (Mutuku, 2019). This was attributed to human activities like charcoal burning, agricultural expansion, unrelated logging, and urbanization (Mutuku, 2019). This not only increased Kenya's contribution to climate change, but also had a number of devastating impacts, like soil erosion, increased flooding, and scarcity of fresh water especially during drought (Mutuku, 2019). Other than the plummeting forest cover, Kenya average temperatures have changed tremendously over the years as can be seen with unpredictable and irregular rainfall patterns. Worse still, when it pours, the rain is usually very intense leading to flooding in lowlands and causes extreme soil erosion that contributes to siltation of rivers (Mutuku, 2019).

Secondly, the melting of glaciers in highland areas of Mt. Kenya is a clear evidence of climate change (World Bank, 2019). Indeed, UNEP notes that only ten out of the eighteen glaciers that covered the mountain's cap a century ago remains (World Bank, 2019). The future projection as per UNEP on Mount Kenya is that in the next 25 years, continued global warming would clear all the ice on Mount Kenya, an indication of the adverse impacts of climate change in the region. A case in point is the Lewis Glacier, the largest in Mount Kenya, has reduced by 90% in volume since the year 1934 (Mutuku, 2019). The highest rates of ice volume loss were registered at the turn of the century. Whenever the ice caps melt, rivers flowing down from the mountain register high water volumes. However, that is never sustainable because the glaciers do not get back to their original volumes due to the impacts of climate change. As a result, rivers flowing from Mount Kenya receive less water in subsequent years. Therefore, Kenya is one of the countries that is highly vulnerable to climate change.

Consequently, according to the World Bank report, Africa is responsible for about 4% of the current global greenhouse gas emissions, and about 65% of Africa's population is directly affected by climate change (World Bank, 2019). In May 2018, for instance, torrential rains displaced hundreds of thousands of people in East Africa (World Bank 2019). Specifically, about two hundred and sixty people were displaced from their homes in Kenya while half a million were affected in Somalia (World Bank, 2019). Notably, the floods came at a time when people were just recovering from drought and famine that had affected the region, leading to poor crop production in Kenya (World Bank, 2019). The resultant famine drove food prices high, increased inflation, and slowed economic growth (World Bank, 2019). Therefore, climate change has increased cases

of hunger and food insecurity conditions. The World Bank recorded that a fifth of Africans, which is about 257 million individuals, are undernourished courtesy of extreme environmental conditions and extreme climatic factors (World Bank, 2019). Therefore, Kenya has not been spared by the ravaging effects of climate change.

Studies show that climate change is heavily affecting Kenya's major staple crops of maize and beans. Already, it is projected that if climate change impacts continue in Kenya, the country could face huge food insecurity problems over the next four decades (Mutuku, 2019). Although the country has many water bodies including rivers and lakes, there is huge uncertainty over the availability of water. Major rivers like Athi and Sagana have witnessed reduced water levels over the years, an indication of irregular and unpredictable rainfall amounts in the highlands that host their catchment areas. Certain climate models used to predict the future have put Kenya on the spotlight, pointing to the likelihood of suffering reduced rainfall amounts in the near future (Mutuku, 2019). Perhaps, this points to the fact that Kenya is arguably the biggest emitter of greenhouse gases in the East African region due to her industrialization status. Thus, Kenya could be one of the countries to face dire consequences of climate change, which points to the need for effective mitigation and adaptation mechanisms.

Kenya is also home to some of the most visited national parks in Africa. Of late, Kenya's game tourism has kept up with the demand but there is no doubt that the number of animals in the game parks have been dwindling. If climate change continues to endanger Kenya's wildlife, the country could suffer a huge blow in the tourism industry, one of the major economic earners for decades now (Mutuku, 2019). The Tsavo East, Tsavo West, and Maasai Mara National Parks are probably some of the most famous game parks in Kenya and among international tourists. Their prestige could be compromised through the impacts of climate change which affect wildlife, vegetation, and their migratory patterns. For example, the famous wildebeest migration that takes place between Kenya's Maasai Mara National Park and Tanzanian's Serengeti no longer attracts so many wildebeests due to the low levels of water in the Mara-Serengeti River. Therefore, these eventualities emanating from climate change are a major concern for Kenya's tourism sector and economy at large.

2.5 Climate Justice

Just like environmental justice, Climate justice is concerned with local impacts, vulnerabilities, experiences, and the importance of agency in local communities (Scholsberg & Collins, 2014). The main idea of climate justice as postulated by Scholsberg & Collins (2014), is mainly focused with normative and ideal conceptions of justice theory in relation to international organizations and the policies carried out regarding climate change mitigation and adaptation. According to Caney (2014), proponents of climate justice aim to have the said inequalities addressed amicably through long-term mitigation and adaptation measures. The basis of climate justice is the acceptance that climate change affects groups differently, with the marginalized or underprivileged bearing the heaviest burden. In essence, climate justice looks at the climate crisis through a human rights lens and on the conviction that by working together, humans can establish a better future for current and future generations (Caney, 2014). As such, the climate justice concept is a shift from the greenhouse gas discourse to a civil rights movement that focus mostly on the people and communities most affected by climate change impacts. Thus, the attempt to inculcate an intergenerational partnership on climate change matters encourages the climate justice concept.

There are two concepts of climate justice as postulated by Caney (2014), that is, *Harm Avoidance justice* and *Burden-sharing justice*. The first notion, Harm Avoidance Justice, seeks to prevent climate change and works from the standpoint of how to arrive at a reasonable conclusion indicating who should do what in terms of climate change mitigation (Caney, 2014). The goal is primarily to ensure that the disaster, that is, climate change, does not occur. If that is not practicable, it attempts to reduce the threat. Furthermore, the Harm Avoidance justice idea is concerned with potential victims, persons or areas that are threatened, and assigns duty to others in order to protect or keep possible victims safe (Caney, 2014).

Consequently, the second concept, Burden-Sharing Justice, addresses how the burden of combating climate change issues should be shared fairly among duty-bearers (Caney, 2014). Burden-Sharing Justice can be divided into three principles; The first, those who have caused the problem should bear the burden. The second, those who can pay should bear the burden, and the last principle is that those who have benefited from activities that cause climate change should bear the burden (Caney, 2014). Subsequently, it is a case of taking responsibility among duty bearers.

While previous climate concerns focused on the threat to land and animals, climate justice aims to make humans appreciate that it is not just the environment that is in danger, but humanity. That way, people begin to acknowledge the responsibilities that come with climate mitigation and adaptation, with clear emphasis on the most vulnerable in society. With that shift, climate change solutions are not only meant to be scientific, but politics has a role to play too. Contemporary conversations on climate should not only incorporate statistics and data on changing temperature but need to include concepts such as access to justice, better power consumption, and access to resources (Caney, 2014). Crucially, achieving climate justice has to take into account the complex and messy world of global politics since climate crisis is perceived as a human and political crisis. This is because, the effects of global warming are not felt evenly around the world, something that might spur controversy among global leaders.

The beauty with climate justice agenda is that it recognizes the human being for creating the current crisis we find ourselves in and that it is not evenly distributed. For example, the regions of the world that are currently suffering the largest effects of global warming bear minimum or no historical responsibility for causing them. As has previously been articulated, countries within the tropics are suffering so much from global warming yet much of the pollution from industrialization is happening elsewhere in the West and parts of Asia (Caney, 2014). It is the Global North that consume the highest amounts of fossil fuels to power their industrial plants, causing global warming in the process (Caney, 2014). For instance, the United States is responsible for more than one quarter of all carbon emission that have been recorded, Africa as a continent just 3%, yet Africa's temperatures are rendering certain places inhabitable (Caney, 2014). Thus, it is only through climate justice that countries can pay an equitable share for them they have caused planet Earth.

The paradox is that the existing situation did not come by accident but rather by design created by the dominant political choices by rich nations. Similar to how colonialism altered the culture of other nations, destroying some in the process, political decisions made by powerful countries have impacted smaller ones on the climate front. Ideally, most European nations and North America have accrued their wealth largely by exploiting resources, and, and human capital from Latin America, Asia, and Africa, yielding huge economic inequality present in modern society (Caney, 2014). Even after colonization, multinational companies that were created during the white

hegemony have continued to exploit resources without concerns for cultural integrity and environmental standards. Such inequalities have made it difficult for countries to reach proper climate resilience levels because some cannot afford to implement renewable energy sources at the expense of other services like health and education. In the end, it is the poorest and the vulnerable that suffer the most, a phenomenon that climate justice seeks to eradicate.

As a result, achieving climate justice calls for a concerted effort by all but rich countries have to accept their historical culpability for creating the climate crisis and institute measures to rectify the situation. For instance, rich countries like the United States and other European countries should support the developing world to transition to renewable and clean energy as a way of adapting to climate change (Caney, 2014). Similarly, their governments must take legal action to compel companies within their jurisdiction to bear the pain of paying for the harms that climate change is causing to locals and those abroad (Caney, 2014). This applies to multinational companies, especially those in the oil and gas industry like Mobil, Shell, BP, and Chevron to mention a few. Other initiatives should be geared towards upholding the rights of indigenous populations, protecting forests, and encouraging sustainable resource utilization. By listening to the cries of the most affected, the vulnerable, and poor countries, the world can come together to end the climate crisis or at least reduce its harsh impacts.

CHAPTER 3: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

In this chapter, I present the literature review and the theoretical framework. The literature review dwells on climate change discourses while the theoretical framework includes the climate change mitigation options, adaptation strategies and institutional capacity approach.

3.1 Climate Change Discourses

In this section, I will describe what kind of a problem the climate change is using four different types of climate change discourses. Mostly, climate change is understood as an environmental problem caused by increases in the levels of greenhouse gases in the atmosphere due to human activities (Leichenko & O'Brien, 2019). However, there are also other approaches in which climate change is considered. For instance, some studies suggest that climate change is a problem of economic, political, and cultural forces that are perpetuating fossil fuel development and consumption, leading to increased emissions (Leichenko & O'Brien, 2019). Likewise, other interpretations see the problem of climate change as deeply rooted in beliefs and perceptions of human-environment relationships and humanity's place in the world, which influences norms, rules and institutions that support unsustainable resource use and practices (Leichenko & O'Brien, 2019). In contrast, some studies dismiss the problem of climate change, describing it as a scam or a hoax that is intended to promote government regulations or increased funding for science (Leichenko & O'Brien, 2019).

Those who argue that climate change is a hoax maintain that the changing climate is part of a natural cycle that should not worry humans. According to Rogerson (n.d.), deniers of climate change often like to cite the 17th century Dutch oil paintings as evidence of a mini ice age because they depicted frozen lakes. However, what most of them do not realize is that there have been many notable changes in the last four decades that cannot simply be termed as natural cycles. Similarly, the fact that a mini climate may not have changed over the last few years is not a justification that climate is not changing elsewhere. As has been discussed in this essay, global land and ocean temperatures have changed to a level that justifies climate change as a phenomenon. Therefore, such arguments about climate change being a part of a natural cycle do not hold water.

Humans at all levels of society have their unique perception of climate change. Yet, understanding climate change involves complex constructs like knowledge, attitudes, beliefs, and concerns about it and how it is happening (Fierros-Gonzalez & Lopez-Feldman, 2021). That is the principal

objective that scientists have had to prove over the years to prove climate doubters wrong and to prepare humanity to tackle the harmful impacts of climate change. According to Fierros-Gonzalez & Lopez-Feldman (2021), perception is influenced by an individual's characteristics, his experience, the information he receives, and the geographical and cultural context in which they live. For example, people who live in places that have changed drastically in terms of weather are more likely to appreciate the existence of climate change compared to those whose climate has remained relatively intact in many years. Similarly, people who live in countries where climate change is given much attention are more likely to accept its existence. Therefore, climate change perceptions vary and that interferes with the understanding of climate discourses.

In addition, a person's experience, profession, and educational level could determine their perception of climate change, thereby resulting in their understanding of a discourse. Literature from Asia and Africa show that age, gender, culture, and education play a pivotal role in the process of determining a farmer's perception of climate change (Fierros-Gonzalez & Lopez-Feldman, 2021). In Latin America, the same findings have been established specifically in Chile where younger and more educated households tend to have a perception of climate change that is more linked to the observable weather changes than the perceptions held by the less educated and older counterparts (Fierros-Gonzalez & Lopez-Feldman, 2021). However, that is not the only scenario. In Mexico, farmers are more likely to appreciate the existence of climate change regardless of their educational or cultural background. In almost every part of Latin America, the agro-climatic conditions play a crucial role in climate change perception. Therefore, climate change perception should be viewed as a critical component of the discourses that I shall discuss in this section.

To understand the problem of climate change better, this study will present four different types of climate change discourses. The study will describe in detail how the four discourses shape the ways in which climate change is defined and studied, as well as the types of responses that are identified and prioritized. A discourse may be defined as a system of representation that is made up of norms, rules of conduct, institutions, and language that influence and legitimize certain perspectives and meanings over others (Leichenko & O'Brien, 2019, pg. 62). "Discourses include explicit and implicit values, judgements, and contentions that defines the terms of discussion around a particular issue, as well as what is included and excluded from analysis and debate.

Discourses reflect different perceptions and understanding of climate change, which are linked to worldviews, assumptions and beliefs about nature and society” (Leichenko & O’Brien, 2019, pg. 62). The following are four different types of climate change discourses.

3.1.1 Biophysical Discourse

Within this discourse, climate change is understood as a problem linked to rising concentrations of greenhouse gas emissions due to human activities (Leichenko & O’Brien, 2019). This means that human beings through their activities, have collectively contributed to climate change. The biophysical discourse as argued by Steffen et al (2005), draws heavily from the Earth-system science research and shows how human activities such as fossil fuel consumption, deforestation, and other land-use changes influence the atmosphere, biosphere, oceans, and ice cover (Leichenko & O’Brien, 2019). Most scientific studies cite greenhouse gases emanating from human activities as the most significant driver to climate change since the mid-20th century. As the greenhouse gas emission due to human activities increase, they collect in the atmosphere and cause global warming, leading to many changes on land, air, and sea (Steffen et al., 2005). Many of the greenhouse gases occur naturally, but anthropogenic activities are increasing their concentrations in the atmosphere. They include carbon dioxide, methane, nitrous oxide, and fluorinated gases (Leichenko & O’Brien, 2019). The proliferation of these gases naturally and through human activities exemplify the biophysical discourse as one of the climate change discourses.

Scientific knowledge that prioritizes positivist science is common to biophysical discourse (Leichenko & O’Brien, 2019). In this, physical processes and interactions are objectively observed, understood, modelled, and validated (Leichenko & O’Brien, 2019). This means that the biophysical discourse is premised on the assumption that greater scientific knowledge would reduce the uncertainty about the consequences of increased greenhouse gas emissions, and that a basic social consensus on climate policy responses and actions will follow (Leichenko & O’Brien, 2019). This, as stated by Moser (2016), reflects that more knowledge and better science communication will translate into policy and action to better solve environmental challenges. Moser’s assertions are a testament that scientific problems call for scientific solutions. Over the years, humans have proven that complex challenge can be addressed through a change of behavior or regulation or policy frameworks. In the United States, for example, the Environmental Protection Agency (EPA) has a Greenhouse Gas Reporting Progra that collects annual emissions

data from industrial establishments that emit large amounts of greenhouse gases into the atmosphere (Leichenko & O'Brien, 2019). While the program is not an emissions control program, the data collected greatly improves the ability of the agency to make informed business, policy, and regulatory decisions.

Tools such as climate models and economic models are used within the biophysical discourse to support what is sometimes referred to as techno-managerial approach to climate change responses (Leichenko & O'Brien, 2019). Truly, technological innovations such as development and deployment of non-fossil fuel energy sources, increasing the energy efficiency, or development of drought-resistant seeds, are often seen as key strategies for climate change mitigation and adaptation (Biagini et al, 2014). Some of the most common economic models that aid in the reduction of climate change impacts are carbon tax, ending subsidy on fossil fuels, subsidizing green energy, and changing priorities. A carbon tax is an economic incentive that attaches huge levy on the production and consumption of goods that emit carbon or methane. In cases where carbon taxation is challenging, the other option is ending subsidies of fossil fuels, which are known to be great carbon dioxide emitters. Instead, that subsidy should go to green energy that is more environmental friendly. The last ideology here would be a complete change of priorities that reduce consumerism approach and puts less stress on the environment.

Furthermore, within the biophysical discourse, the role of individual behavioral changes is an emphasis on the mitigation actions (Leichenko & O'Brien, 2019). Sustainable practices such as walking, riding a bicycle, or taking public transportation to work, are seen as key in reducing greenhouse gas emissions (Leichenko & O'Brien, 2019). These practices can be promoted through market-based measures and incentives. For instance, putting a tax on carbon so that it becomes so expensive to purchase fossil fuel, or even providing free transport to employees to reduce use of personal cars (Lieberoth, Jensen, & Bredahl, 2018). Undoubtedly, individuals have the responsibility, just like governments and other state actors, to think about their impact on the environment. It is incumbent upon every human to minimize the damage his or her actions causes to the planet. For example, it is a great practice to turn off lights at night when going to sleep and switch off the air conditioning equipment when it is not necessary to run it. Everyone bears the brunt of harsh climatic conditions; therefore, it is the duty of all to ensure the world remains a

favorable place to live. More importantly, individuals can also choose to engage in political advocacy in their community to educate society on the importance of climate change mitigation.

In conclusion, biophysical discourse asserts that climate change is an environmental problem caused by rising concentration of greenhouse gases from human activities, and it can be addressed through policies, technologies, and behavioral changes that reduce greenhouse gas emissions and support adaptation. Policies can be coined at the governmental level, but non state actors and individuals can also play a central role in advocacy to ensure their communities adopt environmentally friendly practices. Various technologies, especially those used in the modification of fossil fuels and green energy to make them more environmentally friendly are fundamental to the biophysical discourse. Climate change mitigation is the role of everyone because the impacts of climate change affect us all without considering our social, economic, or political statuses. Therefore, adopting clear policies and initiating advocacy programs in society can easily solve the climate change menace.

3.1.2 Critical Discourse

Within the critical discourse, climate change is seen as a social problem caused by economic, political, and cultural processes that contribute to uneven and unsustainable patterns of development and energy use (Leichenko & O'Brien, 2019). In particular, the critical discourse draws attention to the role of the capitalist economic system that fosters and perpetuates an economic growth that leads to unsustainable patterns of resource use (Wilhite, 2016). Relevant to the critical discourse is the recognition that all humans are not equally responsible for climate change, and that they will not experience the consequences of climate change in the same way (Liverman, 2009). As climate change persists, millions of people around the world face dire consequences in terms of health effects, extreme events, food security, migration, water security and other associated risks (Basaninyenzi, n.d.). Certain social groups are more vulnerable to climate change than others. For instance, female-headed households, persons with disabilities, children, indigenous people, ethnic minorities, socially marginalized groups, and other socially marginalized groups. These attributes are some of the factors that make it difficult for a country to achieve sustainable development and energy consumption, leading to proliferation of climate change impacts. Thus, economic, cultural, and political disparities are key components for understanding the critical discourse of climate change.

As Klinsky et al (2017), puts it, equity and social justice issues are key in the critical discourse to climate change, and this results in calls for social and political responses, as well as technical ones. Therefore, the critical discourse raises questions about whose voices are heard, who makes the rule, whose values count, and who decides the future (Leichenko & O'Brien, 2019). The critical discourse puts more emphasis on the importance of wider participation in science-policy processes to ensure that a diversity of perspectives is included in climate change related decisions (Leichenko & O'Brien, 2019). It is no doubt that climate change is deeply knitted into the global inequality patterns. According to Basaninyenzi (n.d.), the most vulnerable people in society bear the brunt of climate change impacts yet they contribute least to the crisis. This is also true for the less industrialized nations who are compelled to pay for the climate change mitigation efforts when in reality they do not emit significant amounts of greenhouse gases into the atmosphere. Perhaps, this is the background of critical discourse because it puts emphasis on addressing climate change regardless of the contribution levels of individuals and countries.

A lot of progress has been made on the types of policies and scientific innovation needed to support a transition to climate resilient development, low carbon emissions. However, the biggest challenge facing many countries worldwide is engaging citizens who may not comprehend the need for addressing climate change and gaining support of those who are mostly concerned that they might be unfairly impacted by climate policies (Basaninyenzi, n.d.). In turn, that is a huge challenge for the practicality of the critical discourse because people need to accept responsibility for a mistake before they can accept to be part of the process to rectify it. Therefore, it is vital for decision makers to tag along everyone in the process of making choices for a better world, a process that demands transparency, information access, and citizen engagement on green development and climate risk assessment (Basaninyenzi, n.d.). The resulting coalitions should then support or demand public reduction of climate change impacts and to encourage people to overcome behavioral and political inertia to decarbonization (Basaninyenzi, n.d.). All the efforts are eventually meant to yield new ideas and ownership of climate change solutions to support the primary objective of the critical discourse.

In a nutshell, the critical discourse recognizes that without attention to social, economic, and political contexts, an emphasis on technical and behavioral responses is unlikely to contribute to the types of structural and systemic changes needed to address the underlying causes of climate

change (Leichenko & O'Brien, 2019). Certainly, solutions to climate change within the critical discourse emphasize the need to challenge economic, political, and cultural processes that contribute to climate change. The three components: social, political, and cultural perspectives are the cornerstone of the critical discourse. From a social angle, climate change issues need to recognize the social diversity that exists in many communities around the globe and institute practical solutions for the target population. For the political perspective, governments and other state actors around the world have the responsibility to initiate plausible policies and regulations to control energy consumption, emissions, and other human activities responsible for the changing climate. From a cultural perspective, administrations have the responsibility of implementing better cultural practices that encourage climate consciousness, otherwise the polluter-pays principle would set in to bridge the gap.

3.1.3 Dismissive Discourse

The dismissive discourse questions the reality and significance of climate change. It asserts that climate change is not a problem at all, or at least not an urgent action, and that no action is needed to address climate change (Leichenko & O'Brien, 2019). The discourse entails a diversity of views that deny climate change as a problem linked to humans and their activities (Leichenko & O'Brien, 2019). Mostly, the denial is linked to beliefs that humans cannot possibly change the climate because such systems are beyond human influence, and that only God can intervene in the climate (Leichenko & O'Brien, 2019). Astonishingly, the dismissive discourse also encompasses the scientific denial, whereby deniers insinuate that climate change is part of a natural cycle or that existing climate models are too sensitive to climate change or unreliable. According to Maslin (2019), some deniers even suggest that carbon dioxide is such a small component of the atmosphere that it cannot have a massive heating effect. The other shocking argument is that climate scientists are fixing the data to prove that climate change is occurring, something dubbed the global conspiracy on climate change. These arguments are false. They make the fight against climate change challenging.

The dismissive discourse is also manifested in the arguments that climate change is too fix. Most of those who propagate the notion posit that the world is not ready to generate a portion of the GDP dedicated to climate change mitigation. However, economists predict that humanity could fix the climate menace by spending only 1% of the global GDP, a figure that could even reduce if we save

through expansion of global green economy and improved human health (Maslin, 2019). In 2018, the world generated \$86 trillion and the annual global GDP grows by 3.5%. Therefore, setting aside 1% to address climate change would not be an issue as long as every country is dedicated to contributing to the kitty. Besides, climate deniers forget that they are protecting the fossil fuel industry who pocket annual subsidies of up to \$5.2 trillion (Maslin, 2019). Therefore, it is in the best interest of everyone to address climate change matters.

From the humanitarian perspective, climate change deniers escalate the dismissive discourse by arguing that climate change is good for humanity. Their hypothesis is that the longer and warmer summers get the better it will be for temperate regions who will have the chance to produce more agricultural produce (Maslin (2019)). Over time, extreme weather events have proven that their position is inaccurate because the frequency of heatwaves and drier summers have increased. For instance, Moscow's 2010 heatwave claimed the lives of 11,000 people, affected the Russian wheat harvest, and escalated global food prices (Maslin (2019)). Although deniers rightly claim that plants need carbon dioxide to grow, excess of carbon dioxide in the atmosphere has been proven by scientists to cause climate change since it is the most prevalent greenhouse gas. The high number of deaths due to extreme weather events like heat and cold can also be attributed to climate change, disapproving the dismissive discourse.

Although those within the dismissive discourse can be seen as uninformed, misinformed, influenced by special interests, or simply hypocritical, it is important to recognize that this discourse holds considerable political influence (Leichenko & O'Brien, 2019). For instance, the decision taken in 2017 by the President of the United States, His Excellency Donald Trump, to withdraw from Paris Agreement, justified in part on the basis of skepticism about human causes of climate change, and it illustrated the power associated with dismissive discourse (Leichenko & O'Brien, 2019). What is interesting about climate change is that however much a section of humanity dismisses its existence, evidences of climate change are more common now than they ever were. If we are not careful certain parts of the globe will soon become too hot for human habitation and those who will manage to remain behind will not survive longer before they die. For instance, food shortages will become chronic if we do not shift our agricultural practices to be in line with the changing climate. The solution is climate smart agriculture and improved technology to catch up with harsh weather conditions. All these decisions require political will and

a cultural shift to better climate practices. Therefore, the dismissive discourse influences political and cultural debates about climate change policy and action.

3.1.4 Integrative Discourse

Within this discourse, climate change is viewed as interconnected with multiple processes of environmental, economic, political and cultural and closely linked to individual and shared norms, beliefs, values and world views (Gibson & Graham, 2011). Importantly, the integrative discourse questions the dualistic views of nature as separate from society (Leichenko & O'Brien, 2019). As contended by Merchant (2005), the dualistic views are reflected in most of the social and material relationships associated with modernity, including the treatment of nature as an object to be managed, exploited, or preserved. The view assumes that the climate system is an external object that can be controlled and managed by humans (Leichenko & O'Brien, 2019).

The integrative discourse as stated by Hulme (2011), challenges linear and deterministic understandings of the connections between physical and social processes and impacts. The discourse recognizes that such understanding often supports the conclusion that climate change is the most important driver of future social conditions and human destinies, and that predicted climate will determine the future (Hulme, 2011).

In a nutshell, as stipulated by Leichenko & O'Brien (2019), addressing the climate change within the integrative discourse requires challenging mindsets, norms, rules, institutions, and policies that supports unsustainable resource use and practices.

3.2 Climate Change Mitigation

Climate change mitigation is the intervention to reduce the sources or enhance the sinks of greenhouse gases (IPCC, 2014). The goal of climate change mitigation is to avoid significance human interference with the climate system and stabilize greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner (IPCC, 2014).

The below sub-section discusses various climate change mitigation options.

3.2.1 Forest Conservation and Afforestation (Tree Planting)

Forests contain a substantial part of the earth's carbon, and therefore current rates of forest's loss contribute to almost twenty percent of total emissions of carbon dioxide (Bodegom et al.,2009). Climate change and forests are intrinsically linked, that is, climate change is a threat to forests, and protecting forests from conversion and degradation helps mitigate the impacts of climate change (Bodegom et al., 2009). The world's forests have been under threat and are declining due to human activities (IISD, 1994). In the beginning of the eighteenth century, the world's forest was four-fifths of the land area and out of this, half of the forest was in tropical areas and the remaining in temperate and boreal regions respectively. (IISD, 1994)

However, these forests have been declining because of deforestation (IISD, 1994). By the mid-Nineteenth century, it was estimated that global forest cover had decreased to 3,900 million hectares or 30 per cent of the world's land area (IISD, 1994). The statistics from the Food and Agriculture Organization of the United Nations as reflected in the Forest Resources Assessment 1990 had estimated that global forest cover as at the end of 1990 had further decreased to 3,188 million hectares or about 24.4 per cent of the world's land area (IISD, 1994).

The forest loss has been experienced both in the tropical and temperate or boreal regions (IISD, 1994). Even though the annual loss of temperate and boreal forests is said to be negligible in recent time, historically, as postulated by Hinde (1985), large- scale deforestation had taken place in Europe during the Industrial Revolution to cater for the needs of agricultural expansion, building materials and industrial development (IISD, 1994). In fact, as per the United Nation's statistics, it is estimated that almost 200 million hectares or more than 50 per cent of the original forest cover had been lost (UN, 1991).

Conversely, deforestation in the developing world is a rather recent phenomenon because of poverty, unemployment and the increasing need for food, shelter, and energy to cater for the growing population needs (IISD, 1994). Therefore, the four main causes of deforestation in developing countries are shifting cultivation, conversion to agriculture and pasture, wood removals for fuelwood and inappropriate timber utilization, and the need for infrastructural development (IISD, 1994). For instance, as per the statistics of Food and Agricultural Organization of 1993, 39.5 per cent of the 1.54 million hectares of closed forest deforested between 1981 and 1990 in Africa was due to agriculture fallow and shifting cultivation, 35.1 per cent due to conversion to

mainly permanent agriculture, and the balance 25.4 per cent due to over-exploitation and over-grazing (IISD, 1994).

The degradation of global forests is a cause for concern as it involves not only the loss of forest areas, but also the ultimate quality of the forests (IISD, 1994). If this trend is not checked, the impact on the world would be catastrophic. Not only would the existence of all forest types be threatened, but also the capability of these forests to perform their various roles and functions in perpetuity would also be seriously undermined (IISD, 1994).

To address deforestation, during the Paris Climate Conference in the year 2015, all the parties to the UN Framework Convention for Climate Change, unanimously agreed to a goal of limiting global warming to well below 2°C above pre-industrial levels and trying to further limit it to 1.5°C (Benjaminsen & Svarstad, 2021, pg. 132). This cannot be achieved without stopping or reducing tropical deforestation (Seymour & Busch, 2016). A considerable part of climate mitigation today focuses on forest conservation and afforestation (Benjamin & Svarstad, 2021, pg. 133). This is because trees absorb and store carbon dioxide from the air (Benjaminsen & Svarstad, 2021, pg. 133). Statistically, as was estimated by fourth assessment report of IPCC, deforestation constituted 20% of total climate emissions in 2007, and in 2014 as was estimated by fifth assessment report of IPCC, the estimate reduced to about 12% (Benjaminsen & Svarstad, 2021, pg. 133). This reduction in emissions was attributed to forest conservation and afforestation measures that helped in carbon sequestration from the atmosphere (Benjaminsen & Svarstad, 2021, pg. 133).

Even though tree planting results in more carbon storage, it has received criticism because reforestation and afforestation measures could increase competition for land, rendering communities landless with less space for agriculture, and thereby threatening food security (Seymour & Gibbs, 2019). If natural climate solutions are to succeed while economies decarbonize as argued by Griscom et al (2017), then researchers and policy makers must recognize and avoid the expense, risk, and damage that poorly designed and hastily implemented tree plantings brings on poor people and ecosystems (Fleischman et al, 2020). Moreover, to strengthen efforts in forest conservation and the sustainable management of forest resources, it is imperative to ensure the participation of local community. (IISD, 1994)

Nevertheless, as per the IPCC report, there is a high confidence that reducing deforestation and forest degradation rates represents one of the most effective and robust options for climate change mitigation, with large mitigation benefits globally (Seymour & Gibbs, 2019). Therefore, tree planting offers one of the best solutions to climate change mitigation options, with the understanding that it should be done in a manner that it responds to the needs of the rural and indigenous people who depends on the ecosystems for their livelihoods (Fleischman et al. 2020).

3.2.2 Carbon Capture and Storage

Since industrialization, there has been an increase in the use of fossil fuels to meet the energy demands. The use of fossil fuels causes emission of carbon dioxide and other greenhouse gases which results to global warming (Singh, 2013). Global warming can result into a highly injurious impact on Earth's life (Singh, 2013). One way to prevent this is to reduce the use of fossil fuels and an alternative method is to capture and store the emitted carbon dioxide from going to the atmosphere in a process called Carbon Capture and Storage (Singh, 2013).

Carbon capture and storage is a process that captures carbon (iv) oxide from a point source and then stores it securely, usually in a geological formation (Peters & Sognaes, 2019/2021, pg. 7). The capture of carbon can be from a power plant (coal, biomass etc.), industrial site (cement, steel etc.), or even direct air capture from the atmosphere (Peters & Sognaes, 2019/2021, pg. 7). Currently, there are 19 operating Carbon Capture and Storage (CCS) facilities in the world, with 4 under construction, and these facilities have a total capacity of about 40MtCO₂ per year (Peters & Sognaes, 2019/2021, pg. 7).

The process of Carbon Capture and Storage also involves transportation and storage of captured carbon. Currently, most CO₂ is transported through pipeline and is used in Enhanced Oil Recovery (EOR), where it is stored (Peters & Sognaes, 2019/2021). Also, captured CO₂ can be transported through ship, and this is because of increase in CCS facilities (Peters & Sognaes, 2019/2021, pg. 7). For instance, the Norwegian Northern Light Project is expected to ship liquified CO₂ from different industrial capture sites to an onshore terminal, from where the carbon will be transported by pipeline to an offshore storage in the North Sea (Peters & Sognaes, 2019/2021, pg. 7).

To achieve the Paris agreement goal of limiting global warming to well below 2°C, rapid reductions of greenhouse gas emissions is required. IPCC in their report explains that in all their analyzed pathways to limit warming to 1.5°C, they have applied technology to some extent to

neutralize emissions from sources (IPCC, 2018, pg. 3). One example of such technology is Carbon Capture and Storage (CCS). The aim of developing CCS technology is to reduce direct emissions from the burning of fossil fuels and to remove carbon dioxide from the atmosphere at a scale that leads to net negative emissions (Peters & Sognaes, 2019/2021, pg. 7).

Although the technological initiative of Carbon Capture and Storage plays an important role in the pathway towards limiting emissions to well below 2°C, it has received a lot of criticisms with IPCC pointing out that it is a risk relying on this technology because the technological initiative of CCS has not been successful in scale (IPCC, 2018). Other scholars like Hickel (2019), has also criticized the technological initiative of CCS terming it an “allure”, because it allows politicians to postpone the need for rapid emissions reductions.

Whilst the Carbon Capture and Storage initiative has received some criticism, scenarios continue to show the critical role for CCS in meeting climate stabilization targets (Peters & Sognaes, 2019/2021, pg. 28). Scenarios that restrict the use of CCS show much higher costs (about double), and many cannot reach the Paris agreement goal of well below 2°C targets without the use of CCS (Peters & Sognaes, 2019/2021. Pg. 28). Indeed, as stated by the World Energy Outlook (2019), retrofitting existing coal facilities in Asia with CCS is necessary in order to follow their Paris-compliant Sustainable Development Scenario (Peters & Sognaes, 2019/2021. pg. 28). Therefore, the question is not really whether CCS is needed, but at what scale it can be deployed given political realities (Peters & Sognaes, 2019/2021).

3.2.3 Renewable Energy Sources

One of the greatest challenges of the 21st century is climate change. Its impacts are severe, and it could only be avoided if efforts are made to transform the energy systems (IPCC, 2011, pg. 1). Indeed, there is a high concentration of the greenhouse gases into the atmosphere because of use of non-renewable energy, that is, fossil fuels, (IPCC, 2011, pg. 19). Renewable energy sources have a large potential to displace emissions of greenhouse gases that comes from the combustion of fossil fuels (IPCC, 2011, pg. 1). Coal, Oil and Gas are examples of fossil fuels and are the most forms of energy used worldwide. Out of the three, Coal is responsible for the largest climate emissions, followed by Oil and then Gas (Benjaminsen & Svarstad, 2021). To reduce or eliminate the emissions from these fossil fuels, there is need to implement and make use of renewable energy sources like bioenergy, solar energy, geothermal energy, hydropower, ocean, and wind energy

(IPCC, 2011, pg. 1). Proper implementation of renewable sources of energy can lead to social and economic development, energy access, secure and sustainable energy supply, and to a reduction of negative impacts of energy contribution on environment and human health (IPCC, 2011, pg. 1).

The renewable energy sources and their contribution to climate change mitigation is discussed in the following sub-section.

3.2.3.1 Bioenergy

Bioenergy is a renewable energy produced from a variety of biomass feedstock like, agricultural and livestock residues, short-rotation forest plantations, energy crops, the organic component of municipal solid waste, and other organic waste streams (IPCC, 2011, pg. 20). Through a variety of processes, the biomass feedstock can be directly used to produce electricity or heat, or can be used to create gaseous, liquid, or solid fuels (IPCC, 2011, pg. 20). There are a range of bioenergy technologies such as small- and large-scale boilers, domestic pellet-based heating systems, and ethanol production from sugar and starch (IPCC, 2011, pg. 20). Bioenergy technologies have applications in centralized and decentralized settings, with the traditional use of biomass in developing countries being the most widespread current application (IPCC, 2011, pg. 20). With the advent of technology, bioenergy can be utilized by more countries now, creating a positive impact on climate mitigation since it moves away from the reliance on fossil fuels.

Although production of bioenergy is linked to certain environmental problems, contemporary innovative ideas have made bioenergy a sustainable and necessary renewable energy option. As rightly opined by IPCC (2011), providing renewable energy to all of the world's population is one of the biggest challenges of the 21st century. At the same time, the international commitment to lowering the rate of global warming to preindustrial levels will certainly demand the use of bioenergy, carbon capture, and reforestation among other viable mitigation strategies (Röder & Welfle, 2019). It is no doubt that renewable energy is ultimate solution for averting the most destructive effects of climate change that have been witnessed the last few decades. Already the growth of renewable energy is projected to outpace non-renewables in the next few years, a potential for the escalation of bioenergy and emergence in areas where its use has not gained much traction. By its very nature, bioenergy can revolutionize energy consumption and distribution; thereby, helping nations cut on the overreliance on fossil fuels.

Shifting to bioenergy has numerous benefits. First, renewable bioenergy can contribute to a more sustainable, secure, and economically sound future for all by supplying domestic clean energy sources, generating jobs, revitalizing rural economies, and reducing dependence on fossil fuels (Röder & Welfle, 2019). Specifically, biomass can be converted to liquid transportation fuels using the right technology to make it equivalent to common fossil fuels like gasoline and diesel. The advantage is that modern-day technology allows manufacturers of bioenergy to reuse carbon from biomass as well as waste streams turning it into reduced-emission energy sources for jets, trucks, ships, and cars (Röder & Welfle, 2019). Further, the two dominant biofuels known to humanity today are biodiesel and ethanol, which science has proven to be usable in airplanes and most vehicles. A shift to such biofuels would lower the carbon footprint created by the many airplanes and vehicles in use currently and those getting into the market. The last benefit is that bioenergy can also be used for electricity and heating in homes. This can be achieved through bacterial decay, burning, and conversion to liquid or gas fuel (Röder & Welfle, 2019). Certainly, relying on bioenergy for the future will improve the reliability of electricity supply due to the low cost of production and availability of raw materials.

In mitigating climate change, bioenergy offers renewable, low-carbon energy systems, sequestering atmospheric carbon as well as offer numerous environmental and socio-economic benefits (Röder & Welfle, 2019). The amount of carbon released into the atmosphere is one of the major concerns about climate change, but biomass reduces that since the fuel is a natural part of the carbon cycle. As plants get replenished, new ones absorb the same carbon dioxide, creating an element of neutrality where no new amounts of the gas get produced, making biomass exceptionally clean. Therefore, the versatility provided by bioenergy offers a viable alternative to fossil fuels and grants governments an opportunity to invest in a type of energy that is sustainable and readily available.

3.2.3.2 Solar Energy

Solar energy is radiant light and heat from the Sun that is harnessed using a range of technologies such as solar power to generate electricity, solar thermal energy and solar architecture. It is the most abundant of all energy resources and can even be harnessed in cloudy weather (UN, 2022). Solar technologies convert sunlight into electrical energy either through photovoltaic panels or through mirrors that concentrate solar radiation. According to the report by the United Nations, the rate at which

solar energy is intercepted by the Earth is about 10,000 times greater than the rate at which humankind consumes energy (UN, 2022). There are so many advantages of solar energy, for instance, solar technologies can deliver heat, cooling, natural lighting, electricity, and fuels for a host of applications.

The availability of Solar energy offers significant potential for near term (2020) and long term (2050) climate change mitigation (IPCC, 2011, pg. 349). The wide range varieties of solar technologies of varying maturities in most parts of the world contributes to a suite of energy services (IPCC, 2011, pg. 349). The solar technologies offer smaller environmental burden compared to the opportunities it offers for positive social impacts (IPCC, pg. 349). Although not all countries in the world are equally endowed with solar energy, it forms the most abundant of all the energy sources and its contribution to the energy mix is possible for almost every country (IPCC, 2011, pg. 349). Already, there is an escalating demand for energy to enable social and economic growth, and solar energy is touted as a game changer in the quest for climate mitigation. Solar energy is advantageous because it is clean and readily available and can easily meet basic human needs of lighting, cooking, communication, and mobility.

Unlike the burning of fossil fuels that emit a lot of greenhouse gases, solar panels do not emit any harmful gases to the environment. In fact, solar panels transform the sun's light into energy through zero emissions (IPCC, 2011). Many countries around the world are slowly adopting solar energy as a panacea to climate mitigation and adaptation; thereby, reducing the overreliance on fossil fuels that are harmful to the environment. The United States and China are probably the ones leading the pack owing to their large land mass and investment, but countries globally including those in Africa like Kenya are drifting towards an up-scaled solar energy use. Investing in solar energy does not only help mitigate climate change but also provides room for economic growth thanks to the high number of employees working in the sector (IPCC, 2011). More importantly, it has led to the reduction of individual, national, and global carbon footprint, a factor that contributes to the fight against global warming and the whole climate crisis.

Perhaps, one of the least talked about but very instrumental benefits of solar energy is that it causes very little pollution. On the other hand, burning of fossil fuels not only warm the earth but causes massive pollution through emission of nitrous oxides, particulate matter, and Sulphur dioxide, all of which are responsible for health problems like cardio issues (IPCC, 2011). Therefore, solar power offers many health benefits too like reduced cases of respiratory and cardiovascular

problems, chronic bronchitis, and other health challenges. These benefits put solar energy ahead when it comes to preference of clean and renewable energies that can help humanity move away from fossil fuels. However, the investment in solar energy is not yet dominant in many countries making the realization of climate mitigation goals a challenge. With the increase in solar uptake, most of the world nations will undeniably shift to a better energy source that is free and does not cause health problems.

3.2.3.3 Geothermal Energy

Geothermal energy is the thermal energy stored underground (Earth's crust), including any contained fluid, which is available for extraction and conversion into energy products (Manzella, 2017). It is a renewable energy and has the potential to provide long-term, secure base-load energy and greenhouse gas emissions reductions (IPCC, 2011, pg. 416). "Climate change is not expected to have any major impacts on the effectiveness of geothermal energy utilization, but the widespread deployment of geothermal energy could play a meaningful role in mitigating climate change" (IPCC, 2011, pg. 416). In electricity applications, the commercialization and use of engineered geothermal systems may play a central role in establishing the size of the contribution of geothermal energy to long-term greenhouse gas emissions reductions (IPCC, 2011, pg. 416). Thus, geothermal energy is a viable option for combating climate change.

Geothermal energy is particularly important for heating or cooling of homes during winter and summer, respectively. Unlike fossil fuels, geothermal energy is a renewable form of energy that does not emit greenhouse gases responsible for the large chunk of climate change (IPCC, 2011). Although its original establishment could be expensive, the running of geothermal plants later demands relatively low marginal costs since fuel is available for free. Studies show that underground temperatures are also almost consistent everywhere, geothermal energy could offer a suitable option to fossil fuel as it can provide energy used for heating and cooling but can also be channeled to the national electricity grid. For example, in Iceland up to 90% of the household rely on geothermal heating systems since around 2013 (Manzella, 2017). The country is one of the biggest proponents for geothermal energy and their model can be replicated in other countries around the world.

A special 2010 Inter-Governmental Panel on Climate Change (IPCC) report recognized the need for nations to invest in geothermal energy. It also provided guidance on future mitigation options

for climate change by reducing carbon dioxide emissions (IPCC, 2011). Experts posit that geothermal energy is well-suited to mitigation of climate change because it offers base-load power and heating from a huge energy resource that is fairly distributed worldwide (IPCC, 2011). It also has an amazing track record of sustainable production relying on existing technology in developed and developing countries. In addition, geothermal has been proven to be socially acceptable, showcasing some positive social and environmental impacts like small land use footprint (IPCC, 2011). The advantage of geothermal energy is that its adverse impacts are manageable using best practice reservoir management practices like water resource conservation. Thus, geothermal energy has a considerable leverage compared to other energy sources because it is readily available and has low to zero carbon footprint.

Like any new or underdeveloped technology, the uptake of geothermal energy has been low in many countries. According to IPCC (2011), notable barriers to the development of geothermal energy include lack of awareness and data about geothermal energy technology, its advantages for direct use and power, uncertainty in the future of incentive schemes, perceived environmental issues, and the lack of trained geothermal engineers and scientists. These challenges have made it difficult for nations to move with speed to utilize this energy source that offers massive benefits and few environmental concerns. Even so, countries should deem it fit to invest in geothermal energy because it eradicates the concerns around the reliance on fossil fuels and compliments the available power options with a resource that does not get depleted. There is evidence of geothermal investment from many developed countries, but the developing world is still struggling, in part, due to lack of investment capacity. Going forward, geothermal energy is going to be a massive renewable energy source.

3.2.3.4 Hydropower

Hydropower is a renewable form of energy source where power is derived from the energy of water moving from higher to lower elevations (IPCC, 2011, pg. 453). Hydropower plays a very important role in supplying renewable energy to millions of people worldwide (Leichenko & O'Brien, 2019, pg. 122). Statistically, the production of hydroelectricity has doubled over the past three decades, and it is projected to double again by 2050 (Leichenko & O'Brien, 2019, pg. 122). Hydropower offers significant potential for carbon emissions reductions as stated by IPCC (2011, pg. 454). Evidence suggests that relatively high levels of deployment of hydropower over the next

twenty years are feasible, and hydropower should remain an attractive renewable energy source within the context of global greenhouse gas mitigation scenarios (IPCC, 2011, pg. 454).

As acknowledged by the United Nations, the rapid and responsible deployment of clean and renewable energy is vital to the quest of meeting the goals of the Paris Climate Accord. Today, hydropower generation accounts for 70% of the world's renewable energy generation, a proportion that exceeds 80% in South America, according to data from the International Renewable Energy Agency (UN Climate Change, 2022). This confirms that the sector has a monumental role to play toward Paris Agreement implementation. On one hand, hydropower contributes to the reduction of greenhouse gases from burning of fossil fuels while on another water availability and hydropower generation are likely to be impacted by the irregular rainfall patterns that can reduce flow of water in rivers (UN Climate Change, 2022). Thus, hydropower has a unique relationship with climate change. Even so, hydropower still provides water services like reservoirs that can be used to supply water for irrigation, drinking, and flood control.

Notably, the development of hydropower has its associated social and environmental costs. For example, deforestation, displacement of ethnic groups, and impact to marine life are some of the negative impacts that can be brought about by meg hydropower projects (UN Climate Change, 2022). The generation potential of hydropower is also affected by climate change that is responsible for extreme weather events. For instance, between 2014 and 2017, Brazil witnessed unprecedented reduction in the amount of water in its hydropower plants, resulting in higher water consumption tariffs (UN Climate Change, 2022). Therefore, hydropower should not only be seen as a contributor to the objectives of the Paris Accord by its avoidance of greenhouse gases, but also in projects that help in reducing the environmental impacts common with large projects. The contribution of hydropower to clean energy is undisputed since most countries have their electricity grid majorly supplied by power from hydro plants.

3.2.3.5 Wind Energy

Wind energy refers to the process of using the movement of air to convert it into mechanical power or electricity (Morrison, 2022). Wind energy provides us with a powerful, clean, and sustainable renewable energy source (Morrison, 2022). It is the second largest source of global renewable energy production after the hydropower (Morrison, 2022). Wind energy is incredibly clean form of energy and the carbon dioxide emissions caused during manufacturing and installing wind

turbines can be easily offset during the first year of operation (Morrison, 2022). Moreover, wind energy is sustainable, and the electricity produced through wind energy is cheap compared to other sources like hydropower (Morrison, 2022).

As per the IPCC report, Wind energy offers significant potential for near-term (2020) and long-term (2050) greenhouse gas emissions reductions (IPCC, 2011, pg. 551). Several different wind energy technologies are available across a range of applications, but the primary use of wind energy of relevance to climate change mitigation is to generate electricity from larger, grid-connected wind turbines, deployed either on- or offshore (IPCC, 2011, pg. 551). Focusing on these technologies, the wind power capacity installed by the end of 2009 was capable of meeting roughly 1.8% of worldwide electricity demand, and that contribution could grow to more than 20% by 2050 if ambitious efforts are made to reduce greenhouse gas emissions and to address the other impediments to increased wind energy deployment (IPCC, 2011, pg. 553). “Achieving the higher end of this range would be likely to require not only economic support policies of adequate size and predictability, but also an expansion of wind energy utilization regionally, increased reliance on offshore wind energy, technical and institutional solutions to transmission constraints and operational integration concerns, and proactive efforts to mitigate and manage social and environmental concerns” (IPCC, 2011, pg. 553).

With many countries working hard to lower carbon emissions, wind energy has turned out to be one of the most effective forms of renewable energy. Nations like Denmark, United Kingdom, Australia, China, and the United States have recognized the huge benefits of wind energy, as evidenced by their huge investment in the sector. As humans invest more in wind energy for electricity generation, we are essentially lowering greenhouse gas emissions and reducing the dependency on fossil fuels (IPCC, 2011). Wind farms are regarded as a form of clean energy because they do not emit greenhouse gases when they generate electricity, like is common with coal and other fossil fuels. Moreover, minimal or no energy is wasted during the conversion of wind energy to electricity. In contrast, it is estimated that about half of energy gets lost during the production process for fossil fuels. Therefore, wind energy is not just clean and renewable, it is also very efficient and offers unlimited supply of electricity as long as the wind keeps blowing.

Wind energy has a huge potential in countries where its development is still low owing to its massive benefits. Obviously, wind energy creates jobs. In the United States, the wind energy sector

has employed more than 100,000 workers and has the potential of supporting more than 600,000 jobs in installation, manufacturing, maintenance, and support services (Office of Energy Efficiency & Renewable Energy, n.d.). Wind is also a domestic source of energy that is inexhaustible. In the last decade, the U.S. wind power capacity has grown by 15% annually and wind is currently the biggest source of renewable power in the United States (Office of Energy Efficiency & Renewable Energy, n.d.). In Kenya, the government and other sector workers have also sped up the adoption and implementation of wind energy, most of which are located on the hillsides where the wind speeds are high and consistent. Wind energy generated by those firms gets channeled to the national grid, which supplies electricity to households and industries.

3.3 Adaptation

As stated by Leichenko & O'Brien (2019), adaptation is generally understood as “a change that is made in response to a new condition, and often connotes with a new behaviour, strategy, or intervention that is designed to accommodate or take advantage of a particular environmental or social change” (Leichenko & O'Brien, 2019, pg. 172). Adaptation to climate change as explained by IPCC, is “the process of adjustment to actual or expected climate and its effects” (IPCC, 2014d: 118).

Solutions to adaptations can take many forms and shapes depending on the unique context of a community, business, organization, country or region (UNFCCC, 2022). Many countries and different communities are already taking steps to build resilient societies and economies through adaptation (UNFCCC, 2022). The success of adaptation not only depends on governments but also on the active and sustained engagement of stakeholders including national, regional, multilateral, and international organizations, the public and private sectors, civil society, and other relevant stakeholders, as well as effective management of knowledge (UNFCCC, 2022).

Parties to the UNFCCC and its Paris Agreement recognize that adaptation is a world's challenge faced with all with local, subnational, national, regional, and international dimensions (UNFCCC, 2022). Adaptation is a key component of the long-term global response to climate change to protect people, livelihoods, and ecosystems (UNFCCC, 2022). Parties to UNFCCC acknowledge “that adaptation action should follow a country-driven, gender-responsive, participatory and fully transparent approach, considering vulnerable groups, communities and ecosystems, and should be

based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions” (UNFCCC, 2022).

There are four discourses that give different interpretations to adaptation as explained by Leichenko & O’Brien, (2019). The discourses are biophysical discourse, critical discourse, integrative discourse, and dismissive discourse.

3.3.1 Biophysical Discourse

Within the biophysical discourse as explained by Biagini et al (2014), adaptation is often understood to be a technical, managerial, or behavioral intervention that minimizes exposure or reduces the severity of a particular climate impact (Leichenko & O’Brien, 2019). Technical adaptations may include engineering measures such as raising bridges to accommodate higher water levels or installing irrigation systems in response to increasing agricultural demands for water (Leichenko & O’Brien, 2019). Equally, as stated by Stewart et al (2007), technical adaptation measures can also entail taking advantage of opportunities associated with climate change, such as cultivating grapes to produce wine in regions where climate have warmed or expanding cruise tourism in arctic region where sea ice has diminished (Leichenko & O’Brien, 2019). On the other hand, managerial and policy measures may include new regulations on how infrastructure is built or managed (Leichenko & O’Brien, 2019). Lastly, behavioral measures within biophysical discourse may include changes in the timing of agricultural practices or informational and educational campaigns that seeks to raise awareness of dangers associated with extreme events such as heat waves (Leichenko & O’Brien, 2019).

3.3.2 Critical Discourse

As stated by Pelling (2011), adaptation within the critical discourse tends to draw the attention to the root causes of vulnerability (Leichenko & O’Brien, 2019). These includes economic and social processes and inequalities that put people in a vulnerable way (Leichenko & O’Brien, 2019). The most effective approaches to adaptation are understood to involve addressing root causes including on-the-ground processes of social differentiation, unequal access to resources, poverty, poor infrastructure, lack of representation and inadequate systems of social security (Leichenko & O’Brien, 2019). For adaptation processes and outcomes to be more equitable, the critical discourse

emphasizes the need for inclusion and representation of vulnerable and disadvantaged communities in adaptation decision making (Leichenko & O'Brien, 2019).

3.3.3 Integrative Discourse

As argued by Wilbanks and Kates (2010), integrative discourse on adaptation recognizes that climate change is taking place within a dynamic social context that is influenced by numerous ongoing changes, such as globalization, urbanization, and technological innovation (Leichenko & O'Brien, 2019). In responding to multiple processes of change, integrative discourse emphasizes the need for new pathways and possibilities for creating sustainable development trajectories (Leichenko & O'Brien, 2019). As explained by Shaw et al (2014), integrated strategies links adaptation, mitigation, and sustainable development by engaging a wide range of actors and appealing to values related to both the environment and quality of life (Leichenko & O'Brien, 2019). This includes identifying outcomes of climate change adaptation that are valued within other discourses, such as social well-being (Leichenko & O'Brien, 2019).

3.3.4 Dismissive Discourse

Even though the dismissive discourse does not consider climate change as a serious concern, it nonetheless supports the approaches to adaptation (Leichenko & O'Brien, 2019). For instance, the dismissive discourse may take a more fatalistic approach and assume that adaptation will occur autonomously, based on the idea that humans have always adapted to climate change (Leichenko & O'Brien, 2019). In extreme cases such as drought conditions, people may be encouraged to pray for rain and have faith that it will rain (Leichenko & O'Brien, 2019).

3.4 Adaptation Strategies

As postulated by Leichenko & O'Brien (2019), adaptation strategies may be reactive, passive, or anticipatory depending on the timing and intention of adaptation.

3.4.1 Reactive Adaptation

This includes actions that are deliberately taken in response to the experienced impacts of climate shocks and stresses (Leichenko & O'Brien). For instance, regions where there is extreme heat and it is making it difficult for people to work, individuals do autonomously adapt their work schedule to be either in the morning or late in the evening when the heat energy is low (Leichenko & O'Brien, 2019). In areas prone to cyclones, owners upgrade their houses using new building standards that are more resistant to cyclones. The idea behind reactive adaptation is to prevent the

consequences that may reoccur when extreme weather events emerge in the future. But while reactive adaptation is effective, humanity should consider moving beyond reactive approaches and find better means of disaster preparedness and adaptation to the impacts of climate change in general (Leichenko & O'Brien, 2019). For instance, governments can develop policies that shield farmers against the consequences of climate change and improve their resilience. Thus, reactive adaptation is effective, but it can be improved through better preparedness.

3.4.2 Passive Adaptation

They include actions and adjustments taken because of changing environmental conditions but not purposely intended to respond to climate change (Leichenko & O'Brien, 2019). For instance, a study done by Tripathi & Mishra (2017) among farmers in India, found that despite farmer's disbelief in climate change, they were taking numerous adaptation actions like changing their farming practices in ways that enhanced capacity to cope with a changing climate (Leichenko & O'Brien, 2019). Although passive adaptation does not always get the attention it deserves, studies have shown that they are very instrumental in changing people's perceptions on climate change. For example, encouraging farmers to plant trees whenever they clear land to farm increases the amount of carbon sink. Besides, when people shift to electric cars due to social class or otherwise, they inadvertently reduce the amount of carbon dioxide in the atmosphere because they move away from cars dependent on petrol or diesel. Thus, a change in behavior or agricultural practice may never be intended to help mitigate climate change, but in the end, that goal is more often than not achievable.

3.4.3 Anticipatory Adaptation

They include actions and strategies that are planned and may entail proactive policies that are adopted prior to anticipated future climate conditions, such as higher sea levels, heavier rainfall events, or more severe heat waves (Leichenko & O'Brien, 2019). Planning is necessary for most anticipatory adaptations, particularly for large scale infrastructure such as public transportation systems that are expected to last longer (Leichenko & O'Brien, 2019). As opposed to reactive and passive adaptation strategies, anticipatory adaptation focusses on the preparedness aspect. Thus, countries develop early warning signs at different scales. For example, Japan, a country that suffers frequent earthquakes and cyclones, developed warning signs that tell authorities when and the magnitude of an impending earthquake. As a result, they are able to evacuate people and plane

well enough to respond to the impacts of the huge water overflows into human neighborhoods. Anticipatory adaptation can also be used when planning on how to address food insecurity when forecasts show that rainfall amounts will be low. Therefore, anticipatory adaptation is arguably the best bet when it comes to climate change adaptation.

3.5. The Institutional Arrangements and Capacity Approach

3.5.1 The Institutional Arrangements

“Institutional arrangements often include the necessary legal, administrative and procedural arrangements to report on the progress of climate action, to ensure transparency and accountability, evaluate performance and to identify areas of improvement” (UNFCCC, 2019, pg. 16). Countries with national institutional arrangements often have an earmarked budget and dedicated staff to enable their smooth functioning (UNFCCC, 2019, pg. 16). Usually, the institutional arrangements involve ministries and agencies responsible for a range of sectors (UNFCCC, 2019, pg. 16). For instance, the government ministries like environment, agriculture, energy, transport, forestry, finance in collaboration with other ministries allows government to realize climate action by establishing aligned objectives in different institutions or ministries and to incorporate climate considerations into other major national policies (UNFCCC, 2019, pg. 16). Most countries that are party to UNFCCC (United Nations Framework Convention on Climate Change), have established institutional arrangements purposely for planning, implementation, and monitoring of climate action (UNFCCC, 2019, pg. 15).

Many countries within the UNFCCC have set up dedicated ministries for climate action, while other countries have established inter-ministerial commissions or inter-institutional coordination mechanisms at the highest political level, underpinned with a legal mandate (UNFCCC, 2019, pg. 15). However, having a strong institutional arrangement can be quite challenging as this depends on short-to-medium term political and economic priorities, human and financial capacities within the country (UNFCCC, 2019, pg. 15). Nevertheless, climate change mitigation and adaptation are becoming more deeply lodged into government structures responsible for environment, energy, transport, agriculture, forestry, emergency management among many other sectors within the government structure (UNFCCC, 2019, pg. 16). This illustrates the increasing profile of climate change in national political agendas (UNFCCC, 2019, pg. 16).

The Institutional arrangement approach will therefore help this study to know the various institutional arrangements in Kenyan government while addressing climate change. Equally, the approach would help the study to know how climate change adaptation and mitigation are embedded in government structures or agencies in Kenya.

3.5.2 The Capacity Approach on Climate Related Actions

An institutional approach based on capacity assessments can provide useful insights, both at national and international levels on the appropriate steps for climate actions (Willems & Baumert, 2003). The two categories of capacities that are typically needed for climate change as a horizontal concern are climate-specific capacities and climate-relevant capacities (Willems & Baumert, 2003). Like any other policy matter, addressing climate change requires the development of a specific capability, i.e., a capability dedicated to creating climate actions (Willems & Baumert, 2003). Most of the institutional capability that will likely be required for climate activities is not, however, climate-specific, but rather climate-relevant because climate change is a multifaceted issue as postulated by Willems and Baumert (2003). In many different industries, including energy, transportation, agriculture, and forestry, it will have been created for reasons other than climate change, yet it may have the biggest influence on the effectiveness of climate initiatives or policies (Willems & Baumert, 2003). Once again, due to their interdependence, these two categories of capacities are necessary. Climate change is still a new problem compared to most other policies. Therefore, building a climate-specific capability is necessary to launch climate policy (Willems & Baumert, 2003). For other policy areas to build the capacity to integrate climate objectives with their other sectoral aims, it is also necessary to exert influence over those other policy areas (Willems & Baumert, 2003). In contrast, if climate-relevant capacities are not there, a climate-specific skill may not be able to grow sufficiently. For instance, if the civil service is ineffective, sufficient climate knowledge may not be able to grow inside the public sector (Willems & Baumert, 2003). A distinction between climate-specific capacity and climate-relevant may not even exist in an ideal form of public governance (Willems & Baumert, 2003). The need for a climate-specific capability, such as human resources or climate-specific networks, may be quite minimal if other policy sectors effectively integrate climate objectives into their own and if the public sector and society have significant networking capabilities (Willems & Baumert, 2003). However, there will always be a need for fully developed climate-specific and climate-relevant

capacities if traditional forms of governance based on sectoral policies are in place (Willems & Baumert, 2003).

Governments need to have the necessary capacity in place before taking steps to combat climate change (Willems & Baumert, 2003). The country can have the capacity through her own means or through the assistance of the international community to respond to climate actions (Willems & Baumert, 2003).

For effective response to climate change, human resource capacity, financial capacity and technological capacity are needed. The following sub-section will therefore discuss the relevance of the three mentioned capacities in climate related actions.

3.5.2.1 Human Resource Capacity

As argued by Willems and Baumert (2003), the way individuals and organizations interact both in the public sector and within society may be more relevant to the overall level of capacity. This is particularly true and applicable to climate policy (Willems & Baumert, 2003). In all phases of climate policy, capacity is required: for example, a strong monitoring, reporting, and review system is needed to enhance the effectiveness of the climate strategy and individual policies and measures over time (Willems & Baumert, 2003).

To launch climate policy, there must be a sufficient level of climate-specific capacity, including: adequate staff members dedicated to climate issues in the primary organization in charge of climate, other pertinent agencies/ministries, important research centers (or consulting firms), businesses, and non-governmental organizations; recognition of climate change in organizational structures; institutional arrangements to develop a climate strategy with the cooperation of all relevant parties (Willems & Baumert, 2003). This capacity needs to be gradually expanded to include the design and implementation of policies and measures as well as monitoring, reporting, and review (Willems & Baumert, 2003).

The most valuable resource to an institution or organization are its staff (Turner & Hulme 1997, pg. 116). Without staff, there would be no organization because they perform the tasks, coordinate the tasks, organize the inputs that eventually leads to the outputs (Turner & Hulme 1997, pg. 116). For greater efficiency and effectiveness in an organization, Human resource Development (HRD), and Human Resource Management (HRM), are of great concern to reformers or policy makers

(Turner & Hulme, 1997, pg. 116). HRD is open to different definitions but in a narrower sense, it refers to organizational activities directed to improving the skills and capacities of its workforce (Turner & Hulme 1997, pg. 116). On the other hand, HRM focuses on selection, recruitment, appraisal, reward, and career development within an organization (Turner & Hulme 1997, pg. 116). The relevance of HRD and HRM is that they are the principal means used to promote increases and improvements in an organizational capacity (Turner & Hulme 1997, pg. 116).

A variety of administrative reforms are always employed by the governments to improve the efficiency in human resource development (Turner & Hulme 1997, pg. 130). Training has been the major reform in human resource development, and it is usually done in many ways (Turner & Hulme 1997, pg. 117). For instance, through education in terms of long courses, short courses, specialized courses, one-day workshops, over-public sector training institutes, overseas through scholarships, and in the field (Turner & Hulme 1997, pg. 117). Although training has received some criticism, it is always viewed as the interrelated component for organizational change and administrative reform (Turner & Hulme, 1997, pg. 118).

On climate related actions, education as a form of training raises awareness about human and institutional capacity on climate change mitigation, adaptation, and impact reduction, as well as on early warning systems (UNESCO, 2021). Equally, education on climate related actions also promotes mechanisms for raising capacity for effective climate change related planning and management in developing countries (UNESCO, 2021).

Similarly, capacity development helps individuals, organizations, and societies to mitigate and adapt to climate change (UNFCCC, 2019, pg. 29). In the past recent years, the number of national policies and entities in developing countries have grown significantly and this has led to enhanced climate related capacity (UNFCCC, 2019, pg. 29). Governments from developing countries that are party to UNFCCC, are also beginning to increase national climate related capacity through awareness creation, education and by integrating climate issues into school curricula (UNFCCC, 2019, pg. 29).

In a nutshell, increased and improved human resource capacity is necessary to coordinate relevant ministries and agencies in government for better mainstreaming of climate considerations in national planning and budgeting (UNFCCC, 2019, pg. 29).

3.5.2.2 Financial Capacity in Climate Actions

Climate finance refers to local, national, or international funding that supports mitigation and adaptation measures to address climate change (UNFCCC, 2022). It is derived from public, private, and alternative sources of funding (UNFCCC, 2022). The Convention, the Kyoto Protocol, and the Paris Agreement all demand that Parties with greater financial means provide aid to Parties who are less wealthy and more vulnerable (UNFCCC, 2022). Because major investments in reducing emissions are needed, climate finance is essential for mitigation (UNFCCC, 2022). Since large financial resources are required to mitigate the effects of a changing climate and make accommodations for their negative effects, climate financing is equally vital for adaptation (UNFCCC, 2022).

Climate change is viewed as a key environment and development challenge affecting all continents and threatens to undo all progress made towards poverty reductions (UNDP, 2011, pg. 6). Governments therefore need a new way forward that can help their economies grow in a manner that acknowledges the pressing reality of climate change (UNDP, 2011, pg. 6). The new development therefore requires dramatic increase in climate finance (UNDP, 2011, pg. 6). This will cost billions of dollars making it impossible for developing countries which have contributed fewer greenhouse gas emissions to effectively respond to climate change (Miller & Jordan, 2022).

On that note, during COP 16, it was agreed that the developed countries that are party to UNFCCC, should jointly mobilize an equivalent amount of USD 100 billion per year by 2020 to address the needs of developing countries (UNFCCC, 2019, pg. 23). On the same note during COP 21, it was agreed that the developed countries should continue their existing collective mobilization goal up to the year 2025 (UNFCCC, 2019, pg. 23). Furthermore, article 9 paragraph 3 of the Paris Agreement stipulates that, developed countries that are party to UNFCCC should take the lead in mobilizing climate finance from a wide variety of sources, instruments, and channels, considering the needs and priorities of developing countries that are party to UNFCCC (UNFCCC, 2019, pg. 24). Similarly, developed countries have been channeling climate support to developing countries through multilateral, bilateral, regional among many other channels (UNFCCC, 2019, pg. 24).

The assistance offered by developed countries to developing countries is necessary because developed countries have adequate preparation with climate change impact owing to their enormous finances and technology (Wijaya, 2014, pg. 1). Consequently, developing countries

deserves climate support from developed nations because developing countries have limited capability and are more vulnerable to climate change (Wijaya, 2014, pg. 1).

Therefore, this concept would guide the study to know the amount of financial assistance offered to Kenyan government by the developed world in combating climate change. Likewise, the study would determine if Kenya on her own has earmarked budget for climate related actions.

3.5.2.3 Technological Capacity in Climate Related Actions

Technology plays an important role in reducing vulnerability to climate change (Klein et al, 2005, pg. iii). This is because technologies help in development of information and awareness creation, planning and designing adaptation strategies, selecting appropriate adaptation techniques, and implementing them, and finally monitoring and evaluating their performance (Klein et al, 2005, pg. iii). The technological need of a country is determined by doing Technological Needs Assessment (TNA) (UNFCCC, 2019, pg. 28). The aim of doing so is to support national sustainable development, build national capacity and facilitate the implementation of prioritized climate technologies (UNFCCC, 2019, pg. 28).

Most technological development takes place in the Global north and China, while it is in poorer countries that technology are needed to combat climate change because of their vulnerability to climate shocks (Mathieu, 2020). On that note, during COP-7, in the year 2001, the member states to UNFCCC present at the meeting established an Expert Group on Technology Transfer (EGTT) with the objective of implementing article 4.5 of the UNFCCC (Klein et al, 2005, pg. 1). The article stipulates that “the developed country Parties and other developed Parties shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention. In this process, the developed country Parties shall support the development and enhancement of endogenous capacities and technologies of developing country Parties” (Klein et al, 2005, pg. 3). Therefore, technological transfer is one of the ways to help poorer countries strengthen their adaptive capacity to climate change.

The historic Paris Agreement, which was ratified by nations in 2015, opens a new chapter in efforts to combat climate change on a worldwide scale (UNFCCC, 2019). It prepares the ground for the transmission and development of vitally required climate technology (UNFCCC, 2019). Notably,

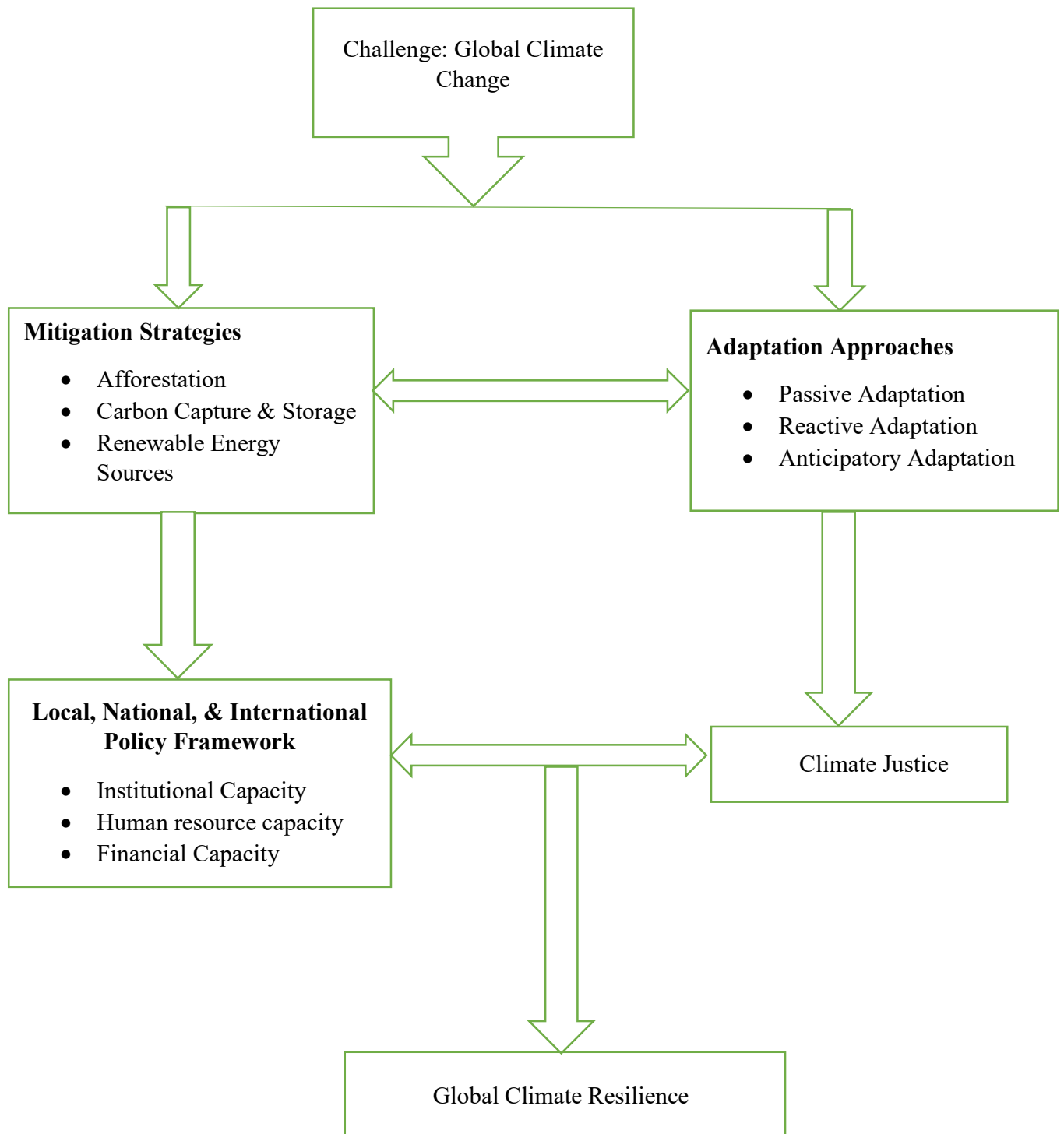
member parties decided that the Technology Mechanism would be a crucial component in putting the Paris Agreement into practice and anchored it inside the Agreement (UNFCCC, 2019). Additionally, the member parties to UNFCCC enhanced the Technology Mechanism by seeking more work on endogenous capacities and technologies as well as technology research, development, and demonstration (UNFCCC, 2019). The Paris Agreement also established a technical framework to give the Technology Mechanism general direction (UNFCCC, 2019). Countries will develop the framework to improve their technological efforts during the coming years. Combining forces with the technological framework, the Technology Mechanism will assist nations in limiting the rise to global temperature and adapt to climate change (UNFCCC, 2019).

Evidently, the UNFCCC report on developed nations shows an increase in the number of supported technology development and transfer activities to developing countries from 190 in the year 2010-2012, to almost 300 in the year 2013-2014 (UNFCCC, 2019, pg. 28). This is a clear illustration of commitment to article 4.5 of UNFCCC by the developed nations to poorer countries. Similarly, digital technologies can contribute to enhancing adaptive capacity to climate change by supporting the flow of useful and locally contextualized climate information as well as the communication between stake holders in responding to climate shocks (IIED, 2019). For instance, the current smart city development trend, with digitalization as its main component, triggers planners to build communication and information capacities that ensures climate resilience of the cities (Kim, 2021).

In conclusion, the development and transfer of technology is significant as it helps countries to effectively reduce climate emissions and adapt to the adverse effects of climate change. Notably, technology has been recognized as one of the essential elements for adapting to climate change (IPCC, 2015)

3.6. Summary of Theoretical Framework

Below is a summary of my theoretical framework. I argue that a combination of mitigation strategies and adaptation approaches, supported by proper legislative framework and climate justice will yield climate resilience.



CHAPTER 4: RESEARCH METHODOLOGY

This chapter deals with the methodological approach of the study and present the methods used to collect and analyze data.

The chapter presents the Qualitative research approach, data collection methods and the possible challenges while doing qualitative research.

4.1 Qualitative Research Approach

According to Kirsti (2001), qualitative research entails the systematic gathering, organization, and analysis of textual materials acquired from conversation or observation. This method provides a series of instruments that enable the researcher to go deeper into and uncover parts of the reality in which people live (Jacobsen, 2015). The qualitative technique was chosen for this study not only because it is about acquiring information in the form of words, but also because it strives to gain an in-depth understanding of how individuals comprehend and act on their relationships with the environment (Jacobsen, 2015).

The qualitative research method has both advantages and disadvantages. It excels at describing specific situations or people, deducing meaning from interviewees and observations, and comprehending the processes that lead to behaviors and consequences (Maxwell, 2013). Furthermore, as noted by Patton (2002), qualitative research methods are helpful since they involve fieldwork, or direct and personal contact with persons under investigation in their own setting. People being studied can provide accurate information about their circumstance or event, as well as describe their perceptions and interpretations of the research topic (Jacobsen, 2015). On the other side, the flexibility of qualitative research contributes to its weakness in that the research can become a never-ending process because flexibility can lead to the collection of many data (Jacobsen, 2015).

The concept of reflexivity in qualitative research is an important consideration in this study. Patton (2002) defines flexibility in qualitative research as highlighting the importance of self-awareness, political and cultural consciousness, and ownership of one's position (Patton, 2002, pg. 64). According to Cohen et al. (2018), reflexivity is a critical component in addressing participants' perspectives on the study subject.

4.2 Data Collection Methods

The research includes both primary and secondary data. Interviews with public authorities are considered primary data, whereas data received from documents is considered secondary data. The study did not conduct fieldwork or physical interviews due to the Covid-19 outbreak and the resulting government regulations. However, the study chose the route of online interviews, which were guided by the university's platform.

An important characteristic in data collection method is triangulation. This is the use of more than one method or source of data in the study of a social phenomenon so that findings may be cross-checked (Bryman, 2008). To eliminate gaps in data gathering, the study employed both interviews and document analysis to ensure that the conclusions are reliable. Similarly, the utilization of both interviews and documents has aided the study in validating and confirming the data's quality.

4.2.1 Document Analysis

Document analysis is the systematic procedure of reviewing or evaluating documents, that is, both printed and electronic materials (Bowen, 2009). As argued by Corbin & Strauss (2008), examination and interpretation of data is required in document analysis in order to elicit meaning of data, gain understanding and develop empirical knowledge (Bowen, 2009). Documents can be characterized as notes, case reports, contracts, drafts, statistics, annual reports, expert opinions, judgements among many others (Flick, 2019, pg.159). As stated by Bowen (2009), documents can provide background information and broad coverage of data and are therefore helpful in contextualizing one's research within area of study or field. More so, documents can also contain data that can no longer be observed, provide details that informants have forgotten and can track change and development (Bowen, 2009).

The study has analyzed the documents in what Bowen (2009), referred to as "thematic analysis", which categorizes patterns of the data into different themes. This according to Bowen (2009), includes coding and construction of categories to investigate themes to a phenomenon. The study has relied on public documents to get Kenya's response strategies to climate change and therefore, the study has developed coding guide to help capture the different responses to climate change in line with mitigation and adaptation strategies. Chapter 6 will elaborate further on this and show empirical findings from document analysis.

4.2.2 Interviews

Due to Covid-19 pandemic and resultant government's restrictions, the study did not do physical interviews. However, the study took the path of online interview through zoom that was necessitated by the university. Online interview as argued by Flick (2019), "can be organized in a synchronous form, which means that you get in touch with your participant in a chatroom where you can directly exchange questions and answers while you are both online at the same time" (Flick, 2019. Pg. 243).

There are so many forms of interview, but this study has taken the semi-structured interview style. As defined by Cohen et al. (2018), semi-structured interview is when "the topic and questions are given, but the questions are open-ended and the wording and sequence may be tailored to each individual interviewee and the responses given, with prompts and probes" (Cohen et al., 2018, pg. 511). By having semi-structured interview for this study, the interview questions will be more open giving room for new ideas for the research issue and this can result in collection of more valuable data.

Interview guide is one of the elements of semi-structured interview (Flick. 2019, pg. 245). It consists of the main questions to be covered within the research topic and serves as a checklist to ensure that the topics are well covered during the interview (Cohen et al., 2018). The study used the interview guide that ensured that the topics were well covered during the interview.

4.2.2.1 Sampling Strategy

A sample is a smaller group or subject of the total population being studied (Cohen et at, 2018). There are several types of sampling, but this study has used purposive sampling which is also known as non-probability sampling. As defined by Cohen et al. (2018), purposive sampling is when the researcher chooses members of the population (cases) to be included in the sample based on their typicality or possession of characteristics being sought (Cohen et al. 2018). Purposive sampling is viewed as time and money saving as the researcher always believes that a representative sample can be obtained through sound judgement (Dudovskiy, 2018).

This study has chosen purposive sampling because the study focused on a specific case of response strategies to climate change. The target group for this study was officials from public agencies and private organizations.

To get good samples, the study combined both purposive sampling and snowball sampling. Central to snowball sampling is networking and referral whereby the participants are asked to recommend other contacts who fit the research criteria and who potentially might also be willing participants, who then in turn recommend other potential participants (Parker, Scott & Geddes, 2019). Through snowball sampling, the study was able to get participant 4 and 5, through participant 3. They were both referred and recommended by participant 3.

4.2.2.2. Strengths and weaknesses of the selection method

One of the advantages of purposive sampling is that the sample can produce results that are available in real time (Regoli, 2019). The participants all possess an appropriate level of understanding and knowledge about issue being examined, hence less delay in data processing (Regoli, 2019). You don't need to process the data to acquire results because you can ask specific queries that generate the exact responses you need in any case (Regoli, 2019). This method enabled the study to select participants with known knowledge of the issues that were being examined. All participants were well versed with climate change issues.

Another strength of the selection method is that it made the interview process a success due to the flexibility nature of purposive sampling. This is because the selection method provided an adaptive procedure in the sense that it allowed for the addition, elimination, or rewording of certain interview questions. For example, participants were asked about climate change discourses, such as whether climate change is a biophysical discourse, a critical discourse, a dismissive narrative, or an integrative discourse. This was a follow-up question after they responded to the interview guide questions on their views on climate change.

On the other hand, the main disadvantage of purposive sampling is that it is prone to researcher bias because researchers make subjective or generic assumptions when selecting participants for their research (Regoli, 2019). Although this is unavoidable process as the researcher has the powers to select participants relevant for the research, this study dealt with this issue by combining purposive sampling with snowball sampling. Indeed, the participants selected through purposive sampling recommended other participants that were relevant for the study through snowball sampling. For example, participant 4 and 5, were both recommended by participant 3.

Furthermore, another disadvantage of purposive sampling is that it may be challenging to defend the representative nature of the sample (Regoli, 2019). Researchers must show proof that the

judgment used to pick the various purposive sample units or persons was appropriate for the process used (Regoli, 2019). In practically every circumstance, the high degrees of subjectivity put an unavoidable shadow of doubt on the results (Regoli, 2019). There will always be readers who are skeptical about the generalizations achieved, even when theoretical, logical, or analytical structures are present, unless there is a means to justify the overall representative structures that were employed to generate findings (Regoli, 2019). Since the study was specific on climate change issues, the participants chosen were representatives of organizations and public agencies that were responsible for environmental matters in Kenya. For example, there were participants from the Ministry of Environment, ministry of energy, ministry of agriculture among many others. The representative nature of the chosen participants for this study is a clear proof that the judgement used to select participants was appropriate.

4.2.2.3. Informants

In qualitative research, we have key-informants and informants. A key-informant is a person with knowledge about what is being done in the study area (Haberg, 2020). On the other hand, an Informant is a person who responds to the questions being asked by the researcher, where the researcher may only meet the informant once to hear his or her opinion on the issue (Haberg, 2020). Usually, the key-informant answers questions as a representative of a public or development agency, whereas the informant answers questions in terms of their own experiences (Haberg, 2020). The study had key-informants only. This is because representatives from public agencies and private organizations in Kenya, are the only ones that can help in providing official information on how the Kenyan government have responded to climate change.

The study had five key-informants. Out of the five key-informants, three came from the government ministries, one from devolved units, and one from non-governmental organization.

Key Informant 1 – Ministry of Environment and Forestry

Key Informant one is an expert working with the Ministry of Environment under the department of Climate Change Directorate. The informant has education background in Environmental Engineering and holds key position in the department of climate change directorate. The Ministry of Environment is mandated to protect, conserve, and manage the environment and natural resources for socio-economic development.

Key Informant 2 – Christian Aid Organization Kenya.

Key Informant 2 is another environmental expert from Christian Aid Organization which is a Non-Governmental Organization in Kenya. The informant is a project manager in matters of climate change and has education background in Environmental Planning and Management. The organization deals with Climate change and Energy as one of their works in Kenya.

Key Informant 3 – Kajiado County Government

Key informant 3 is a development actor from Kajiado County government. The informant is attached to department of lands, physical planning, and urban development within Kajiado county government. He has a background in environmental studies and is well experienced in matters of climate change.

Key Informant 4 – Ministry of Energy

I managed to have a fourth interview with an expert from the Ministry of Energy. The interviewee is well experienced on matters of clean energy and is one of the senior staffs at the Ministry of energy. The informant elaborated how Kenya is one of the leading users of renewable energy in the world.

Key Informant 5 – Ministry of Agriculture

My last interviewee was from the Ministry of Agriculture under the department of Livestock. The interviewee was very instrumental on matters of adaptation and explained how farmers in Kenya are shifting to short term duration crops due to changes in rainfall patterns.

4.2.2.4 Research Assistant

Due to Covid-19 pandemic and the resultant government restrictions, I did not travel to Kenya for physical interviews. In that case, I employed research assistant who helped in facilitating online interviews. The following were the roles of the Research Assistant:

- Identifying Key-informants
- Scheduling and booking appointments with Key-informants.

4.3. Ethical Considerations While Doing Qualitative Research

Ethics is concerned with what is good and bad, or what is right and wrong, and it is concerned with researcher's behaviour in the sense that it entails what the researcher ought and ought not to do in their research (Cohen, 2018).

There are ethical considerations a researcher must adhere to while doing qualitative research. Central to these considerations are informed consent, biases that the researcher might have, and ethics in data analysis.

4.3.1 Informed Consent

As articulated by Cohen et al. (2018, pg. 122), informed consent is concerned with matters of autonomy, and it gives the participants rights to freedom and self-determination. The participants have the right to self-determination, meaning they have the right to consider the benefits or risks of participating in research (Cohen et al., 2018). By this they have the right to choose whether to participate or refuse to participate, and as well withdraw their participation at later stage (Cohen et al., 2018). Since the interview was online through zoom, and some aspects of personal data like voice recordings, background information, image and IP-address was going to be captured, the study had to comply with General Data Protection Regulations (GDPR) in Norway by subjecting research project proposal to Norwegian Centre for Research Data (NSD) for approval.

Fortunately, my application at Norwegian Centre for Research was approved before starting the interviews. Also, I was able to share the information and consent form with all the informants and gotten their consent before the interviews. The information and consent forms were all signed and stamped by all the informants. The informed consent sheet by all the informants will be included in the Appendix section of the thesis.

Since my informants were public officials and experts within the field I was researching, I initially thought of disclosing their names and careers, but this later changed when I took into consideration the right to privacy and protection from harm as stipulated by Cohen et al., (2018). Therefore, I anonymized my participants and labelled them as Informant 1,2,3,4,5 and 6. Similarly, as the interview was voice recorded, I sought permission from informants both in writing through consent form and also verbally during interview if I can store the voice records, and they all agreed that I can store the voice recordings as long as I want, so long as it is used for purposes of my research. Luckily, I did not encounter any biases or ethical concerns, as a person, either by being a black Kenyan in Norway, or by being a male and Luo in Kenya, where ethnic biases can sometimes play a huge role in information access.

4.3.2 Biases

The term bias as postulated by Kristi (2021), can generally be understood as an inclination or tendency in favour of or against one thing, in a way considered to be unfair or not revealing the reality. From literature point of view as argued by Oreg & Bayazit (2009), bias can be defined as erroneous responses that constitute a departure from normative rules or standards (Kristi, 2021, pg. 311).

When doing document analysis, some biases can occur. For instance, my interest as a researcher can influence the selection of documents as well as the interpretation of documents. My research is on response strategies to climate change in Kenya, and therefore choosing official documents from Kenyan government on their response to climate change was my priority, but to ensure representability, I had to include documents from non-governmental organizations.

Similarly, as noted by Bowen (2009), there is always the potential of biases both in a document and from the researcher. And to address this, Bowen (2009), argues that it is important to thoroughly evaluate and investigate the subjectivity of documents and your understanding of their data in order to preserve the credibility of your research. The documents used for analysis were thoroughly evaluated and corresponded to the issues being examined.

Consequently, on the interview side, an important element to note is the reflexivity. As articulated by Cohen et al. (2018), reflexivity is a crucial element to address participant's views on the research issue. During the interview, one of the informants asked me how much I have been paid by my university to do research and how much is there share. My identity as a student abroad made my informant perceived that I have a lot of money from the university and that I should share with them. I addressed this by making some jokes and trying to emphasize the similarity between education in Kenya and abroad.

4.4. Possible Methodological Challenges in Qualitative Research

In this part of the subchapter, I present the possible methodological challenges one can encounter while doing qualitative research. First, I present the challenges while doing document analysis, and then thereafter I present the challenges while doing online interviews. I close the subchapter by presenting the validity and reliability in qualitative research.

4.4.1 Document Analysis

When doing document analysis, certain problems can occur. As noted by Bowen (2009), a document may not perfectly provide all the necessary information required to answer the research questions. Some documents may provide scanty information, inaccurate or incomplete data and some may not provide information at all (Bowen, 2009). The study has addressed this problem by means of triangulation. I have combined both interview and document analysis so as to validate and cross-check data obtained during the study.

Another problem in document analysis as stated by Grønmo (2016), is the researcher's perspective or rather personal interest that can lead to the selection of documents being one-sided. Initially, I wanted to use only government documents on response strategies to climate change in Kenya, but to avoid being bias and ensure representativity, I changed my mind and included documents from non-governmental organizations.

Furthermore, another challenge in document analysis as stipulated by Bowen (2009), is low retrievability. Access to documents sometimes could be difficult. In my research, I did not face this problem because most of the documents were official documents from the government and non-governmental organization that were available in their respective websites.

4.4.2 Online Interviews

Flick (2019) argues that with online interviewing, there is much greater anonymity of the participants which protects them from any detection of their identity during the research and the results. This sounds as an advantage, but for the researcher, this makes any form of contextualization of the participant's statements much more difficult (Flick, 2019, pg. 245). It was difficult for the study to accredit good ideas from informants due to anonymity. One of the informants gave a good example of reactive adaptation that he has personally practiced, but due to anonymity, it was difficult to accredit his idea.

Also with online interviewing, there is possibility of interference and disruptions from phone calls, internet connections, messages, and colleagues if especially the interview is in the office (Flick, 2019). During the study, two informants had problems with their internet connectivity at the onset of the interview. Although the problem was rectified, the interview consumed more time than was scheduled due to internet problems.

Finally, interruption and asking leading questions is always a problem especially in semi-structured expert interviews. In my case, I exercised flexibility and allowed my informants to have a good flow of the conversation without interrupting them. Instances where there were interruptions, I exercised etiquette making informants understand the reason for interruption.

4.4.3 Validity and Reliability

A very important thing in research is to evaluate the quality of data collected in a research project. High data quality is considered when the data material can elucidate the research process. This is only achievable through two concepts, that is, research validity and reliability. The integrity of the research and the application of the methodologies used are referred to as research validity, and the findings accurately reflect the data (Noble & Smith, 2015).

The premise for validity is necessary in order to discuss how well the actual data collection corresponds to the researchers' aims (Grønmo, 2016, p. 241). There are internal and external validity (Cohen et al., 2018). Internal validity seeks to demonstrate that the findings describe accurately the phenomena that is being researched, that is, the research should be accurate, consistent, and dependable (Cohen et al., (2018). Whereas external validity verifies the degree of possible generalization to a wider population or setting (Cohen et al., 2018).

Qualitative researchers use a variety of ways to ensure the validity of their data. According to Flick (2019), triangulation is one of the methods of assuring trustworthiness or data authenticity. Therefore, the study has used both the document analysis and interviews to cross-check and confirm the findings. Semi-structured audio-recorded interviews allowed repeated revisiting of the data to remain true to participants' accounts and to cross check with data from data analysis. Although most data from interviews were not well detailed, cross checking from document analysis enabled the study to have a well detailed data for the findings.

Reliability describes the consistency within the employed analytical procedures (Noble & Smith, 2015). It is concerned with the measurability of the study and seeks to measure the consistency, dependability, and replicability of the research (Flick, 2019). "Can we believe the results of a research project? For research to be reliable it must be able to prove that the same result could be obtainable if the research was conducted with different participants, where similar knowledge could be obtained" (Cohen et al., 2018). Throughout the research, I was careful not to let my personal bias impact the selection and interpretation of the documents chosen for examination.

While conducting the online interviews, I was very careful to ask clear and specific questions, and the interview-guide questions were straightforward and similar to each informant. In addition, while conducting data transcription, I used a recording tool (Dictaphone) provided by the university to avoid misunderstandings or erroneous quoting.

CHAPTER 5: FINDINGS AND ANALYSIS OF RESPONSE STRATEGIES RELATED TO CLIMATE CHANGES

In this chapter, I present the findings and analysis of mitigation options and adaptation strategies as responses to climate change. The findings and analysis here will answer research question 1 and 2.

To begin with, I would like to define what I mean by mitigation and adaptation. According to the IPCC (2001a), mitigation is any anthropogenic intervention that reduces the sources or increases the sinks of greenhouse gases, whereas adaptation is any adjustment in natural or human systems in response to actual or anticipated climatic stimuli or their effects that mitigates harm or capitalizes on beneficial opportunities (IPCC, 2014). A single mitigation and adaptation option is insufficient to address climate change, but numerous mitigation and adaptation choices can help address climate change (IPCC, 2014, pg. 98). The findings and analysis in this chapter address research questions one and two.

The first research question was *“How has the Kenyan government responded to impacts of climate change on the environment based on climate change mitigation options and adaptation strategies”*. The research question sought to determine the response to climate change by the Kenyan government based on mitigation and adaptation. There are two elements in this research question, the mitigation part, and the adaptation part.

On the first element of the research question, the study conducted research on three different mitigation options. They include Forest conservation and afforestation measures, carbon capture and storage and renewable energy.

Similarly, on the second element of the research question, the study conducted research on three different types of adaptation strategies. They include reactive adaptation, passive adaptation, and anticipatory adaptation.

The second research question sought to know where the Kenyan government has put more emphasis regarding climate change mitigation and adaptation strategies, or whether there is a balanced approach between the two.

The below sub-sections therefore discuss the findings in each and every response strategy that were examined.

5.1 Mitigation Options

The study considered three mitigation options namely, Forest conservation and afforestation (tree planting), carbon capture and storage, and renewable energy sources. As stated by the IPCC (2014, pg. 98), there are mitigation options available that can reduce greenhouse gas emissions, improve energy intensity, and enable structural changes or changes in activity. Additionally, direct mitigation options in Agriculture, Forestry, and other land use involves reducing carbon emissions by reducing deforestation, forest degradation and forest fires and providing bioenergy feedstocks (IPCC, 2014, pg. 98). On that note, the study examined Kenya's response to climate change through measures such as forest protection and afforestation, carbon capture and storage, and renewable energy sources in accordance with mitigation options. The findings of the three mitigating options are shown in the subheadings below.

5.1.1 Forest Conservation and Afforestation (Tree Planting)

As outlined by Benjaminsen & Svarstad (2021, pg. 132), a considerable part of climate mitigation today focuses on forest conservation and afforestation measures because trees absorb and store carbon dioxide from the atmosphere. As per the IPCC report, there is a high confidence that reducing deforestation and forest degradation rates represents one of the most effective and robust options for climate change mitigation, with large mitigation benefits globally (Seymour & Gibbs, 2019).

To get the Kenyan government response on forest conservation and afforestation as a mitigation option to climate change, the study has analyzed Kenya's National Climate Change Action Plan of 2018-2022 together with interviews.

According to the national climate change action plan, the forestry sector is one of the biggest emitters of greenhouse gases in Kenya, and this is mainly because of deforestation and forest degradation (Government of Kenya, 2021, pg. 17). The forestry sector accounts for 32% of greenhouse gas emissions in Kenya and it is second in emission after Agricultural sector (Government of Kenya, 2021, pg. 17). Initiatives like tree planting, conservation and rehabilitation of forests are some of the activities being taken by the Kenyan government to improve the national forest cover and the continued provision of the environmental goods and services (Government of Kenya, 2021, pg. 17). Additionally, the strategic objective of forest conservation and afforestation also focuses on increasing tree cover to 10% of the total land area, rehabilitating degraded lands

and increasing resilience of wildlife (Government of Kenya, 2021, pg. 17). Most of the interventions in forest management in Kenya contributes to mitigation efforts, as well as supporting livelihoods and ecosystem sustainability (Government of Kenya, 2021. Pg. 17).

As obtained from the Kenya National Climate Change Action Plan, table 2 below shows the results of forest conservation and afforestation measures undertaken by the Kenyan government as of June 2020.

Kenya has managed to reforest and afforest 62,142.6 Ha of land and put 20,252 Ha of land under improved management and carbon stock enhancement (Table 2). Similarly, at least 2,292,327 tree seedlings have been planted and a further 7,565,355 bamboo seedlings have also been planted in line with forest conservation and afforestation as a mitigation option (Table 2).

Moreover, in agricultural sector, the most cost-effective mitigation options are cropland management, grazing land management and restoration of organic soils (IPCC, 2014, pg. 102). This is evidenced in table 2 where 11, 146 Ha of rangelands have been rehabilitated and 62, 142.6Ha of land forested through agroforestry and other afforestation measures.

Accordingly, data from the interview also confirms that the Kenyan government have taken drastic steps in combating climate change through forest conservation and afforestation programs. For instance, all the informants affirmed that they have undertaken tree planting as a mitigation measure in response to climate change. They also affirmed that priority is given to indigenous tree species during tree planting as some exotic species like Eucalyptus has negative impacts on water sources.

The main finding from both the interview and the document analysis is that tree planting is being undertaken as a mitigation measure in Kenya. Although there was no specification on the type of tree species planted from the document analysis, most informants from the interview gave specification on indigenous tree species as a priority during planting. This was because some exotic tree species like Eucalyptus has adverse impacts on water sources according to most informants.

Afforestation, sustainable forest management and reducing deforestation are some of the most cost-effective mitigation options according to the IPCC report as discussed in chapter 4 (IPCC, 2014). The focus on forest conservation and afforestation as a mitigation option is because trees absorb and store carbon (iv) oxide from the atmosphere (Benjaminsen & Svarstad, 2021). The

findings above illustrate how Kenya is committed in reducing carbon emissions through forest conservation and afforestation programs.

Although tree planting has received some criticism on the impacts it has on land and food security, the IPCC report has given a high confidence that tree planting offers one of the most cost effective and robust options for climate change mitigation with large mitigation benefits globally (Seymour & Gibbs, 2019). Therefore, it is evident from findings that Kenya is committed towards reduction of greenhouse gases through forest conservation and afforestation measures. The results from both the document analysis and the interviews corroborate the findings that Kenya is responding to climate change by implementing forest conservation and afforestation initiatives as mitigation measures.

5.1.2 Carbon Capture and Storage

Carbon capture and storage (CCS) is a technique that absorbs carbon (IV) oxide from a point source and then safely stores it, often in a geological formation (Peters & Sognaes, 2019/2021, pg. 7). There are already 19 operational Carbon Capture and Storage (CCS) plants in the world, with 4 under development, with a total capacity of around 40MtCO₂ per year (Peters & Sognaes, 2019/2021, pg. 7).

The aim of developing CCS technology is to reduce direct emissions from the burning of fossil fuels and to remove carbon dioxide from the atmosphere at a scale that leads to net negative emissions (Peters & Sognaes, 2019/2021, pg. 7). IPCC in their report explains that in all their analyzed pathways to limit warming to 1.5°C, they have applied technology to some extent to neutralize emissions from sources (IPCC, 2018, pg. 3). One example of such technology is Carbon Capture and Storage (CCS).

There was no official document from the Kenyan government that demonstrated carbon capture and storage technology in capturing greenhouse gas emissions throughout my investigation, nor was there any information from the interview on the utilization of carbon capture and storage in Kenya. All of the informants agreed that the carbon capture and storage mitigation option is not yet being used in Kenya due to lack of technology (Table 1). Informant 1 stated that natural methods of carbon capture, such as the usage of Mangrove trees, are prioritized over technology.

I therefore concluded that the mitigation option of carbon capture and storage (CCS), is not being practiced in Kenya.

5.1.3 Renewable Energy

The research was done on five renewable energy options namely, solar, wind, bioenergy, hydropower, and geothermal energy. Presented below are the findings from interview on each renewable energy. Renewable energy which is often referred to as clean energy, comes from natural sources or processes that are constantly replenished (Lora, 2018). For instance, sunlight and wind keeps on shining and blowing even if their availability depends on time and weather (Lora, 2018). Fossil fuels, which is referred to as non-renewable energy has led to high concentrations of greenhouse gases in the atmosphere (IPCC, 2011, pg. 19). Renewable energy sources have a large potential of displacing emissions of greenhouse gases that comes from the combustion of fossil fuels (IPCC, 2011, pg. 1). As recommended by the IPCC report, to reduce or eliminate the emissions from these fossil fuels, there is need to implement and make use of renewable energy sources (IPCC, 2011). Some of the examples of renewable energy sources as recommended by IPCC includes bioenergy, solar energy, geothermal energy, hydropower, ocean, and wind energy (IPCC, 2011, pg. 1). Proper implementation of these renewable energy sources can lead to social and economic development, energy access, secure and sustainable energy supply, and to a larger extent, reduction of negative impacts of energy contribution on environment and human health (IPCC, 2011, pg. 1).

In a bid to get Kenya's response to climate change through use of renewable energy as a mitigation option, the study has analyzed the Kenya National Climate Change Action Plan of 2018-2022 and the Energy and Petroleum Statistics Report of 2019. The following presents the findings from the analysis.

5.1.3.1. Geothermal Energy

Geothermal is one of the long-term greenhouse gas emission reductions as mentioned in chapter three. Kenya is one of the leading countries in production of geothermal energy in the world (Table 1). In order to get data on the geothermal energy, Kenya Energy and Petroleum Statistic Report of 2019, was analyzed together with data from interview.

The analysis from the Energy and Petroleum Statistics Report 2019, shows that Kenya has installed geothermal capacity of 663MW as of 2019 (EPRA, 2019, pg. 10). Additionally, geothermal

resources within Rift Valley region in Kenya is estimated to have a potential capacity of between 7000MW to 10, 000MW (EPRA, 2019). Although the geothermal power generation in Kenya keeps on fluctuating, it remains the highest contributor to the national power grid and the most suitable source for baseload electricity generation in the country (EPRA, 2019, pg. 11).

Accordingly, data from the interview also confirms the use of geothermal energy in Kenya. For instance, apart from informant 2 which did not comment on geothermal energy, all other informants confirmed that Kenya has Geothermal energy with their main plant at Olkaria (Table 1). Informant 4 also reiterated that there is ongoing development of new power plant at Menengai and that 40% of the national grid is from geothermal power (Table 1).

A summary of the findings shows that Kenya is one of the leading producers of geothermal energy in the world. Data from document analysis shows that as of 2019, Kenya has installed geothermal capacity of 663MW. Similarly, most informants confirmed the use of geothermal energy in Kenya. Despite fluctuating, geothermal power generation in Kenya remains the highest contributor to the national power grid and the most suitable source for baseload electricity generation in the country according to the findings.

Therefore, the analysis shows that Kenya is using geothermal power which is a renewable energy source. The IPCC report indicates that geothermal energy has the potential to provide long-term, secure base-load energy and greenhouse gas emissions reductions (IPCC, 2011, pg. 416). Its widespread deployment can play a meaningful role in mitigating climate change (IPCC, 2011, pg. 416). Since the geothermal energy is the highest contributor of energy to the national grid, Kenya is in the right path towards reduction of carbon emissions.

5.1.3.2. Wind Energy

Just like geothermal energy, wind energy is one of the long-term greenhouse gas emission reductions as mentioned by the IPCC report. Data from Kenya Energy and Petroleum Statistic Report of 2019 and interview were analyzed.

Kenya is endowed with favorable wind speeds and 73% of the country experiencing wind speed of 6m/s, or higher at areas of 100m above sea level (EPRA, 2019). This, according to the analysis from the Energy and Petroleum Report of 2019, has made Kenya to install a total capacity of 336.1MW from wind energy as of 2019 (EPRA, 2019, pg. 10). From the analysis, the major wind

plant in Kenya is in Marsabit county (Lake Turkana wind plant) and has the capacity of 310MW and there are also smaller wind plants in many parts of the country (EPRA. 2019).

Therefore, with a capacity of 336.1MW from wind energy, Kenya is in the right path towards use of renewable energy. This is a great achievement towards climate change mitigation as wind energy offers significant potential for near-term (2020) and long-term (2050) greenhouse gas emissions reductions (IPCC, 2011, pg. 551).

Consequently, analysis of data from the interview also confirms use of wind energy in Kenya. For example, all the informants confirmed that there is use of wind energy in Kenya (Table 1). The main wind power plants are Turkana wind power in Marsabit and Ngong wind power in Nairobi (Table 1). Informant 4 gave a figure of 310MW from the Turkana Wind Plant to the grid that was slightly different from what informant 5 gave, that is, a figure of 300MW to the grid. Despite of the small difference, the figures are a confirmation that wind energy is one of the contributors to the Kenya's grid.

A summary of the findings shows that the major wind plant in Kenya is in Marsabit county (Lake Turkana wind plant) and has the capacity of 310MW and there are also smaller wind plants in many parts of the country. According to the statistics, wind energy adds 336.1MW to the national grid. This is an important breakthrough in climate change mitigation since wind energy has tremendous potential for both near-term (2020) and long-term (2050) greenhouse gas emission reductions, as detailed in Chapter four. As a result, the data demonstrate Kenya's commitment to reducing carbon emissions through the use of wind energy.

5.1.3.3. Solar Energy

To get data on Solar Energy as a mitigation option, data from the Kenya National Climate Change Action Plan of 2018-2022, data from Energy and Petroleum Statistics report of 2019, together with interviews were analyzed.

The information obtained from Kenya National Climate Change Action Plan of 2018-2022 shows that as of June 2020, 10% of Technical and Vocational Education Training Institutions (TVET) were powered by solar (Government of Kenya, 2021, pg. 27). Similarly, 5 solar mini grids were installed as of June 2020, whereby four solar mini grids were in Marsabit and one in Kisumu (Government of Kenya, 2021, pg. 27). Additionally, as shown by the national climate change

action plan 2018-2022, more than 200 solar powered boreholes were constructed in Meru County as of June 2020 (Government of Kenya, 2021, pg. 27). All these are evidence that Kenya is among the countries that is using solar energy as renewable energy. The adoption of solar energy is an indication that Kenya is using renewable energy as a mitigation option towards mitigating adverse effects of climate change.

Moreover, data from the Energy and Petroleum Statistics Report of 2019, shows that Kenya has installed a total capacity of 50.7MW of solar energy as of 2019 (EPRA, 2019, pg. 10).

As mentioned in chapter 4, the availability of Solar energy offers significant potential for near term (2020) and long term (2050) climate change mitigation (IPCC, 2011, pg. 349). Therefore, as presented above, Kenya is in the right path towards mitigating climate change by use of clean solar energy.

Subsequently, analysis from the interview also confirms use of solar as a renewable source of energy in Kenya. For instance, apart from informant one, all the other informants confirmed the use of solar energy in Kenya (Table 1). Of interesting was the finding from informant 3 where he confirmed the use of solar energy in lighting of streetlights. Also, another important finding was from informant 5 where he confirmed the use of solar energy to pump irrigation pumps. The common finding from most informants was the use of solar energy at local level.

There is overwhelming evidence from both the document analysis and the interview that Kenya is using solar energy. Nearly all the informants from the interview confirmed that there is use of solar energy as a renewable source of energy in Kenya. Likewise, findings from document analysis shows that Kenya has installed a total capacity of 50.7MW of solar energy as of 2019.

As discussed in chapter four, the IPCC report shows that the availability of solar energy offers significant potential for near term (2020) and long term (2050) climate change mitigation (IPCC, 2011, pg. 349). The wide range varieties of solar technologies of varying maturities in most parts of the world contributes to a suite of energy services and the solar technologies offer smaller environmental burden compared to the opportunities it offers for positive social impacts (IPCC, pg. 349). Therefore, the results above confirm that Kenya is in the right path towards mitigating climate change by use of solar energy as a renewable source of energy.

5.1.3.4. Hydropower

Data from the National Climate Change Action Plan 2018-2022, the Energy and Petroleum Statistics Report 2019, and interviews were evaluated to determine Kenya's hydropower as a renewable energy source and a climate change mitigation option.

The analysis from the Energy and Petroleum Statistics Report 2019, shows that Kenya has a total installed large hydropower capacity of 826.23MW, and small hydropower potential estimated at 3000mw (EPRA, 2019).

Similarly, the analysis from the National Climate Change Action Plan 2018-2022, shows that over 1000Ha of water catchment areas have been conserved and rehabilitated in a bid to protect the areas feeding hydro-generation reservoirs (Government of Kenya, 2021, pg. 28). In addition, the Kenya Power and Lightning Company (KPLC), are in the processing of replacing wooden electric poles with concrete poles in a bid to reduce deforestation that has impact on water catchment areas (Government of Kenya, 2021. Pg. 28).

Accordingly, analysis of data from interview confirms use of hydropower as a renewable source of energy in Kenya. For instance, apart from informant 3 who did not comment on hydropower, all other informants confirmed the use of hydropower in Kenya (Table 1). However, informant 2 as much as they promote use of hydropower, they are cautious about the impact's hydropower has on water sources. The capacity produced is 800MW according to informant 4.

According to the IPCC report, hydropower has a tremendous potential for reducing carbon emissions (IPCC 2011, pg. 454). Evidence implies that reasonably high levels of hydropower deployment are achievable over the next twenty years, and hydropower should continue to be an appealing renewable energy source in the context of global greenhouse gas reduction scenarios (IPCC, 2011, pg. 454).

Hydropower has considerable potential for reducing carbon emissions and plays a critical role in the global supply of renewable energy (IPCC, 2011, pg. 454). The usage of hydropower in Kenya, as demonstrated by the results, confirms that Kenya is embracing the use of renewable energy, which is critical in the mitigation of climate change. As a result, the data confirm that Kenya is on the right track toward reducing carbon emissions by utilizing hydropower as a renewable energy source

5.1.3.5. Bioenergy

As discussed in Chapter 3, bioenergy provides renewable, low-carbon energy sources that capture atmospheric carbon while also providing significant environmental and socioeconomic benefits. To obtain information on bioenergy, data from the National Climate Change Action Plan 2018-2022 and interviews were evaluated.

According to the analysis from the National Climate Change Action Plan 2018-2022, the Kenyan government has scaled up biogas technology to increase access to clean energy by building 6500 residential digesters and 600 biogas systems in various schools and public organizations (Government of Kenya, 2021, pg. 28). In Kenya, more than 280 homes used clean cooking stoves as of June 2020. (Government of Kenya, 2021, pg. 28). Furthermore, as part of the transition to clean cooking, the Kenyan government has lowered import duties on complete efficient biomass stoves from 35% to 25% through laws (Government of Kenya, 2021, pg. 28).

Consequently, analysis of data from interview confirms use of bioenergy in Kenya. For example, apart from informant 2 and 3, all the other informants confirmed the use of bioenergy in Kenya (Table 1). Mostly, bioenergy is used in form of biogas, manure, and wood fuel (Table 1).

A summary of the findings indicates that bioenergy is being used in Kenya. Data from the interview shows that majority of the informants affirmed use of bioenergy. Similarly, data from the document analysis indicates that Kenyan government through regulations have reduced import duty on complete efficient biomass stoves from 35% to 25% in transition to clean cooking.

Bioenergy, as discussed in Chapter 3, provides renewable, low-carbon energy systems that capture atmospheric carbon while also providing significant environmental and socioeconomic benefits (Röder & Welfle, 2019). As a result, the findings corroborate Kenya's investment in bioenergy in order to provide low-carbon energy systems. This is a confirmation of a good climate change response strategy based on mitigation options.

5.2 Adaptation

To guide the analysis on different forms of adaptation techniques, the study examined the literature of Leichenko and O'Brien (2019) "Climate and Society: Transforming the Future." As noted in Chapter 3, Leichenko and O'Brien (2019) identified three distinct adaptation strategies: reactive adaptation, passive adaptation, and anticipatory adaptation.

Similarly, to find out how Kenya has adapted to adverse impacts of climate change, the study has analyzed the National Climate Change Action Plan 2018-2022 (NCCAP), the National Adaptation Plan 2015-2030 (NAP) and the data from interviews.

The following subheadings present the findings and are based on each category of adaptation strategies.

5.2.1 Reactive Adaptation

As defined in chapter 3, reactive adaptation includes actions that are deliberately taken in response to the experienced impacts of climate shocks and stresses (Leichenko & O'Brien, 2019, pg. 175). Usually, this type of adaptation reduces the vulnerability to associated climate risks (Leichenko & O'Brien, 2019, pg. 175).

The data from the National Climate Change Action Plan 2018-2022, shows that the Kenya government as of June 2020 and due to adverse effects of drought, gave out cash transfers to a total of 8732 households as a drought shock responsive measure (Government of Kenya, 2021, pg. 10). Similarly, number of beneficiaries under the National Safety Net Programme on adaptive services reached 1263000 households as of June 2020 (Government of Kenya, 2021, pg. 10). On flood management, affected counties like Taita Taveta, Kisumu and Kajiado constructed drainage systems, dams and storm water drains as a responsive measure to floods (Government of Kenya, 2021, pg. 10). To add on, a total of 3493 flood warnings as of June 2020 were issued by the meteorological department to enable locals move to safer areas before floods (Government of Kenya, 2021, pg. 10). Moreso, 60km of blocked drainage channels were opened in Nyando basin (Kisumu County), under the adaptation project by National Environment Management Authority (NEMA), to reduce the risk of flooding and protect the local livelihoods (Government of Kenya, 2021, pg. 10).

The agricultural sector has not been left behind, and much reactive adaptation measures has been done on the sector in Kenya. To control disease outbreaks and improve resilience of livestock, the government of Kenya in the financial year 2019/2020 vaccinated a total of 10, 086, 752 heads of cattle in 30 counties (Government of Kenya, 2021). On the same note and through the intervention of the government, 18, 012 households insured a total of 90, 060 heads of cattle to avoid the risks associated with drought (Government of Kenya, 2021).

Accordingly, analysis of the data from the interview also confirms reactive adaptation in Kenya. All the informants confirmed several reactive adaptation measures in Kenya (Table 1). The most interesting finding was from informant 2, 3 and 5, where they highlighted promotion of agricultural diversity amongst pastoralist communities in cases of extreme drought. Some of the agricultural methods they have helped and encouraged pastoralist communities to engage in include poultry farming and beekeeping (Table 1). According to informant 3, there is also purchasing of animal feeds for cattle during times of serious drought.

Poultry farming and bee keeping are some of the agricultural practices they have supported and encouraged pastoralists communities to venture into (Table 1). Also, there is buying of animal feeds to livestock during cases of extreme drought as noted by informant 3.

A summary of the data reveals that the Kenyan government has implemented reactive adaptation measures in response to climate risks and shocks. Data from the two research methods demonstrate that the Kenyan government and other non-governmental organizations promote pastoralist communities to undertake agricultural diversity, such as beekeeping and chicken production. This is a response to extreme drought, where cattle keeping is impossible due to a shortage of pasture and water. Furthermore, data from document analysis suggests that livestock is being vaccinated to boost their resilience capacity in the event of a disease outbreak. Also, as a drought-response tool, the Kenyan government has made direct cash payments to some households in drought-prone areas in order to help them survive during harsh climatic conditions.

According to Leichenko and O'Brien (2019), reactive adaptation minimizes sensitivity to climate threats. As a result, the findings confirm that the Kenyan government is taking appropriate steps to reduce people's exposure to climate hazards.

5.2.2 Passive Adaptation

As defined in chapter 3, passive adaptation includes actions and adjustments taken because of changing environmental conditions but not purposely intended to respond to climate change (Leichenko & O'Brien, 2019). Data from National Climate Change Action Plan 2018-2022 together with interviews have been analyzed to examine passive adaptation in Kenya.

The analysis of National Climate Change Action Plan 2018-2022 shows that due to changes in rainfall pattern in most parts of Kenya, 382, 929 farmers accessed climate-oriented crop insurance (Government of Kenya, 2021). The insurance is meant to pay farmers due to crop failure because of changes in rainfall patterns. The idea is not purposely to respond to climate change but to make farmers adapt to a changing climate.

Subsequently, data from the interview also confirmed passive adaptation in Kenya. For instance, apart from informant 2 and 4, all the other informants confirmed practice of passive adaptation in Kenya. Due to shift in rainfall patterns, as stated by informant 5, farmers have opted to plant short duration crops instead of long duration crops so as to adapt to the changing rainfall pattern in Kenya. This is a clear illustration of passive adaptation as discussed in chapter 3, because farmers are adjusting to changes of rainfall condition but not necessarily responding to climate change.

This type of adaptation according to Leichenko & O'Brien (2019), is not necessarily to respond to climate change but to enable people adjust to changing environmental conditions. Plantation of short duration crops due to changes in rainfall pattern and crop insurance are the main findings practiced in Kenya on this type of adaptation. Crop insurance program is meant to pay farmers due to crop failure because of changes in rainfall patterns. The advantage of this kind of adaptation as articulated by Leichenko & O'Brien (2019) is that it's directed towards addressing immediate challenge affecting the society. Therefore, the findings from two research methods confirm practice of passive adaptation in Kenya.

5.2.3 Anticipatory Adaptation

Anticipatory Adaptation include actions and strategies that are planned and may entail proactive policies that are adopted prior to anticipated future climate conditions (Leichenko & O'Brien, 2019, pg. 175). This type of adaptation which mainly entails proactive policies as stated by Leichenko & O'Brien (2019), are usually intended to avoid negative impacts, or reduce future vulnerabilities. Practicing this type of Adaptation reduces future climate vulnerabilities or negative

impacts associated with climate change. Data from Kenya National Climate Change Action Plan 2018-2022, National Adaptation plan 2015-2030, together with data from the interviews were analyzed to examine this type of adaptation in Kenya.

From the analysis of the National Climate Change Action Plan, as of June 2020, several proactive policies and regulations were adopted by the Kenyan government in a bid to adapt to the changing climate. To start with, in order to improve the ability of people to cope with the ravaging drought, the National Drought Emergency Fund Regulations was developed (Government of Kenya, 2021, pg. 10). This was to regulate the issuance of national safety net programme and other cash transfers for adaptation purposes. Secondly, to improve coordination and delivery of disaster risk management, eight counties developed county disaster management legislation, plans and coordination units or committees (Government of Kenya, 2021, pg. 11). On the same note, 23 counties within arid and semi-arid areas, developed drought contingency plans (Government of Kenya, 2021, pg. 11).

Furthermore, Kenya has National Adaptation Plan (NAP) for the year 2015-2030 (Government of Kenya, 2016). The aim of NAP is to consolidate the country's vision on adaptation supported by macro-level adaptation actions that relate with the economic sectors and country level vulnerabilities to enhance long-term resilience and adaptive capacity (Government of Kenya, 2016, pg. 1).

Accordingly, all the informants apart from informant 4 who did not comment on this type of adaptation, confirmed the practice of anticipatory adaptation in Kenya (Table 1). Of the most notable response was the National Adaptation Plan 2015-2030, which aims to consolidate the country's vision on adaptation supported by macro-level adaptation actions that relate with the economic sectors and county level vulnerabilities to enhance long term resilience and adaptive capacity. Also, another important finding was the development of Kenya Climate Smart Agriculture Strategy (KCSAS) that was highlighted by informant 5. This is a policy or a strategy to build resilience of agricultural systems while minimizing emissions for enhanced food and nutritional security.

As presented above, the anticipatory adaptation has been practiced by the Kenyan government through enacted of various policies and regulations that gives guidance on climatic conditions. As discussed in chapter 3, this type of adaptation mainly contains proactive policies which are usually

intended to avoid negative impacts or reduce future vulnerabilities (Leichenko & O'Brien, 2019). Data gathered from the two research methods show that anticipatory adaptation is practiced in Kenya. The main finding of this type of adaptation is the National Adaptation Plan 2015-2030. It aims to consolidate the country's vision on adaptation supported by macro-level adaptation actions that relate with the economic sectors and county level vulnerabilities to enhance long term resilience and adaptive capacity. Also, another important finding from the interview was the development of Kenya Climate Smart Agriculture Strategy. This is a policy or a strategy to build resilience of agricultural systems while minimizing emissions for enhanced food and nutritional security. Data from document analysis also shows the development of the National Drought Emergency Fund Regulations which regulates the issuance of national safety net programme and other cash transfers for adaptation purposes.

Therefore, the findings confirm that anticipatory adaptation is being practiced in Kenya and the government has put down proactive policies to avoid negative impacts associated with climate shocks.

5.3 Summary of chapter 5

In order to answer research question two, there was need to ascertain whether Kenyan government has put more effort or priority between mitigation options and adaptation strategies, or if there is a balanced combination of the two.

Data gathered from informant 1, 4 and 5 shows that there is a balanced approach in the two response strategies to climate change. However, data from informant 2 and 3 shows that priority is given to adaptation and not mitigation.

On the other hand, the study has analyzed the National Climate Change Action Plan 2018-2022 and the National Adaptation Plan of 2015-2030, which encourages the mainstreaming of adaptation and mitigation actions across sectors and levels of government. The data from the National Climate Change Action Plan 2018-2022, shows that “the National Climate Change Action Plan (NCCAP) 2018-2022, aims to further Kenya’s development goals by providing mechanisms and measures to achieve low carbon climate resilient development in a manner that prioritizes adaptation” (Government of Kenya, 2021, pg. 2). Equally, as stated in the National Adaptation Plan 2015-2030, the country’s priority is on adaptation (Government of Kenya, 2016).

The two Kenyan adaptation reports presented above demonstrate that adaptation takes precedence over mitigation. Although most interviewees claimed that the Kenyan government takes a balanced approach to mitigation than adaptation, data from document analysis, which included official Kenyan government reports, revealed that adaptation is prioritized. This raises the issue of the validity of the findings, which brings us back to the sampling approach used in this study. According to Regoli (2019), Purposive sampling offers large levels of flexibility, but it also necessitates a greater level of evidence-based approaches to demonstrate to outside observers that the information collected is relevant. Flexibility in data and theory in qualitative research allows researchers to be interpretive, creative, innovative, and embodied (Regoli 2019). I have therefore used my interpretive skills and considered data from the official government records on adaptation to be accurate and therefore taken the position that adaptation is given priority as per the Kenya government's reports.

Based on capacity concerns related to climate change actions, this research attempted to investigate why adaptation has been prioritized over mitigation by the Kenyan government. To begin with, as Tol (2015) argues, mitigation is primarily an international issue with global benefits, whereas adaptation is mostly a local matter with local benefits. Because it is the obligation of any government to provide adequate services to its people, prioritizing adaptation over mitigation may be the reason why the Kenyan government prioritized adaptation over mitigation. Simply said, it is less expensive to prioritize a local matter than an international issue. Kenya being a developing country coupled with economic challenges, it is more prone to local issues than international concerns.

Secondly, as emphasized by informant 5 during the interview on financial capacity, particularly on international support to Kenya, the type of support they receive for mitigation purposes is always related to projects or money given as loans by the developed world. Because Kenya is a third-world country that relies heavily on assistance, servicing debts becomes difficult, making the government to give priority to adaptation than mitigation.

Furthermore, effective mitigation necessitates high technological capacity, which most developing countries lack. Only the developed world has good technologies like carbon capture and storage (CCS), Monitoring, Reporting, and Verification tool (MRV) that can quantity carbon emissions,

among many others. Few of these technologies are available in developing nations such as Kenya, making it difficult for the government to prioritize mitigation.

The reasons presented above could be the reasons why the Kenyan government has given more priority to adaptation than mitigation.

With the information above and the whole of chapter 5, I therefore conclude by saying that the first and the second research question has been answered.

CHAPTER 6: FINDINGS AND ANALYSIS OF ACTION CAPACITY RELATED TO CLIMATE CHANGES

In this chapter, I present the findings and analysis of action capacity related to climate change in Kenya. The findings answer research question three which was “*Do Kenya have the capacity to respond to climate change?*”

Kenya’s capacity to respond to climate change was based on three categories, that is, human resource capacity, financial capacity, and technological capacity.

The research question wants to know if Kenya has the capacity to respond to climate change in terms of human resource capacity, financial capacity, and technological capacity. The National Climate Change Action Plan 2018-2022 together with data from interview was used to get the findings on Kenya’s capacity to respond to climate change. Below subheadings present the findings from the analysis.

6.1. Human Resource Capacity

As discussed in chapter 3, education as a form of training raises awareness about human and institutional capacity on climate change mitigation, adaptation, and impact reduction, as well as on early warning systems (UNESCO, 2021). Equally, education on climate related actions also promotes mechanisms for raising capacity for effective climate change related planning and management in developing countries (UNESCO, 2021).

On that note, the Kenyan government as of June 2022, trained staffs from the Ministry of Public Service Youth and Gender on implementation of Climate Change Act (Government of Kenya, 2021, pg. 40). This was to strengthen the capacity of national government institutions to implement the climate change act (Government of Kenya, 2021, pg. 40). Additionally, the Kenyan government trained officials from both the national level and the county level (devolved units), on mainstreaming of climate change into national and county policy, planning and budgetary processes (Government of Kenya, 2021, pg. 40). Moreover, journalists have also been trained on reporting of climate related disasters as of June 2020 (Government of Kenya 2021, pg. 41).

Finally, Climate Change Curriculum and training materials were developed as of June 2020 and used to train national and county officials at Kenya School of Government (Government of Kenya, 2021, pg. 42).

Consequently, data from interview also confirms Kenya having well trained staffs. For instance, Informants 1, 2 and 5 confirmed that they have well trained staffs on climate related actions (Table 3). Informant 3 did not comment on training of staffs, whereas informant 4 reiterated the need for more people to be trained. On staff adequacy, informants 1, 3, 4 and 5 confirmed that they have inadequate staffs, whereas informant 2 confirmed that they have adequate staffs (Table 3).

Kenya's human resource capacity to respond to climate change related actions was determined by looking at staff's training and adequacy. Training in the form of education on climate related actions promotes mechanisms for raising capacity for effective climate change related planning and management in developing countries (UNESCO, 2021).

Data from the interview and document analysis shows that Kenya has well trained staff for effective climate change related planning and management.

There was no data from document analysis on staff's adequacy. However, findings from the interview shows that there is shortage of staff in various public agencies. Informants 1, 3, 4 and 5 confirmed that they have inadequate staffs during the interview.

As presented in Chapter 3, the most valuable resource to an institution or organization are its staff. Without staff, there would be no organization because they perform the tasks, coordinate the tasks, organize the inputs that eventually leads to the outputs (Turner & Hulme 1997, pg. 116). Equally, education as a form of training raises awareness about human and institutional capacity on climate change mitigation, adaptation, and impact reduction, as well as on early warning systems (UNESCO, 2021). Therefore, the confirmation by the findings that Kenya has well trained staff is an indication that the Kenyan government promotes mechanisms for raising capacity for effective climate change related planning and management. However, because the majority of informants stated that the available staff members are insufficient to enable the smooth operation of environmental administrative offices, the study finds it impossible to generalize whether Kenya environmental institutions have adequate human resource capacity.

6.2 Financial Capacity

The study determined Kenya's financial capacity to respond to climate change based on local support and international support. The country can have the capacity through her own means or through the assistance of the international community to respond to climate actions (Willems &

Baumert, 2003). Data from the documentary sources and interviews have been used to determine Kenya's financial capacity on related climate actions. The below sub-chapters therefore present the findings on Kenya's financial capacity to respond to climate change.

6.2.1. International support

According to Article 9 paragraph 3 of the Paris Agreement, developed countries that are parties to the UNFCCC should take the lead in mobilizing climate finance from a wide range of sources, instruments, and channels, while taking into account the needs and priorities of developing countries that are parties to the UNFCCC (UNFCCC, 2019, pg. 24). Kenya is a developing country and a member of the UNFCCC, and hence has the right to receive assistance from the developed world under Article 9 of the Paris Agreement.

Data from the interview shows that most of the informants confirmed that Kenya has received support from the international community. For instance, informant 1 from the directorate of climate change confirmed the following support from international community.

- GIZ (German donor agency) which partners with the government of Kenya in support of the transformation towards sustainable green technologies.

- United Nations Environment Programme (UNEP) helps in the development of Monitoring Reporting and Verification (MRV) systems, that quantifies emissions

- Food and Agriculture Organization (FAO) partners with Ministry of environment in certain programs. For instance, programme on Integration of Agriculture in National Adaptation Plan (NAP-Ag) that was done in 2017.

- UNDP helps in mainstreaming of Climate change into the curriculum.

Also, data from the document analysis shows that in 2020, the UNDP supported the updating of the Monitoring Reporting and Verification (MRV) system to improve accuracy and usability.

Despite the fact that the interviews and document analysis demonstrated that there is minimal international support, Informant 5 reaffirmed that the majority of the assistance is always in the form of loans or is related to specific projects. There was no evidence available from any of the two methodologies used to demonstrate that Kenya receives adequate financial help from the developed world. What informant 5 said is not far from the truth, because informant 4 reaffirmed

that the developed world's \$100 billion USD pledge to developing countries to assist them in mitigating and adapting to climate change has not been honored. As a result, I argue that, while Kenya receives international help for climate change, the assistance provided is insufficient to effectively adapt to and mitigate the effects of climate change.

6.2.2. Local Support

On local level, a summary of the findings shows that there is a bit of local support in a bid to respond to climate change by the Kenyan government. For instance, data from document analysis shows that as of June 2022, the Climate Finance Unit was established at the national treasury to facilitate priority climate actions set out in the National Climate Change Action Plan. On the same note, the National Treasury developed the Sovereign Green Bond Framework as of June 2022 where the funds were earmarked for green projects

As of June 2022, the Climate Finance Unit was established at the national treasury to facilitate priority climate actions set out in the National Climate Change Action Plan (Government of Kenya, 2021, pg. 44). Also, Financing Locally led Climate Actions (FLLoCA) program was developed to finance priority interventions over the next five years as of June 2022 (Government of Kenya, 2021, pg. 44).

On local banks, the three local banks (Diamond Trust Bank, Commercial Bank of Africa and Cooperative Bank) received support from the Kenya Association of Manufactures to develop green credit lines aimed at financing renewable energy and energy efficiency projects in Kenya (Government of Kenya, 2021, pg. 44). On the same note, the National Treasury developed the Sovereign Green Bond Framework as of June 2020 where the funds were earmarked for green projects (Government of Kenya, 2021, pg. 45).

Similarly, data from informant 3 shows that the devolved units are mandated to allocate 2% of their budget to climate related actions. Also, Informants 1,3,4 and 5 confirmed financial support from the Kenyan government (Table 3). They have also affirmed that what is given by the government is not enough, and that there is need for more allocation. Informant 2 being a non-governmental organization, also emphasized on financial challenges as most donors are not committed on their pledge.

Regardless of the government's efforts to fund climate actions, there is inadequate financial resources to support implementation and reporting (Government of Kenya, 2021, pg. 49). This is because many local institutions do not allocate or mobilize adequate resources for climate change activities (Government of Kenya, 2021, pg. 49). I therefore argue that despite Kenyan government doing her best to mitigate and adapt to climate change, the local support is not sufficient to effectively respond to climate change. Being a developing country coupled with economic challenges could be the reason why there is little local support to effectively mitigate and adapt to climate change in Kenya.

6.3 Technological Capacity

As mentioned in chapter 3, technology plays an important role in reducing vulnerability to climate change (Klein et al, 2005, pg. iii). This is because technologies help in development of information and awareness creation, planning and designing adaptation strategies, selecting appropriate adaptation techniques, and implementing them, and finally monitoring and evaluating their performance (Klein et al, 2005, pg. iii). To examine Kenya's technological capacity on climate related actions, data from document analysis and interviews were analyzed and the findings presented in the below paragraphs.

Analysis of the National Climate Change Action Plan 2018-2022 shows that Kenya has several technologies in response to climate change. To start with, as of June 2022, fifteen counties had Climate Information Services (CIS), which is used to help farmers manage risks and inform early warning systems (Government of Kenya, 2021, pg. 37). Secondly, in a bid to promote gender responsive technologies and innovations, 27 counties have supported and commercialized clean technology businesses (Government of Kenya, 2021, pg. 37). Additionally, System for Land Based Emissions Estimations in Kenya (SLEEK) was operationalized as of June 2020 and is used by Kenya Forest Services and Directorate of Resource Surveys and Remote Sensing to compute land cover changes (Government of Kenya, 2021, pg. 47). Finally, Kenya has Monitoring, Reporting and Verification (MRV+) system that helps the government in informing and guiding in the implementation of concrete climate change response actions (Government of Kenya, 2021).

Similarly, Informant 1, 4 and 5 confirmed uses of technologies on climate related actions in Kenya. Of most interesting finding was the use of Monitoring, Reporting and Evaluating (MRV), system, which according to informants 1 and 4, is used to quantify emissions. Also, the development of

MRV system was through partnership with UNDP. They assisted in the updating of the MRV+ system. However, informant 1 reiterated that they have not fully dived into technology, and also informant 5 emphasized that the technological challenge they are facing is on the cost.

According to the analysis, Kenya has some technologies for responding to impacts of climate change, as well as some international support. Nonetheless, there is need for Kenya to improve its technological capacity in order to successfully respond to climate change. Since Kenya is a third-world country coupled with economic and environmental challenges, the developed world is required by article 4.5 of the UNFCCC convention to promote, facilitate, and finance, as appropriate, the transfer of or access to environmentally sound technologies and knowledge to other parties, particularly developing countries. As a result, I contend that Kenya has limited technological capacity and therefore need for additional international assistance.

6.4 Summary

The third research question sought to answer Kenya's capacity to respond to climate change on human resource capacity, financial capacity, and technological capacity. There were three elements in this research question. The first element was on human resource capacity where the data gathered showed that Kenya has well trained human resource to respond to climate shocks. However, there is shortage of staffs according to the data from the interview. On that note, the study found it difficult to make a generalization whether Kenya environmental institutions have adequate human resource capacity or not.

The second component of the research question is concerned with Kenya's financial capacity in responding to climate change. The findings revealed that Kenya has gotten minimal international assistance in response to climate change. Kenya's support has been ascribed to the country's membership in the UN Framework Convention on Climate Change. As regards to local assistance, there is evidence that the Kenyan government has allocated financial resources to climate-related actions, but what is provided is insufficient to adequately mitigate and adapt to climate shocks and hazards. The study therefore made a conclusion that Kenya has limited financial capacity in responding to climate change.

Finally, the findings on technological capacity showed that Kenya has some of the technologies needed to respond to the environmental problems of climate change. In addition, Kenya receives minimal international assistance on technological support from the developed world. Because

Kenya is a developing country with economic challenges, it has not invested heavily in technology. Therefore, according to the findings, Kenya has insufficient technological capacity to respond to climate change.

As a result, based on the facts presented above, I conclude that research question three has been addressed.

Table 3: Action Capacity – Informant’s views.

	Views on Action Capacity
Informant 1	<p>1. Human Resource capacity</p> <p>We have well trained staffs who are competent. They have different sectoral leads within each sector.</p> <p>The staffs are inadequate, and the employment is under Public Service Commission. Requests to employ more staffs by Public Service Commission are not always adhered to.</p> <p>2. Financial Capacity:</p> <p>International support.</p> <p>Government of Kenya gets support from different donor partners for example:</p> <ul style="list-style-type: none"> -GIZ (German donor agency) which partners with the government of Kenya in support of the transformation towards sustainable green technologies. -United Nations Environment Programme (UNEP) helps in the development of Monitoring Reporting and Verification (MRV) systems, that quantifies emissions -Food and Agriculture Organization (FAO) partners with Ministry of environment in certain programmes. For instance, programme on Integration of Agriculture in National Adaptation Plan (NAP-Ag) that was done in 2017. -Also, UNDP helps in mainstreaming of Climate change into the curriculum. <p>Local Support.</p> <ul style="list-style-type: none"> -They have National climate change budget. -2% of the county government (devolve unit) budget goes to the climate change actions. -Funding Local Lead Climate Action (FLLOCA). This is where organizations and donors inject money for local climate actions. -The money from the Kenyan government is not enough to finance climate change strategies and there is heavy reliance on donors. -2% of county government budget allocated for climate actions is too little to effectively finance climate actions.

	<p>3. Technological Capacity</p> <p>Through partnership with Stockholm institute, they are using Low Emission Analysis Platform (LEAP) that assess pollutants in different sectors.</p> <p>There is MRV system quantifies greenhouse gas.</p> <p>The ministry has not fully dive into technology.</p> <p>MRV system is still under development, and it is funded by the government of Kenya in partnership with UNDP.</p>
Informant 2	<p>1. Human Resource Capacity</p> <p>-They have adequate and qualified staffs.</p> <p>2. Financial Capacity</p> <p>-They have financial challenges because currently most donors want to fund government projects directly and not through private organizations.</p> <p>-They entirely depend on donors</p> <p>3. Technological Capacity</p> <p>-No comment on this</p>
Informant 3	<p>1. Human Resource Capacity</p> <p>-They don't have enough staffs and efforts to get more staffs has been frustrated by the Public Service Commission (PSC).</p> <p>2. Financial Capacity</p> <p>-Only 2% of the County budget is allocated for climate actions. This is not enough.</p> <p>3. Technological Capacity</p> <p>-No comment on this</p>
Informant 4	<p>1. Human Resource Capacity</p> <p>-Need for more people to be trained on climate actions</p> <p>-Need for more staff, they have limited staff</p> <p>2. Financial Capacity</p> <p><i>International Support</i></p> <p>-There is support from the international community, but the support is less than what is required.</p> <p>-The 100billion USD pledged by the Developed world has not been availed.</p> <p>-Support from World Bank in projects like Kenya Off grid Solar Project.</p> <p>-Support from the African Development Bank on Last Miles Connectivity Projects</p> <p>-Support from the European Union.</p> <p><i>Local Support</i></p> <p>-There is support from the Kenyan government, although what is given is not enough.</p> <p>3. Technological Capacity</p>

	<p>-with the help of UNDP, there is development of MRV system that will help in quantifying of emissions</p>
<p>Informant 5</p>	<p>1. Human Resource Capacity</p> <ul style="list-style-type: none"> -The government is not employing the required number of staffs (Inadequate staff) -The staffs are well trained and are qualified -There are structures to coordinate all the sectors in view of limited staff <p>2. Financial Capacity</p> <p><i>International Support</i></p> <ul style="list-style-type: none"> -As a ministry, we have not received any climate finance from any international organization. -However, we have received loans with small grant element that has financed some of the projects like National Agricultural and Rural Inclusive Growth Project and Kenya Livestock Commercialization Project. -Some sectors like the forest sector have received support from them REDD’s project. <p><i>Local Support</i></p> <ul style="list-style-type: none"> -The government supports the National Drought Management Authority (NDMA), to mitigate the effects of drought -There is Kenya Livestock Insurance Program that is supported by the government (Index based livestock insurance), and the government is paying the premiums. -There is also crop insurance program that is also supported by the government, although the premiums are paid by farmers. The program is still under pilot stage. -There is limited financial support from the government. Most of the projects are incomplete due to lack of funding. <p>3. Technological Capacity</p> <ul style="list-style-type: none"> -We have research institutions like Kenya Agricultural Research Institute -There are biogas systems to capture methane from wastes -We have solar systems -Bio-circular systems -The challenge is on the cost in investing in all these technologies

CHAPTER 7: CONCLUSION

In this chapter, I first present the overall conclusion of the thesis, the limitation of the thesis, the recommendations for further research, reflection on climate justice and finally the concluding remarks.

7.1 Overall Conclusion

The purpose of this study has been to identify the response strategies to impacts of climate change on the environment in Kenya. Through climate change mitigation options, adaptation strategies and institutional capacity approach on climate related actions, I have studied how the Kenyan government have responded to impacts of climate change on the environment. I also noted with great concern that climate justice is a fundamental aspect of climate change mitigation and adaptation because it aims to create a level playing field for the vulnerable in society and poor countries. With appropriate climate justice, countries that emit more greenhouse gases will amplify the ability of the developing world to adapt by investing in their renewable energy sectors and supporting their climate change policy initiatives.

The thesis had three research questions which were:

- 1) How has the Kenyan government responded to impacts of climate change on the environment based on Climate mitigation options and the adaptation strategies?
- 2) Has the emphasis in responding to impacts of climate change on the environment been ‘mitigation’ or ‘adaptation’, or has there been a balanced combination?
- 3) Does Kenya have the capacity to respond to climate change?

The main finding related to the first research question is that Forest Conservation and Afforestation, and Renewable energy sources as mitigation options are practiced in Kenya as a response strategy to impacts of climate change on the environment. However, the related finding on the mitigation options showed that Carbon Capture and Storage as a mitigation option is not being practiced in Kenya. This is because of the lack of technological capacity involved in setting up CCS according to the findings. Carbon Capture and Storage is a critical technology in reducing carbon emissions as it is in line with Paris consistent of “well below 2°C” scenarios (Peters & Sognaes, 2019). More so, Carbon Capture and Storage plays an important role in power sector and industry, on fossil fuels and bioenergy and in all world regions (Peters & Sognaes, 2019). As stated by Klein et al, (2005), technology plays an important role in reducing vulnerability to

climate change. Unfortunately, most technological development takes place in the developed world and not the developing countries where technology is needed to combat climate change because of their vulnerability to climate shocks (Mathieu, 2020). Kenya is a third world country, and therefore it is not surprising that it lacks technological capacity to set up carbon capture and storage facility. To strengthen the adaptive capacity of poorer countries to climate change, article 4.5 of UNFCCC recommends that “the developed country Parties and other developed Parties shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention. In this process, the developed country Parties shall support the development and enhancement of endogenous capacities and technologies of developing country Parties” (Klein et al, 2005, pg. 3). With little international support according to the findings, Kenya has not been able to set up Carbon capture and storage facility. The local support given by the government is not adequate and therefore setting a carbon capture and storage plant remains a mirage to Kenya. Nevertheless, findings from other mitigation options show that despite Kenya being a developing country, it is doing well in terms of response to impacts of climate change on the environment. This has well been shown by findings from the Forest conservation and Afforestation programs and renewable energy sources that is highly relied on in the country.

Consequently, another important finding on the first research question is that Kenya has embraced all the three adaptation strategies as listed in the literature of Leichenko & O’Brien (2019), *Climate and Society: Transforming the future*. Article 7 of the Paris Agreement requires all parties to engage in adaptation planning and implementation through national adaptation plans, vulnerability assessments, monitoring and evaluation, and economic diversification. Likewise, Kenya’s National Adaptation Plan of 2015-2030 aims to consolidate the country’s vision on adaptation supported by macro-level adaptation actions that relate with the economic sectors and county level vulnerabilities to enhance long term resilience and adaptive capacity (Government of Kenya, 2016). The Kenya’s adaptation plan is a critical response strategy to climate change challenges facing Kenya (Government of Kenya, 2016). Being a developing country, factors such as poverty, weak institutions, poor infrastructure among many others have hindered Kenya’s adaptive capacity to cope with the impacts of climate change on the environment. Despite the challenges, the findings

show that Kenya has responded well to climate shocks especially to vulnerable pastoralist communities living in arid and semi-arid areas.

The third finding is on the second research question whereby Adaptation has been given more emphasis than mitigation in response to climate change by the Kenyan government. Perhaps maybe because of the differences in scale between mitigation and adaptation as argued by Tol (2005), that adaptation is primary a local issue and mitigation is basically a global issue. To enhance the adaptive capacity of vulnerable pastoral communities, Kenyan government has given more emphasis on adaptation than mitigation. This is anchored in the Kenya National Adaptation Plan that illustrates the country's vision on adaptation supported by macro-level adaptation actions that relate with the economic sectors and country level vulnerabilities in order to enhance resilience and adaptive capacity of vulnerable group (Government of Kenya, 2016). Also, adaptation has been prioritized because of the limited financial and technological capacity as shown by the findings. Kenya is a developing country with economic challenges and therefore putting a good response system with adequate finances and technology becomes a challenge. Mostly, the country relies on international donors to fund its budget. Being a local issue, adaptation is therefore prioritized over mitigation.

The fourth finding was on the Kenya's Institutional capacity to respond to climate change based on human resource capacity, financial capacity, and technological capacity. Although the findings showed that there was limited institutional capacity in each of the three sectors studied, some findings showed that Kenya has institutional capacity to respond to climate change. To begin with, the most interesting finding was on human resource capacity where Kenya despite being a developing country managed to train officials from both the national level and the devolved units on mainstreaming of climate change into national and county policy, planning and budgetary processes. Similarly, journalists from the media industry were also trained on reporting of climate related disasters as of June 2020 according to the findings. Lastly, through partnership with UNDP as per the findings, Climate Change Curriculum was developed and is used in training of national and county officials at Kenya School of Government. Enhancing human resource capacity through training (education), is an important factor in the fight against climate change. The study is convinced that the knowledge gained through educating public officials by the Kenyan government has helped authorities to understand and tackle the consequences of climate change in

Kenya. As stated by UNESCO (2021), education as a form of training on climate related actions raises awareness about human and institutional capacity on climate change mitigation, adaptation, and impact reduction, as well as on early warning systems. Therefore, contrary to the expectation that a third world country cannot have well trained staff, Kenya is doing well in terms of response to climate change by investing in education on climate related matters.

Secondly, on financial capacity especially on the local support, the findings showed that despite government's allocation to different agencies for climate actions both at the national and devolved units, what is given is not enough for the implementation and reporting of climate change related actions in Kenya. The estimated cost of implementing Kenya's mitigation and adaptation actions stands at USD 4.6 billion per year (Mazza, Balm & Caenegem, 2021). A report by Climate Finance to track the climate finance flow in Kenya shows that as of 2018, USD 2.4 billion flowed to climate related investments which is only a half of the climate finance needed annually (Mazza, Balm & Caenegem, 2021). A notable increase in climate related disasters such as floods and droughts as experienced in most parts of Kenya, is creating an economic liability of 2-2.8% of gross-domestic product (Mazza, Balm & Caenegem, 2021). This is because Kenyan economy is largely dependent on climate sensitive sectors such as agriculture, water, health, wildlife, and tourism (Mazza, Balm & Caenegem, 2021). For Kenya to ensure effective response to climate change that can lead to sustainable, resilient, and green economy, there is need for both the government and the private sector to scale-up and mainstream climate-related investments.

Similarly, the international community is not doing much in helping Kenya mitigate and adapt to the effects of climate change on the environment. Informant 4 stated that they have not received any amount from the USD 100 billion pledged by the developed countries in 2020 to help poorer countries adapt to climate change and mitigate further increase in temperature. The pledge was based on hope and that there was no formal deal on what each developed country should pay. This has affected many developing countries that relies so much on aid especially Kenya and financing most of climate related actions has become unrealistic. Also, the priority is always given to mitigation compared to adaptation by most donors because mitigation projects are clearer, measurable and can be quantified (Timbeley, 2021). This makes Kenya lose most of the donors as the government is putting more emphasis on adaptation. Additionally, the international support usually comes as loans or grants as stated by informant 5, and this has an effect on adaptation as

you cannot give people loan for adaptation but rather for mitigation projects that can generate income like solar farms (Timberley, 2021). In line with article 9 paragraph 3 of the Paris Agreement, there is need for developed countries to prioritized Kenya and give more climate finance to help her adapt and mitigate effects of climate change. This is necessary because developed countries have adequate preparation with climate change impact owing to their enormous finances and technology as stipulated by Wijaya (2014). Consequently, as shown by the findings, Kenya has limited capacity and is more vulnerable to climate shocks and therefore need for more international support.

To sum up, finding on technological capacity shows that Kenya has limited technological capacity necessitated by limited financial capability as stated by informant 4. Mostly, technological development takes place in the global north and China, owing to their financial and advancement in technology. Being a developing country, Kenya has limited capacity to match the developed world in technological capacity needed to effectively respond to climate change. To improve their technological capacity, Kenya's hope lies on article 4.5 of UNFCCC which reiterates the need for technological transfer. Nevertheless, the limited technology available in Kenya as shown by the findings has shown that Kenya is equally committed to respond to climate change through mitigation and adaptation.

7.2 Limitations of the Study

The limitations of the study are mostly related to the methodology of the study. I have already mentioned some of the limitations in Chapter 4, and I will briefly mention some here that are not elaborated in Chapter 4.

To begin with, the number of informants in this study does not reflect full representation of the public sector in Kenya. This has made it impossible to get more data from the different public agencies on response strategies to impacts of climate change on the environment. Nonetheless, the study ensured that participants were drawn from critical areas of study such as the Ministry of Environment and Forestry, Energy, Agriculture, and devolved entities from semi-arid regions. The participants were also knowledgeable and provided a thorough overview of the area under study. For the validity purposes, the study conducted document analysis, which provided comprehensive insights into the government's response to climate change.

Secondly, time constraints made it impossible for me to do follow-up interviews to get a broader understanding of the institutional capacity on climate related actions. Most informants were public officials that having appointment with them needed a prior arrangement and the time available wasn't enough. Also, with Covid-19 pandemic and the resultant government regulations, it was impossible to travel for one-on-one interview and therefore I hired a research assistant who helped in booking appointments for online interviews. Nevertheless, the online interview went well, and the study obtained most of the information needed for the research.

The other limitation to this study is external validity. It is difficult to generalize the information I gathered from Kenya and assume that it gives a reflection of what is happening in the rest of the world. Unless proper research is done on other countries, I cannot generalize the response by the Kenyan government to impacts of climate change on the environment the same as how the Tanzanian government have responded.

Lastly, since the university did not provide any financial support to the study, I had to use my own resources to pay the research assistant and meet other costs. This was costly on my side considering the fact that am only a student who has limited working hours as per the immigration regulations.

7.3 Recommendations for Further Research

My recommendations for further research are based on the conceptual challenges I came across while writing this thesis. For instance, I discovered that there is a strong correlation between institutional capacity, mitigation, and adaptation. For effective mitigation and adaptation, there must be a strong institutional capacity. Thus, my recommendation would be to uncover the effect of institutional capacity on mitigation and adaptation. It would also be interesting to compare Kenya to neighboring countries like Uganda and Tanzania for “most similar system” comparison and to European countries like the United Kingdom, Norway, and Denmark for “most different system” comparison. That would give an in-depth direct comparison on their climate change mitigation and adaptation strategies.

7.4. Reflection on Climate Justice

As mentioned in chapter two, climate justice is concerned with local impacts, vulnerabilities, experiences, and the importance of agency in local communities. In essence, climate justice approaches the climate situation through a human rights perspective, with the notion that by working together, humanity can create a better future for present and future generations.

One of the concepts of climate justice is Burden sharing justice according to Caney (2014). It talks of how the burden of combating climate change menace should be shared fairly amongst duty bearers (Caney 2014). It is thus divided into three principles. First, those who have caused the problem should bear the burden. Secondly, those who have the ability to pay should as well bear the burden and lastly, those who have benefitted from activities of climate change should bear the burden (Caney, 2014). Since the developed countries are the biggest emitters of greenhouse gases, it was agreed during COP 16 that the developed countries that are party to UNFCCC, should jointly mobilize an equivalent amount of USD 100 billion per year by 2020 to address the needs of developing countries (UNFCCC, 2019, pg. 23). Moreover, Article 9 paragraph 3 of the Paris Agreement stipulates that, developed countries that are party to UNFCCC should take the lead in mobilizing climate finance from a wide variety of sources, instruments, and channels, considering the needs and priorities of developing countries that are party to UNFCCC (UNFCCC, 2019, pg. 24). The outcome of the studies shows that indeed Kenya has benefited from the international community as far as supporting climate action is concerned. For instance, German donor agency (GIZ), has partnered with the government of Kenya in support of the transformation towards sustainable green technologies. Also, Food and Agricultural Organization (FAO), has partnered with the Ministry of Environment in Kenya in programs like Integration of Agriculture in National Adaptation Plan. The aspect of burden-sharing is well depicted here as the rich nations who are well industrialized with lots of emissions are paying developing countries (in this case Kenya), to help mitigate and adapt to climate change.

Consequently, on the first concept of climate justice as postulated by Caney (2014), that is harm avoidance, was well illustrated in this thesis. The concept seeks to prevent climate change and works from the perspective on how to reach a logical conclusion suggesting who should do what when it comes to climate change mitigation (Caney, 2014). The focus is mainly to prevent climate change from happening and if that is not possible, it seeks to minimize the threat of climate change (Caney, 2014). Specifically, the Harm Avoidance justice is concerned with the potential victims, (the people or area), that are threatened, and assigns responsibility onto others to be able to uphold or keep the potential victims out of harm (Caney, 2014). Accordingly, the outcome of the studies shows that the Kenyan government have invested heavily on mitigation and adaptation to ensure that her people are prevented from climate shocks and risks. For instance, to control disease outbreaks and improve resilience of livestock, the government of Kenya in the financial year

2019/2020 vaccinated a total of 10, 086, 752 heads of cattle in 30 counties (Government of Kenya, 2021). On the same note and through the intervention of the government, 18, 012 households insured a total of 90, 060 heads of cattle to avoid the risks associated with drought (Government of Kenya, 2021). By doing this, the Kenyan government minimizes the threats associated with climate change like death of livestock due to extreme drought. Ham avoidance concept in climate justice was fulfilled through this.

7.5 Concluding Remarks

It is agreed that climate change is a global emergency and a pressing issue globally (IPCC, 2014). Thus, need for effective response to climate shocks and disturbances. Kenya has responded to climate change through various mitigation options and adaptation strategies as evidenced in the findings. But for effective mitigation and adaptation, there should be strong institutional capacity. As envisaged in article 9 of the Paris Agreement, developed country parties are to provide financial resources to assist developing countries in implementing the objectives of the UNFCCC. Third world countries have limited institutional capacity making them vulnerable to climate shocks and stresses and therefore need for assistance from the developed world.

In full realization of goal number seven of sustainable development goals, which is to ensure access to affordable, reliable, sustainable, and modern energy for all. Kenya, as per the findings has tried to actualize this goal. And based on the findings, Kenya is one of the countries leading in the production of geothermal energy in the world. Statistically, as shown in chapter five, the analysis from the Energy and Petroleum Statistics Report 2019, shows that Kenya has installed geothermal capacity of 663MW as of 2019. Moreso, geothermal resources within Rift Valley region in Kenya is estimated to have a potential capacity of between 7000MW to 10, 000MW. The IPCC report indicates that geothermal energy has the potential to provide long-term, secure base-load energy and greenhouse gas emissions reductions and its widespread deployment can play a meaningful role in mitigating climate change. Therefore, having this type of energy together with other renewable forms of energy as per the finding, has made Kenya to ensure access to reliable, renewable, and sustainable energy which is fulfillment of sustainable development goal number seven.

Similarly, Kenya as per the findings, is actualizing goal 13 of Sustainable Development Goals, which is to take urgent action to combat climate change and its impacts. The mitigation measures

like afforestation and renewable energy sources and different forms of adaptation strategies according to the findings, is a clear indication that Kenya is fulfilling goal 13 of SDGs.

Finally, findings from this study, which for me was a bit surprising, was the many response strategies to climate change by the Kenyan government. Being a developing country coupled with high unemployment rates, poverty, diseases, terrorism, ethnic clashes among many others, it was unexpected to find the many response strategies to climate change by the government of Kenya. I therefore conclude that Kenya is responding well to climate change through mitigation and adaptation.

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APPENDIXES

Appendix 1: Interview Guide

Dan Oluoch Owino.

INTERVIEW GUIDE.

1. Based on your experience in your organization/institution, what is your view on climate change?
2. How has your Institution/organization responded to the impacts of climate change on the environment based on the following?
 - i. Mitigation Options
 - Tree Planting
 - Carbon Capture Storage
 - Renewable Energy
 - ii. Adaptation Strategies
 - Reactive Adaptation
 - Passive Adaptation
 - Anticipatory Adaptation
3. Has the emphasis in responding to impacts on climate change been ‘mitigation’ or ‘adaptation’? Or has there been a balanced combination?
4. What are the institutional challenges facing your organization in response to impacts of climate change on the environment based on the following?
 - Human Resource capacity
 - Financial capacity
 - Technological capacity

Appendix 2: Informants

Informants

Informant's Profile	Interview Schedule	Time	Place
Informant 1 (Ministry of Environment – <i>Climate Change Directorate Department</i>)	1/02/2022	1500hrs	Zoom (Nairobi-Oslo)
Informant 2 (<i>Christian Aid Organization</i>)	6/01/2022	1200hrs	Zoom (Nairobi-Oslo)
Informant 3 (<i>Kajiado County Government</i>)	18/01/2022	1200hrs	Zoom (Kajiado-Oslo)
Informant 4 (<i>Ministry of Energy</i>)	02/02/2022	0630hrs	Zoom (Nairobi-Oslo)
Informant 5 (<i>Ministry of Agriculture</i>)	08/02/2022	0900hrs	Zoom (Nairobi-Oslo)

Appendix 3: Supplementary information for chapter 5

Table 1. Mitigation options and adaptation Strategies– Informant’s views

Respondents	Mitigations	Adaptations
Informant 1 (Ministry of Environment – Climate Change Directorate Department)	<p>Forest conservation and Reforestation (Tree planting)</p> <p>Trees are planted in partnership with Kenya Forest Service (KFS)</p> <p>Priority is given to indigenous trees.</p> <p>More effort to plant trees in Arid and semiarid areas.</p> <p>Mostly trees are planted during rainy seasons.</p> <p>Carbon Capture and storage.</p> <p>No Carbon Capture and storage in Kenya because of lack of technology.</p> <p>Priority is given to natural means of capturing carbon like the use of Mangrove trees.</p> <p>Renewable energy</p> <p>Geothermal energy</p> <p>Work in collaboration with the ministry of energy.</p> <p>There is geothermal power plant in Olkaria.</p> <p>Wind power</p> <p>They have wind power plants in Ngong, Lake Turkana</p> <p>Hydropower</p> <p>It’s the main supply of energy in Kenya.</p> <p>Solar Energy</p> <p>Ministry of energy collaborate with private sector to provide solar energy.</p> <p>Mostly its used locally.</p> <p>Bioenergy</p> <p>They partner with the ministry of agriculture to ensure farmers are utilizing the use of manure.</p>	<p>1.Reactive Adaptation</p> <p>Partnership with National Drought Management Authority (NDMA) in giving Insurance to livestock</p> <p>Cushioning farmers during cases of extreme drought</p> <p>Other sectors like the ministry of Agriculture offers vaccination to livestock</p> <p>2. Passive Adaptation.</p> <p>Collaboration with the ministry of Agriculture in promotion of Climate Smart Agriculture. The aim is to ensure food security, but also to enable farmers to be resilient to impacts of climate change on the environment.</p> <p>“You try as much as you can not to plough the land when planting your crop. Bottom line is to ensure that soil is not disturbed, and that soil carbon is not depleted. And at the same time, ensuring that the farmer, has increased yields, and not being dependent on the fertilizer”.</p> <p>3.Anticipatory Adaptation.</p> <p>Development of National Adaptation Plan that stipulates the adaption plans and policies.</p>

	<p>There is also use of biogas and wood fuel at the rural level</p> <p>Summary</p> <p>90% of energy in Kenya is renewable energy. Northern regions rely on solar panels since they have no connection to the power grid.</p>	
<p>Emphasis</p>	<p>Climate change directorate prioritize both actions (Mitigations and adaptation), however adaptation actions are challenging to implement because it involves different type of actors.</p> <p>Adaptation Actions are also affected by socio-economic factors.</p> <p>The Ministry of environment has implemented more mitigation actions than adaptation actions</p>	
<p>Informant 2 (Christian Aid Organization)</p>	<p>Tree planting</p> <ul style="list-style-type: none"> -In partnership with the government, tree planting projects have been done with an aim to increase forest cover. This is to ensure that the country meets the 10% forest cover threshold that is in the constitution. -There is also partnership with schools and communities in planting of trees. -As an NGO, they advocate for resettlement of people living in forest's land rather than displacing them before planting trees. -The organization promotes planting of indigenous trees and are against planting of eucalyptus tree species because of the impact it has on water sources. -Restoration of Mau Forest is one of the projects they have done with the government. Specifically, they give financial support in purchase of tree seedlings. <p>Carbon Capture Storage</p> <p>Nothing has been done about this because of lack of technology and complexity of carbon capture storage.</p> <p>Renewable Energy</p>	<p>1. Reactive Adaptation</p> <ul style="list-style-type: none"> -They advise pastoralist farmers to be diverse and encourage conservation agriculture like bee keeping and poultry farming. -They have worked with communities in semi-arid areas like Isiolo, Garissa, and Marsabit and trained them on bee keeping and poultry farming as an alternative to pastoralism. <p>2. Passive Adaptation</p> <ul style="list-style-type: none"> - "Mostly it borrows from reactive and anticipatory adaptation. We don't really have much about it". <p>3. Anticipatory Adaptation</p> <ul style="list-style-type: none"> -We rely on Climate Change Act of 2016 -Also, we rely on National Climate Change Adaptation plan, and we were the sector lead during its development.

	<p>- “We are championing the production, distribution and use of clean energy for example solar and wind energy”</p> <p>-They are looking at how the government can ensure the production of sustainable green energy that is less detrimental to the environment.</p> <p>-They have not had any discussion around bioenergy because production of bioenergy involves the use of chemicals and destruction of environment. However, they champion the use of biogas.</p> <p>-They promote the use of hydro energy, but they have concerns on its impact on water resources.</p>	
Emphasis	Emphasis is on adaptation. This is because, as an NGO, they get funding for specific projects. Most of which are on adaptation.	
Informant 3 (Kajiado County Government).	<p>Tree Planting</p> <p>-A lot of tree projects have been done in areas like Ngong and Rongai.</p> <p>-They have partnered with NGOs, schools, and communities in several tree plantings projects.</p> <p>Carbon Capture and Storage.</p> <p>-This has not been implemented because of lack of technology in Kenya.</p> <p>Renewable Energy</p> <p>-They have a policy on Renewable energy strategy.</p> <p>Solar Energy</p> <p>-The ongoing project on solar energy includes street lighting in Kajiado county and, they urge locals to rely on solar power.</p> <p>-They have a public park i.e., Kajiado County Public Square, that is powered by solar.</p> <p>Wind Energy</p>	<p>1. Reactive Adaptation</p> <p>-Kajiado county government have done several boreholes to help communities during drought to get water which has been done in partnership with the ministry of water.</p> <p>-In partnership with NGOs, Kajiado county provides animals feeds (hay) in the event of loss of pasture during drought.</p> <p>-They provide alternative livelihoods like bee keeping to communities who have lost their cattle because of drought.</p> <p>2. Passive adaptation</p> <p>-They advocate for the use of solar energy as an alternative to electricity. By doing this, solar energy acts as a clean energy with zero emissions. It is done purposely as an alternative to black-out occasioned by shortages in hydropower.</p> <p>3. Anticipatory Adaptation</p> <p>-The Kenya constitution under forest act demands for 10% tree cover, and this is what the county government is relying on as they are implementing tree planting as a mitigation measure.</p> <p>-They have renewable energy bill that is under development.</p>

	<p>-There is Kipeto wind plant within Kajiado county, but the management is under the Ministry of Energy.</p> <p>Geothermal Energy</p> <p>-There is Olkaria Geothermal Power Plant under the management of the ministry of energy.</p>	
Emphasis	Kajiado county government prioritizes adaptation. This is because Kajiado county is in semi-arid area making it vulnerable to impacts of climate change hence the need for adaptation.	
Informant 4 (Ministry of Energy).	<p>Tree planting</p> <p>-They have partnered with other ministries in several tree planting projects. For example, adopt a forest project.</p> <p>-KenGen has tree nurseries that gives tree seedlings to communities for planting.</p> <p>-Kenya Power has tree planting programs and give financial support on tree planting activities to communities.</p> <p>-They get advice from Kenya Forest Service (KFS) on type of tree species to plant.</p> <p>-They plant trees on gazetted forest land and public institutions like schools.</p> <p>-Tree planting is done during rainy seasons.</p> <p>Carbon Capture energy</p> <p>There is no technology for this.</p> <p>Renewable energy.</p> <p>Hydropower</p> <p>-There is total production of over 800 MegaWatts in Kenya.</p> <p>-The ministry encourages individual production of hydropower that produces less than 1MW for home consumption.</p> <p>Wind Energy</p> <p>-There is wind power plant in Ngong near Nairobi which started as a pilot project with a capacity of 5Mw and was later expanded to 82MeggaWatts.</p>	<p>1. Reactive Adaptation</p> <p>-Raising of dam levels. This is because there are seasons of long rains and dry period. So, the reason of raising of dam levels is to accommodate excess water during seasons of long rains, so that it can be used during dry season.</p> <p>-Construction of boreholes in semi-arid lands to provide water during drought.</p> <p>-Use of concrete electric poles instead of timber to minimize use of trees. This is a reactive measure to deforestation.</p> <p>2. Passive Adaptation</p> <p>- No comment on this</p> <p>3. Anticipatory Adaptation</p> <p>-No comment on this</p>

	<p>- Also, there is a big wind plant in Marsabit county (Turkana Wind Plant), which has a capacity of 310 megawatts that contributes to about 15-18% of the national grid.</p> <p>-There is another station in Kajiado county that produces 100 MegaWatts.</p> <p>-There are new plants in Nyandarua, Isiolo and Meru County.</p> <p>Geothermal Energy</p> <p>-Kenya is the 8th largest producer of geothermal energy</p> <p>-It contributes to about 40% capacity of the national grid.</p> <p>-They have geothermal plant in Olkaria.</p> <p>-Currently there is ongoing development of geothermal plant in Menengai.</p> <p>Solar Energy</p> <p>-It is a resource the ministry is taking advantage of</p> <p>-They have the grid cell solar plants in different capacities</p> <p>-There is also off-grid solar system and mini grid system that is implemented at the community level</p> <p>-There are also initiatives like M-kopa, that through partnership with various organizations, has been implemented at the community level.</p> <p>Bioenergy</p> <p>-Done in different forms, for instance, use of biogas, wood fuel, manure, charcoal, etc. These mostly happens in small scale at the rural levels.</p>	
Emphasis	The ministry of energy has a balanced approach. They give priority to both mitigation and adaptation.	
Informant 5 (Ministry of Agriculture)	<p>Tree Planting</p> <p>-Enhancing agroforestry, i.e., incorporating cultivation of trees with agriculture.</p>	<p>1. Reactive Adaptation</p> <p>-The research has been undertaken to ensure that breeds and varieties that can do well in semi-arid areas are given priority as a</p>

	<p>-Under livestock department within the ministry, trees with multiple purposes are considered. This is because in addition to sequestering carbon, they also act as feeds to livestock.</p> <p>-The ministry is keen on tree species they plant, and therefore varieties like Eucalyptus are not encouraged due to their impacts on water sources.</p> <p>-They promote trees that are friendly to crops and livestock, e.g., grevillea and Leucaena species.</p> <p>Carbon Capture and Storage.</p> <p>-No such mitigation measures due to lack of technology and the low emission levels</p> <p>Renewable Energy</p> <p>Bioenergy</p> <p>-Use of timber (wood fuel) in factories like tea factories</p> <p>-Use of manure at the local level</p> <p>-Use of Biomass at Tea Factories</p> <p>Solar Energy</p> <p>-Promoting use of solar energy for irrigation, i.e., the irrigation pumps are driven by solar power</p> <p>-Solar energy is used in milk cooling plants</p> <p>Geothermal Energy</p> <p>-Kenya is the 7th leading producer of geothermal energy in the world</p> <p>-60% of energy is coming from Geothermal sources</p> <p>-As a country we have Geothermal power plant at Olkaria</p> <p>Hydropower</p> <p>-Several dams generating Hydropower</p>	<p>measure to adapt to the changing climate, e.g., leguminous plants, brachiaria plant among many others.</p> <p>2. Passive Adaptation.</p> <p>-Farmers are changing to short duration crops due to shift in rainfall patterns</p> <p>3. Anticipatory Adaptation</p> <p>-Kenya Climate Smart Agriculture Strategy (KCSAS). This is a policy or a strategy to build resilience of agricultural systems while minimizing emissions for enhanced food and nutritional security.</p> <p>-Livestock Development Policy session paper No. 3 of 2020</p> <p>-National Climate Act of 2016, which is within the Ministry of Environment</p>
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	<p>-More efforts given to Geothermal energy and in the last 10-15 years, there is no major development of hydro-plants.</p> <p><i>Wind Energy</i></p> <p>-There is 300Mw from Marsabit which is already in the grid. Mostly the development is under private management</p> <p>-There is also some wind development plant in Ngong near Nairobi</p>	
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Appendix 4: Supplementary information for chapter 5

Table 2: Results on Conservation and Afforestation

Actions	Results achieved as of June 2020 (Cumulative)
Afforest and reforest degraded and deforested areas in counties (devolved units)	62,142.6 Ha of land afforested or reforested including through agroforestry. At least 2,292,327 tree seedlings planted. 7,565,355 bamboo seedlings planted.
Reduce deforestation and forest degradation	20,252 Ha put under improved management including community management and carbon stock enhancement. Tharaka-Nithi County formed 8 community forest associations; fenced 15 km of Mt. Kenya Forest; protected 6 hills awaiting gazettement; and trained 1,000 farmers on biogas and solar energy technology. 1,494 improved cooking stoves supplied and installed in households and institutions. Forest Reference Level (FRL) developed and submitted to UNFCCC.
Restore degraded forest landscapes (ASALs and rangelands)	47,327 Ha of degraded forests within rangelands restored.
Promote sustainable timber production on privately owned land	Area under private sector commercial and industrial plantations increased by 29,501.32 Ha to a total of 100,572.32 Ha.
Conserve land areas for wildlife	366,288 Ha of wildlife habitats conserved. 11,146 Ha of rangelands rehabilitated.
Enabling Action	Forest Reference Level developed and

(technology)	submitted to UNFCCC.
Enabling action (policy and regulatory)	<p>National strategy for accelerated achievement and maintenance of over 10% forest cover approved by Cabinet.</p> <p>Draft national Wildlife Climate Change Strategy developed.</p> <p>3 county-level natural resource-based policies developed (Kiambu, Kisii, and Taita Taveta).</p> <p>Meru County gazetted 37 hills as forest and conservation areas.</p> <p>Turkana developed a tourism sector strategy.</p>

Source: Ministry of Environment and Forestry – Climate Change Directorate (National Climate Change Action Plan 2018-2022).