

**INDIGENOUS RAINMAKING PRACTICES AND THEIR
IMPLICATIONS ON CLIMATE CHANGE IN WESTERN KENYA**

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AIU/03923P/2018

**A Dissertation Submitted in Partial Fulfilment of the Requirements for the Award of
the Degree of Master of Science in Information and Knowledge Management
in
The School of Information and Social Studies
of
The Technical University of Kenya.**

(December, 2022)

DECLARATION

I declare that the dissertation is my original work and as far as I am aware, it has not been presented for the award of a degree in any university.

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DEDICATION

I dedicate this dissertation to God Almighty, my creator, my strong pillar, for this far He has enabled me to reach. Without God directing my path, I would not have made it.

ACKNOWLEDGMENTS

I thank the Almighty God for giving me the strength and guidance to complete this dissertation. I express my gratitude to my supervisors, Prof. Tom Kwanya and Dr. Ashah Owano, for their constant motivation, expertise and patience in guiding me to the successful completion of this dissertation. I thank my family, especially my late father, who encouraged, supported and offered me a deep insight into my studies. I also wish to acknowledge the knowledge provided to me by my lecturers in the Department of Information and Library Sciences, The Technical University of Kenya.

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LIST OF ABBREVIATIONS AND ACRONYMS

BEAMS:	British East African Meteorological Service
FCCC:	Framework convention on climate change
GHGS:	Greenhouse gases
IK:	Indigenous knowledge
IPCC:	Intergovernmental panel on climate change
IRB:	Institutional Review Board
KMD:	Kenya Meteorological Department
MDGs:	Millennium Development Goals
MENR:	Ministry of Environment and Natural Resources
MTP:	Millennium term plans
NACOSTI:	National Commission for Science, Technology and Innovation
NCCRS:	National climate change response strategy
PAR:	Participatory action research
QDAS:	Qualitative data analysis software
SDE:	State Department of Environment
SDGs	Sustainable Development Goals
SGAS:	School of Graduate and Advanced Studies
STI:	Science, Technology and Innovation
TEK:	Traditional ecological knowledge

DEFINITION OF KEY TERMS

This section presents the working definitions of key terms and concepts as used in this research study.

Climate

This refers to the average atmospheric conditions over a long period, like 30 years (Igben, 2021). Climate describes the long-term (minimum 30 years) and average weather conditions for a specific region. Examples include maritime climate, cold-dry desert climate, and tropical climate. Global climate classification maps highlight the high variety of climates. Climate is composed of different components and factors. In this dissertation, climate is perceived as the atmospheric conditions of Western Kenya with a special focus on rainfall.

Climate adaptation

Adaptation to climate change is understood to include efforts to adjust to the ongoing and potential effects of climate change (United Nation, 2016). Climate adaptation includes the actions people take in response to or in anticipation of changing climatic conditions like traditional rainmaking practices, and the beliefs of preventing rain from falling (Ombati, 2017).

Climate change

Climate change can be defined as an unexpected change in the atmosphere which is unpredictable and is a result of forest destruction. For instance, in Kenya the months that are expected to be very hot like January become rainy or very cold as experienced in January 2020 (Fitchett, 2020). It is a change which is attributed directly or indirectly to human activities that alter the composition of the global atmosphere, and which are in addition to natural climate variability observed over comparable periods (United Nations Framework Convention on Climate Change, 1992).

Indigenous knowledge

Indigenous knowledge (IK), also known as traditional knowledge, is the knowledge of an indigenous community accumulated over generations (Jessen et al., 2022). It can also be defined as traditional cultural knowledge that includes intellectual, technological, ecological and medical knowledge. In this study, the focus is on the Nganyi community and their practices in rainmaking.

Weather

The atmospheric conditions of a specific place are considered over a short period, usually one month (Vrac et al., 2014). These atmospheric conditions include sunshine, rain, wind, cloud cover, flooding, hailstorms, and thunderstorms, among others. It can change from hour to hour, day to day, or season to season.

Weather forecasting

Weather forecasting is the application of science and technology to predict the state of the atmosphere of a given location (Kenya Meteorological Department, 2010). In this dissertation, it is perceived as the prediction of atmospheric phenomena which include changes on the earth's surface caused by atmospheric conditions like snow, ice cover, storm tides and floods.

Western Kenya

According to Article 6 (1) of the Constitution of Kenya (2010), Western Kenya comprises four counties, which are Bungoma, Vihiga, Kakamega and Busia. It borders Uganda and was one of Kenya's administrative provinces before the promulgation of the Constitution of Kenya (2010). It is to the west of the Eastern Rift Valley. The major inhabitants of Western Kenya are the Abaluhya people.

ABSTRACT

This study investigated the Indigenous rainmaking practices & implication on Climate Change in Western Kenya. The study particularly focused on the Nganyi clan of Bunyore which is a sub-ethnic group of the Abaluhya community living in Vihiga County. The study found out that climate in Western Kenya has changed drastically as a result of atmospheric changes. This change has affected the rainy seasons. The specific objectives of the study were to: (a) investigate the prevalence, evidence, seriousness, and effects of climate change in Western Kenya; (b) analyse the local community's response to the effects of climate change in Western Kenya; (c) identify and document indigenous rainmaking practices which can be used for climate change mitigation and adaptation in Western Kenya; (d) describe how the traditional rainmaking practices can be used to confront the consequences of climate change; and (e) explore strategies which can be used to mainstream traditional rainmaking in building climate change resilience in line with the Sustainable Development Goals (SDGs), Vision 2030 and the "Big 4" Agenda in Kenya. The research approach was qualitative. Primary data was collected through interviews using interview guides with open-ended questions. The population of the study were traditional rainmakers in Western Kenya and weather forecast experts from the Kenya Meteorological Department. Secondary data was collected through documentary analysis of relevant literature. Data was analysed qualitatively and used a case study design. The local community has responded to climate change by planting drought-resistant crops that can withstand the changes, and planting trees to attract rainfall. Traditional rainmaking practices such as making of rain, prevention of rain from falling, and prediction of rain can be used to enhance the community's capacity to adapt to and/or mitigate climate change effectively. Related knowledge of how to arrest lightning, thunderstorm and hailstorm can also be used to confront the consequences of climate change such as drought, , and overgrazing. Through traditional rainmaking, the community under study has been able to mitigate and adapt to the changes in climate to some extent. It is evident from the study that traditional rainmaking can contribute to food security, improved manufacturing through the provision of raw materials, healthy livelihood, social security, increased employment through sustainable agriculture, as well as safeguarding houses from thunder and floods. For this to happen, there is a need to mainstream traditional rainmaking in the national response to climate change through documenting, popularising and validating the practice.

CHAPTER ONE

INTRODUCTION AND BACKGROUND OF THE STUDY

1.0 Introduction

This chapter presents the introduction, contextual background of the study, problem statement, purpose, objectives, research questions, assumptions, significance, justification, scope, limitations and dissemination of the study.

1.1 Background of the study

Indigenous Knowledge (IK) should be protected through policy due to its distinct intellectual knowledge. For the Government of Kenya to take measures with the threats experienced by climate change, it had to consult several stakeholders – civil society organisations, relevant researchers and scholars, mass media, conservationists, and community leaders, among others – to formulate and adopt an understandable National Climate Change Response Strategy (NCCRS) in April 2012. The NCCRS (2012) states that the country had to come up with an inventory of IK which has been utilised by communities to manage the unpredictable changes in climate as part of the strategy for dealing with climate change. According to the strategy, IK is recorded and absorbed in recommendations on climate change response. Nonetheless, Owuor (2007) laments that IK generally remains on the fringes of Kenya's decision-making processes and is regarded as outdated and historical rather than contemporary.

Indigenous knowledge is embedded in the cultures of local communities like medical, intellectual, technological and ecological knowledge that has accumulated over generations (Owuor, 2007). It is applied in forecasting local weather and to assess, predict and interpret climate through locally observed variables and experiences (UNEP, 2008). It is done using a combination of plant, animal, insects, meteorological and astronomical indications. According to Johnson (1992) and Emery (1995), indigenous knowledge depends on the traditional cultures of local communities that they have accumulated and renewed over generations. Ossai (2010)

explains that IK is tacit in that some of the knowledge has not been transferred to other locals and explicit in that knowledge is shared among the community through experiments, repetition and basic needs. Indigenous Knowledge determines the local level decision-making of a community in agriculture, healthcare, food preparation, education, natural resource management and other activities (Warren, 1991; Matowanyika, 1994; Grenier, 1998).

1.2 Contextual background of the study – the Nganyi clan of Western Kenya

The Nganyi is a sub-clan of Abasiekwe who belong to the Banyore clan which is a sub-ethnic group of the Abaluhya. Their traditional home is in Vihiga County of Western Kenya. It is one of the communities known for the indigenous knowledge practice of traditional rainmaking and have relied on agriculture for close to 500 years (Ottichilo & Khasilwa, 2016). They are known for predictions and making of rain which compliments and baffles the rapidly improving meteorological science of rainfall prediction. The approach combines the metaphysical and scientific paradigms. However, their predictions have been misinterpreted by outsiders as myths.

According to Ottichilo and Khasilwa (2016), the Banyore are descendants of Marimba. Muhibbah, the son of Marimba became the father of Anyole. Anyole is said to have been killed during the war. Onyango (2019) explains that Anyole's widow bore a son named Anyole II. The Nganyi community are descendants of Anyole II. They settled in Ebusiekwe, a dry hilly area endowed with flora and fauna, and conducive to their IK.

Despite the fact that narratives have confirmed that their skills in rain prediction originated from a woman, the larger clan disregarded women, especially those who were childless. The social and *de jure* relationship from a traditional perspective between an Anyole (a person of Banyore) husband and his wife was ill-balanced (Ottichilo & Khasilwa, 2016). The biasness was prolonged into cultural inheritance like rainmaking among the Nganyi whereby men were initiated into, yet it originated from a woman.

Ottichilo and Khasilwa (2016) narrates how rainmaking was both a source of dignity and desecration to the Nganyi in 1919. The extended drought was blamed on Etemesi and Nganyi. They were arrested and taken to Kisumu by colonial rulers who forced them to cause rain to fall. They made rain at the shrines against the Abanyore tradition. This is because the Abanyore had an official rainmaking shrine in the Lela area. It is believed the two rainmakers were killed mysteriously for becoming famous by making rain while under the custody of the white men.

Ottichilo and Khasilwa (2016) states that predictions of rain among the rainmakers was through observation of natural phenomena by traditional elderly men. Conditions of the atmosphere were the indicators mostly relied upon to predict rain. The other mechanism for rainfall prediction was performed by a few selected elders through divination, visions and dreams. The rainmakers derived their forecasts by observing the behaviour of plants, animals and stars.

According to the Kenya Meteorological Department (2010), weather and climate information was provided to local communities. They achieved this by dividing the year into four quarterly calendars that were used in agro-ecological zones to expedite the planning of present agricultural calendars. Crop calendars were beneficial to the local communities in Western Kenya as they provided guidance to the right time for cultivating, sowing and harvesting.



Figure 1: The Nganyi shrine in Esibila Village in Vihiga County

Source: Esipisu (2016)

Rainmakers among the Abanyole community observed the flora and fauna in the Nganyi forest shrine to predict weather conditions. The Nganyi forest shrine in Esibila village has helped the locals predict weather conditions for generations (Herero et.al, 2010).

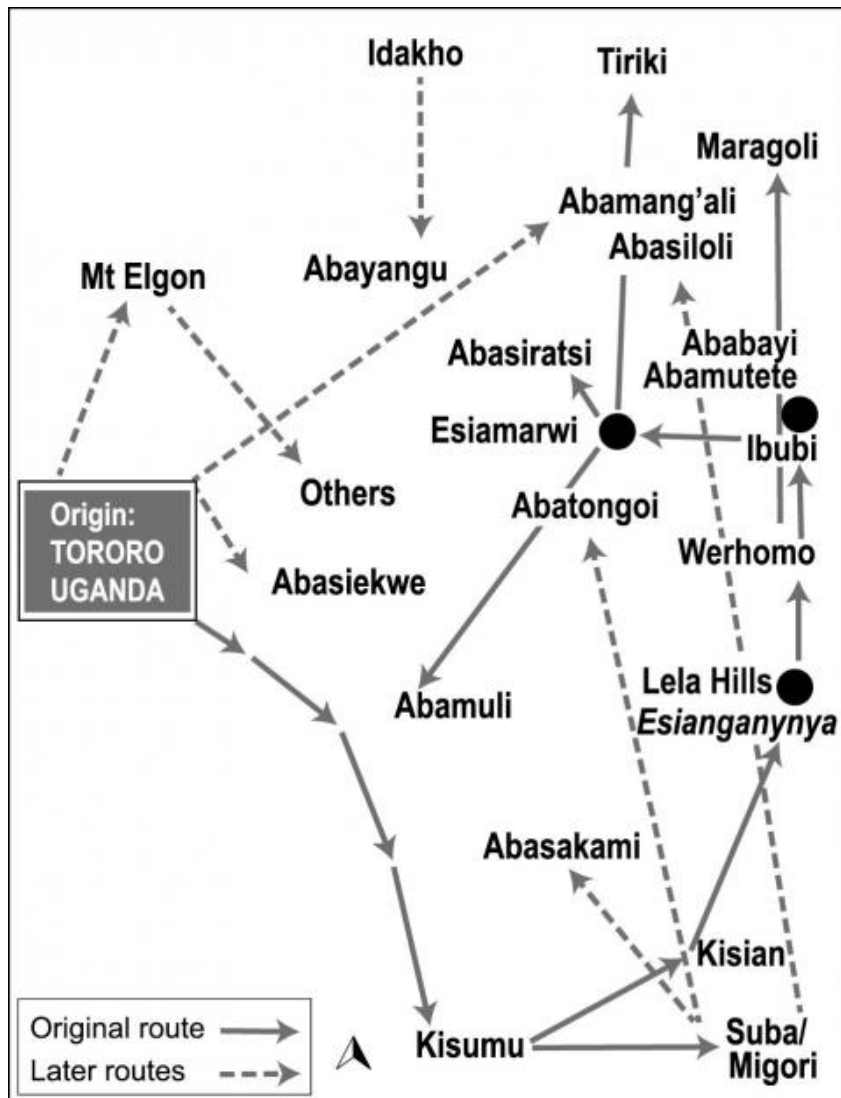


Figure 2: Historical path of the Nganyi community (project site) within Western Kenya

Source: Ottichilo (2016)

Figure 2 is an illustration of the Nganyi historical migration path from their original home in Tororo, Uganda to Abasiekwe in Bunyore of Western Kenya.

1.3 Statement of the problem

Consequences of climate change arises to poverty, drought, famine, health risks, deaths which affects the life of human being and the environment equally. For instance, forest cover plays a role in determining the climate pattern that is vital for animal, plant and human growth. However, out of the selfish desires of man to expand his territory, the activities to create solutions to problems such as settlement and industrialisation are becoming more hazardous

than had been earlier thought of (IPCC, 2007). The Government of Kenya and other stakeholders have tried many options to deal with climate change but these efforts have borne minimal results.

In the past, indigenous knowledge in the context of traditional rainmaking was used to counter cruel climatic occurrences. For example, during cultural ceremonies such as weddings, naming of children and burials, a rainmaker would perform miraculous chants to forbid rain. Currently, the indigenous knowledge of traditional rainmaking among the Nganyi community of Western Kenya is not being used effectively to contribute to the efforts of the government and other stakeholders to respond to the effects of climate change.

The custodians of this knowledge are the community elders who are rapidly decreasing (Akong'a, 1987). The younger generation are less interested in traditional rainmaking knowledge referring to it as a myth. In addition, the spread of Western social structures and institutionalised forms of cultural transmission has restricted the indigenous views of the world and approaches to education (Barnhardt & Kawagley, 1999).

Consequently, important aspects of indigenous knowledge such as the flowering pattern of trees and the position of the moon, stars and sun has not been formally documented anywhere (Masinde, 2015). Agrawal (2008) explains that upgrading was proving to be a threat to the practices of indigenous people.

Traditional rainmaking of the Nganyi community is in danger of getting lost because it is tacit knowledge contained in the brains of the elders of the clan. Therefore, there is a need for conversation on how to mainstream traditional rainmaking in confronting climate change in Kenya hence this study.

1.4 Purpose of the study

The purpose of the study was to investigate the indigenous rainmaking practices in western Kenya, particularly among the Nganyi and its implication to climate change in the same region.

1.5 Specific objectives

The specific objectives of the study were to:

1. Identify and document traditional rainmaking practices which can be used for climate change mitigation and adaptation in Western Kenya.
2. Investigate the prevalence, evidence, seriousness and effects of climate change in Western Kenya.
3. Analyse the local community's response to the effects of climate change in Western Kenya.
4. Examine how the traditional rainmaking practices can be used to confront the consequences of climate change in Western Kenya.
5. Explore strategies which can be used to mainstream traditional rainmaking in building climate change resilience in line with the Sustainable Development Goals (SDGs), Vision 2030 and the "Big 4 Agenda" in Kenya.

1.6 Research questions

This study sought answers to the following research questions:

1. Which traditional rainmaking practices in Western Kenya can be used for climate change mitigation and adaptation by the local community?
2. What are the nature and effects of climate change in Western Kenya?
3. How has the local community responded to the effects of climate change in Western Kenya?
4. How can the traditional rainmaking practices be used to confront the consequences of climate change in Western Kenya?

5. What strategies can be used to mainstream traditional rainmaking in building climate change resilience at the county and national levels in line with the Sustainable Development Goals (SDGs), Vision 2030 and the “Big 4 Agenda” in Kenya?

1.7 Assumptions of the study

An assumption is what one feels or believes is true but lacks adequate evidence.

1. The study assumed that the participants were to answer the research questions willingly and not participate to gain favour from a interviewee who introduced them to the researcher.
2. The interviewees were free to provide the researcher with information on the process of rainmaking as practised in the community and show the researcher location of the shrines.
3. The study assumed that though climate change was a serious challenge globally, the community’s efforts towards mitigating and adapting to it were more practical and sustainable.
4. The study also assumed that the interviewees would provide information freely without giving conditions or demanding payment.
5. The researcher assumes that the criteria of sample selection was accurate hence all the interviewees had the same experience in the phenomena of the study.

1.8 Significance of the Study

According to Owuor (2007), the Nganyi people of Western Kenya have a highly developed system of traditional rainmaking. Osunade (1994) and Warren (1992) explain that such valuable indigenous knowledge should be documented, disseminated and applied to address modern challenges.

The study was to gather and analyse data which may be adopted by organisations like the Kenya Meteorological Department (KMD), Kenya Forestry Research Institute (KEFRI), Kenya

Forestry Service (KFS), and universities. The government should also seek strategies for motivating rainmakers to actively participate in contributing to the national response to climate change.

The findings of the study can be used by the national and county governments to develop policies such as mitigation and adaptation strategies, and integration of modern science with indigenous knowledge which enhance the use of traditional rainmaking in responding to climate change. The government through ministry of environment should collaborate with rainmakers in maximising the promotion of tree planting and reforestation.

The study may also contribute to the efforts to reduce the negative attitude and low opinion that modern science has towards traditional rainmaking which is regarded as a myth or legend by encouraging both parties to work hand in hand as they engage in performing their duties in rainmaking and weather forecasting to achieve accurate information.

The study may also assist other local communities to adopt some of the traditional rainmaking knowledge as practised by the Nganyi such as information based planning for agriculture like the use of accurate weather forecasts as well as planting drought-resistant crops.

The government may also sensitise traditional rainmakers on how they can contribute to the realisation of both short and long term developing blue prints such as the Big 4 Agenda and Vision 2030. They can be educated too on the key targets of these blueprints which are relevant on their practice.

1.9 Justification of the study

It was essential to address climate change which is affecting the country today by looking at the remedies from traditional and scientific approaches. This is effected by encouraging individuals to embrace traditional practices like indigenous knowledge to address climate change (Ascher, 2002). It also acts as an indication that indigenous knowledge and science can

be combined to exchange ideas on climate change adaptation and mitigation methods (Watson & Chambers, 1989). Therefore, research relating to traditional rainmaking practices was necessary as a means of improving the understanding of natural and cultural ways to mitigate climate changes. This study was also motivated by the fact that there is a dearth of scientific literature on the topic.

1.10 Scope of the study

Scope of the study refers to the boundaries of the study. The focus of the study was on Indigenous Rainmaking practices and their implications on Climate Change in Western Kenya. The research covered the identification and documentation of traditional rainmaking practices of the Nganyi rainmakers. The researcher chose Western Kenya because it's the backbone of agriculture and the country relies on it for economic sustenance.

1.11 Limitations of the study

Limitations of the study are constraints beyond a researcher's jurisdiction that can affect the results of a study (Wiersma, 2000). The study involved the participation of professionals from the Kenya Meteorological Department. Limitations may occur if an interviewee is held up with other activities at the time of the interview. To overcome the challenge, the researcher got the contacts of the interviewees and called them for the interview. The languages that the researcher used were English, Kiswahili and Kinyore. The research assistant was of relevance to this study because the researcher does not understand the Kinyore language. Additionally, translators were employed to avoid compromising the quality of information obtained during the research process through translation either during interviews. Some of the interviewees may hold back information or give wrong information. To address this limitation, the researcher recorded the interviews (where permitted) using a mobile phone for later reference.

1.12 Research Limitations

The researcher had expected to interview all the 11 KMD weather informants but instead only managed to get 5. The distance was also of concern because the researcher had to travel to Bunyore for data collection and this was challenging due to COVID-19. Time constraints was of concern because it was difficult to gather all the rainmakers at the same time. Face to face interviews consumed a lot of time and most of the interviewees did not want to be videotaped. The researcher had challenges with a research assistant that declined to travel to Western Kenya due to COVID-19 and this necessitated the researcher to get a replacement immediately.

1.13 Dissemination of the findings of the study

This dissertation will be submitted to The Technical University of Kenya as part of the requirements for the award of Master of Science in Information and Knowledge Management. Additionally, the research will be disseminated to institutions like universities, archival institutions like the Kenya National Archives, Kenya Meteorological Department, Kenya Forestry Service (KFS), Kenya Forestry Research Institute (KEFRI), as well as the Ministry of Environment and Forestry that may be interested in furthering research on the potential application of traditional rainmaking. The findings will also be disseminated through presentations at conferences, electronic publications, through self-archiving and sharing with my lecturers and peers. On finalisation of the research, the findings will be disseminated to the officials of the Vihiga County Government to aid in compiling data that relates to climate change. The findings will also be published in peer-reviewed journals.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviewed existing research on the study topic using thematic approaches. The chapter reveals to the scholar what has been studied and the gap that need to be bridged, hence setting up the need for the research to be conducted (Denney & Tewksbury, 2013). Mattern (2010) avers that it connects a topic to ongoing conversations in the literature by extension of prior studies and filling in gaps. It gives guidance for understanding the reason why the study was conducted. It entails explanations of previous research topics that other researchers had studied in regards to rainmaking practices used in confronting the consequences of climate change. A good review of literature permits different theories to be studied by the researcher in relation to the identified topics (Boell & Cecez-Kecmanovic, 2010). This literature review is aligned to themes drawn from the objectives of the study. The themes include prevalence, evidence and seriousness of climate change, effects of climate change, local community's response to effects of climate change, traditional rainmaking practices which are used for climate change mitigation and adaptation, traditional rainmaking practices used to confront consequences of climate change, strategies that can be used to mainstream traditional rainmaking in building climate change resilience in line with the Sustainable Development Goals (SDGs), Vision 2030 and the "Big 4 Agenda" in Kenya.

2.1 Prevalence, evidence, seriousness and effects of climate change

The crisis caused by climate change has proven to be an environmental and human hazard that partially undermines the Sustainable Development Goals (SDGs) effort on zero hunger and the efforts of the international community to reduce extreme poverty leading to development challenges in the 21st Century (IPCC, 2007). Climate change has a global impact. However, it largely affects developing countries due to their vulnerability to extremes of normal climatic

variability. Given this, it raises the rate and extent of severe weather occurrences like flooding, landslides, and impassable roads (GOK, 2010).

According to Ifejika (2010), climate prediction is difficult despite the local communities in Western Kenya considering themselves as weather experts; differentiating between climate (statistical expectation) and weather such as sunshine, rain, and floods seems to be a challenge. Because of these, unique events are attributed to climate change but fail to reflect on climate changes. Indicators of climate change include climate events like frosts, flooding or drought (Speranza, 2010). In view of the low adaptive capacity in responding to the impact of climate change, there is a consensus that developing countries, due to lack of financial resources for implementation measures, warmer baseline climates and heightened exposure to extreme events are more vulnerable to climate change than developed countries (Fischer, Shah, Tubiello & Velhuizen, 2005). Climate change presents serious global risks according to scientific evidence and should be urgently addressed (IPCC, 2007).

Additionally, Masinde, Bagula and Muthama (2012) explains that changes in rainfall patterns has greatly affected agriculture as well as the disappearance of primary forests as a result of uncontrolled cutting of trees for timber, farming, oil exploration and exploitation. Similarly, urbanisation and mining activities has tremendously contributed to vegetation loss (Fischer, Shah, Tubiello & Velhuizen, 2005). These factors have contributed to climate change being experienced throughout Kenya. Its impact is being felt in areas that are experiencing food insecurity, increased dangers of diseases and the increasing cost of extreme weather damage such as floods, damaged roads, crops and animals being swept away, houses collapsing, and landslides, among others.

According to Golam & Bikash (2016) natural resource management is among the development approaches that adaptation to global warming requires to ensure sustainable application of soils

and water. However, the effects depend on the society's response through climate mitigation measures such as lowering the number of greenhouse gases in the atmosphere. Adaptation includes the potential effects of climate change and the ongoing efforts to adjust it. Adaptation could also involve the actions that people take in responding to the conditions of global warming like traditional rainmaking practices, and the beliefs of preventing rain from falling (Ombati, 2021). This is mostly done during an important function or event like a burial ceremony.

Climate change response places an exception within communities on the generation, interpretation and application of the information in decision making. The abilities of indigenous people are inadequate in contrast with science where traditional ecological knowledge (TEK) and scientifically acquired data are compared and contrasted (Polfus et al., 2014). Indigenous Knowledge (IK) is perceived in debates as possessing the potential of assisting communities in adapting to climate change (Kabisch et al., 2016). However, combining it with modern weather science is of concern, especially at the policy and planning level (Kabisch et al., 2016). Integration of IK in climate policy can enhance effective mitigation and adaptation development strategies that are cost-effective, participatory and sustainable (Robinson & Herbert, 2001; Hunn, 1993).

Africa is experiencing tremendous climatic challenges that has resulted in disasters such as the destruction of roads, houses and farms, and famine due to scarcity of rain. Despite the meteorological scientific intervention application, some communities in Africa still practice the traditional knowledge of making rain (Enock, 2013). Traditional knowledge that characterises the making of rain has the capacity of offering a valuable understanding of environmental changes which complement broader-scale scientific research with local precision and variation (Ombati, 2017).

Prevalence of Climate Change

Income, security and land for food are heavily relied upon by the locals and this prompts them to be highly sensitive to the stresses and shocks of climate change. Social and political marginalization, poverty, and limitations on access to information hinder the human capacity to conform to their changing environment and context (Newell et al., 2020). Despite this, the local communities across the region are responding by managing the dangers that global warming brings to their lives. The vulnerability of developing countries to climate change needed to be reduced by adapting the capacity raised to implement national adaptation plans Rasul and Sharma (2016). Otherwise, the community risk being infected with various diseases that are sensitive to climate change like malaria, tuberculosis and diarrhoea and if not urgently addressed communities may suffer the consequences (Simane et al., 2016).

Evidence of Climate Change

(Codjoe et al., 2014) states that communities in Sub-Saharan Africa are experiencing excessive consequences of global warming whose effects include very high temperature, high levels of rainfall and high frequency of floods, and famine as a result of the drought which has negatively affected livelihoods, especially for the poor households.

The seriousness of climate change

High heat geographically affects the distribution of disease vectors which are forced to migrate or move to areas of higher altitudes. For instance, the migration of mosquitoes to higher altitudes exposes a larger population of the local communities in the densely populated East African highlands to infections such as malaria (Schindler, Rabitsch & Essl, 2018). Some of these are fatal and this negatively impacts on the economy of the communities.

Speranza (2010) explains that sand harvesting among local communities in Western Kenya has proved to be a bumper business for sustainability and livelihood yet the locals do not know that

it is one of the causes of climate change. Other human activities that have had an impact on climate change include deforestation, and the burning of fossil fuels like coal, oil and natural gas. These human actions have resulted in a higher atmospheric concentration of a number of greenhouse gases such as carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, and ozone in the lower part of the atmosphere. Deforestation and other land use over the past 100 years have substantially contributed to atmospheric carbon dioxide increases in many countries (Phillips & Brienen, 2017). Farming along the river banks in Western Kenya has also been affected by climate change tremendously.

2.2 Effects of climate change

Climate change is predicted as having extensive consequences on physical, ecological and societal systems (Ford, McDowell & Jones, 2014).

Health

Some of the possible impacts that are related to health include malnutrition, infectious diseases, changes in temperature-related mortality, environmental quality, societal stability and natural disasters. Climate change causes health risks which occur as a result of the interaction of undetermined future climatic changes with complex ecological, nutrition, healthcare quality, physical, and socio-economic systems such as globalization, demographic changes, and changes in land use, and nutrition (Jabareen, 2013). In this study, high temperatures affected the local communities negatively. For instance, high temperatures in the region causes droughts and when the downpour is heavy, it causes floods which leads to stagnant water. The stagnant water then attracts mosquitoes which cause malaria.

Food security

Wide-ranging effects are experienced in the environment, socio-economic related sectors including food security, water resources, agriculture, human health, terrestrial ecosystems and

biodiversity in Coastal zones and Western Kenya (Urama & Ozor, 2010). In January 2020 (Fitchett, 2020), most parts of Kenya experienced heavy rainfall that caused severe flooding. January is traditionally known as a hot month and is a time when farmers prepare their land for planting. Such drastic changes in rainfall patterns are often as a result of climate change and usually confuse farmers who are not sure when is the best time for planting. The net result of this is that it eventually causes food insecurity. Heavy rain also causes floods which carry away top soil causing the land to be infertile. The top soil is deposited in water bodies causing siltation thus affecting marine life. For example, breeding of fish is interfered with hence a challenge to the economy of the communities. Additionally, high temperature causes shifts in crop growing seasons thus affecting food security and changes in the distribution of disease vectors on the crops hence compromising food security.

Human safety

Kenya experiences multiple hazards, with drought being the dominant one. It affected various locations of the country during the years 2000, 2005, 2006, 2009 and 2011. Different communities lost lives as a result of hunger, lack of clean drinking water, and loss of their livelihoods like livestock. Initiative-Africa (2013) further states that natural disasters such as thunder, floods and drought have been frequently occurring in some parts of Kenya like Budalangi in Western Kenya where thousands of people have previously been displaced from their homes.

Jabareen (2013) states that Africa is one of the most vulnerable continents to climate change. The social, economic, domestic and political lives of the people have received a blow from the phenomenon of climate change which is worsened due to low adaptive capacity. The impacts of climate change in Africa are enormous ranging from poor harvest, runoff changes and availability of water in the Mediterranean and southern countries of Africa, to increased

stresses which come about as a result of increased droughts, floods, important extinction of plant and animal species and associated impacts of livelihoods. Due to the changes in the availability of water and rain patterns, some African countries like Kenya, Tanzania, Ethiopia and many others have encountered high developmental setbacks (Ancharaz & Sultan, 2010).

Economic crisis

Other difficulties that locals are faced with in coping with climate change is the loss of business installations due to floods such as the one experienced in most counties in Kenya between January and June 2020. According to Kimutai and Wale (2020), floods submerged Mugeni Bridge near Sotik town in Bomet County, on the Kisii–Bomet–Kericho–Narok highway on 25th April 2020 and this brought down the economy of the country because businessmen got stranded and had to cover longer distances to reach their destinations and even the locals had to move. Rebuilding the bridge meant that the government had to divert funds meant for other purposes and this had a general negative effect on the economy of the country. Floods also damaged a section of the River Nzoia Bridge at Shibale on the Mumias–Bungoma road in May 2020 (Otenyo , 2020). Many roads were cut off in various parts of the country. In Kisumu Dunga beach and its surroundings, which is a source of income to the locals of Western Kenya as a whole, were flooded in April 2020 (Odhiambo, 2020) causing damages to lots of property. The high temperatures experienced have the potential to severely increase the extinction rates of many species of animals and their habitats. This in turn affects tourism which earns the country foreign exchange.

2.3 Local community's response to the effects of climate

Most people in Western Kenya stay in structures which are not strongly built (Yitambe et al., 2010). For instance, in Bunyore of Western Kenya, most houses are built of mud. Any time it rains heavily, the houses are swept away. Yitambe et al. (2010) explains that watershed management is an effective tool for addressing many of these problems in flood-prone areas so

as to improve livelihoods. People and livestock are an integral part of watershed and their activities affect the productivity status and at the same time affects the mitigation of floods in the watershed. Local communities residing in Kano Plains in Nyando, for example, are affected by floods every year giving rise to malaria and other waterborne diseases. Consequently, storage of water in dams, reservoirs for future utilization are good indicators in the management of the watershed which helps in mitigating floods (Raburu, 2012). He adds that stored water has to be used during the rainy season failure to which it may overflow causing floods. The water can be used for purposes such as irrigation, spraying livestock and for domestic use. This enhances the livelihood of the locals significantly because there will be plenty of food as well as mitigating floods. Raburu (2012) explains further that water is a necessity in the development of any society economically, culturally and socially but can also be disastrous if not properly used. For example, the continued loss of fertile soil and siltation of rivers in the Kano Plains may pave way for frequent flooding. In response to the reoccurring floods, several initiatives have been implemented such as river draining, construction of water pans for water harvesting, and construction of dykes. According to Shilenje and Ojwang (2015), early warning in weather forecasting provides for effective and timely weather information that allows communities, organizations and individuals who are likely to be exposed to weather hazards to act.

Response to climate change has been commonly categorised as a way of reducing the rate at which levels of climate change occur naturally, thereby, reducing the atmospheric concentrations of greenhouse gases (GHGs). This is referred to as mitigation or responding to adverse effects of climate change. The frequency and severity of the hazards of climate change are rising globally and the effects are seriously felt in local communities. It is therefore, uncertain or not easy to enhance the understanding of the available response options that are being selected by the communities (Thornton et al., 2014). Local communities are reporting the

consequences of climate variations in their areas and responding to the new conditions as best as they can using solutions that are specific to the locality (Van Aalst, Cannon & Burton, 2008). Some of the measures to reduce the negative effects of climate change include increased sea defences, coming up with houses or homes on stilts that are flood-proof to reducing the amount of water used during the period of drought, and using insecticide-sprayed mosquito nets (Adedeji, 2014).

2.4 Traditional rainmaking practices used for climate change mitigation and adaptation

The roles of rainmakers in the African traditional society is important due to their responsibilities for the wealth and health of the community through provision and controlling of the life-giving waters (Christian, 2014). Rainmaking was conducted with the assistance of natural cause knowledge such as rainy or dry seasons. Climate change has affected these natural causes. This has ultimately affected the precision of this practice. Rainfall has become inconsistent because of the weather that cannot be predicted due to changes in the climate and temperature globally (Parham & Michael, 2010). This has posed a challenge to rainmakers as their initial knowledge of weather patterns is proving to be obsolete and non-functional in the new climatic realities.

Akong'a (1987) explains that traditional rainmaking practices among the Abanyala community is regarded as a form of magic or prayer, whereby, human beings influence weather conditions to cause rainfall or not to bless or curse a community. He adds that it is founded on indigenous observations of meteorological phenomena which has guided both seasonal and inter-annual activities of the local communities for millennia. The Abanyala refers to this practice or traditional knowledge as *khulangaifula* which means calling rain. Rainmakers among the Abanyole community observes the flora and fauna in the Nganyi forest shrine to predict weather conditions. The Nganyi forest shrine in Esibila village has helped the locals predict weather conditions for generations (Herero et.al, 2010). Rainmaking is practised secretly in the

absence of their heirs. They only bequeathed the power to their heirs when approaching death. Due to the confidentiality, the particulars of the rainmaking process remains the secured secrets of the rainmakers. Gifts such as livestock and money is offered to the rainmakers to make rainfall when there are droughts or for rain not to fall on special occasions like weddings, burials and sports events.

Akong'a (1987) explains that in Western Kenya among the Abanyala community, a ruler called Nasokho was not in a position to intercede for his people against drought. The resultant famine and loss of life led to the ruler being replaced by Masiribayi, a rainmaker from the Maasai tribe who managed to cause rain to fall after asking the Banyala, a Luhya speaking people, to make their fields ready for planting. As a result Masiribayi, became the ruler due to public acclaim. The diverse kinds of rainfall rituals has been hypothesized as having emerged in arid and semi-arid regions as a way of coping with the unreliability and inadequacy of rainfall. Man became aware that he could adapt to conditions of rainfall inadequacy and unreliability through the manipulation of supernatural forces which were believed to be closely associated with weather conditions. This was not to say that rainmaking rituals were to be found only in the areas of rainfall deficit. Ethnographic evidence reveals that some societies in Eastern and Southern Africa experienced sufficient rainfall for agricultural production yet rainmaking was a lucrative and prestigious profession (Oestigaard, 2014). It is important to note that the Abanyole community were not known for making rain until the arrival of an elderly woman from the Nandi district who had no fixed abode but was temporarily sheltered by a man in the Maragoli location. To express her gratitude, she taught the man how to make rain (Akunda, 2010). Unfortunately, the man got frightened of the snakes and thunder that accompanied the rain causing him to chase her away. She eventually arrived at Bunyore where the Nganyi live and was warmly welcomed. To date, the Nganyi are the only family associated with rainmaking practices. Akunda (2010) adds that interestingly, Bunyore Location received over 60 inches of

rainfall with a good harvest during its two planting and harvesting seasons in a year. The community hold the belief that without the Nganyi's art of making rain, they will have problems. They also believe that when drought strikes it is because the Nganyi family has been angered about something in the community.

2.5 Traditional rainmaking practices to confront the consequences of climate change

The concept of traditional rainmaking is founded on indigenous observations which guide seasonal and annual activities of local communities. Haruna (1997) explains that in Nigeria during prayers for rain, priests and locals carry all sorts of assorted food. They also wear sackcloths and rags, and cover themselves with ashes. They drum empty tins and calabashes, and blowhorns. These prayers are held in special locations normally under special trees which are considered to be the sacred abodes of the spirits amongst the people. The farmers' entire livelihoods depend on rain which they believe is a demonstration of the goodness and providence of God. There are similarities in these practices and beliefs to those of neighbouring tribes in western Africa and the Middle East. For instance, Elijah and Moses in the Bible are referred to as rainmakers because they prayed to God for rain and the rain fell.

Huffman (2012) observes that in South Africa, there are archaeological evidence of pre-historic ritual spaces and behaviour in pre-colonial farming societies, as well as that of the Nguni, Sotho-Tswana, Shona and Tsonga, and notes that during severe drought, rainmakers climb special rainmaking hills to cause rain to fall. These hills are unique because they represent mountains that are sources of streams and cisterns that represent pools. Rainmaking sites are sacred sites which are located outside settlements on hilltops associated with heavenly bodies. Rituals are concerned with the daily behaviour of the community and are incorporated into the roles of every citizen including leaders, rainmakers, and pre-adolescents.

Matsuhira (2013) examines the preparation, process and procedure of the annual rainmaking ceremony of the Shona people in Zimbabwe and reports that rainmaking ritual demonstrates the centrality and power of gender and virginity by invoking ancestral spirits and divinity, by way of body purity. The ceremony is not only a preparation for the farming season but also an opportunity to discuss the politics of the clan as it is an important traditional system of social, political, religious and economic organisation of the Shona people of the Nyandoro region. Makuvaza (2008) notes that *Njelele* is a premier mystical and highly revered rainmaking shrine along the south western fringes of Matobo National Park in Zimbabwe. The shrine is an important cultural heritage site believed to have diverse and powerful values and spiritual status. God known as *Mwarior Mlimo* in the local dialect, the creator of the world, is believed to live at *Njelele* and His presence is felt through His voice when invoked and ensures agricultural prosperity by providing adequate rainfall. During rainmaking ceremonies, only pre-adolescents and post-menopausal women are allowed to carry beer pots to *Njelele*, to maintain the shrine's purity. After incessant prayers, incantations, singing, praising, clapping, and requests, *Mlimo*'s voice grants the community's appeal for rain and advises the priest and messengers on some of the procedures and requirements to be adhered to.

Makuvaza (2008) avers that only intermediaries who come from particular families are believed to have strong spiritual traditions connected with the shrine and understand the *Mwari*. They are the people who can lead, guide and regulate pilgrims in consulting the *Njelele* oracle. People still engage in consulting and invoking the shrine during the period of sowing, reaping and also in times of natural phenomena such as drought, rain failure and control of their indigenous cultural properties. They have a strong feeling that they should be considered as an integral part of the team that protects, preserves, repairs, maintains, manages and benefits from the utilisation of their cultural properties. They resent the deprivation of their economic, social, and cultural rights by the proclamation of *Njelele* as a national monument.

Byaruhanga (1982) states that in the traditions of the Ugandan Kingdom of Bunyoro, there are people who are believed to control the weather with regard to having or not having rain through the power given to them by the divinities. The Nyoro rainmakers are either men or women. They mostly come from one specific genealogical lineage or clan. However, they go through training before assuming rainmaking duties. Only people of good character, social quality and grace are allowed to be rainmakers. If serious droughts threaten the survival of the community and livestock, the community has to approach rainmakers to intervene. The rainmakers are also believed to know how to stop rain on wedding days or other functions, like burials, where people do not want the rain to disrupt the function. On the day of supplication, rainmakers clear a section of the bush or forest which is used as the shrine for the sacrifice. Byaruhanga (1982) avers that after the rain prayers ceremony, people go home to wait for the rain which ordinarily fall even before they reach their homes. At times, however, rain can take one to three days before falling. It is very rare for rain to fail as expected.

According to Wagner (1949), the Maasai, Ameru and Agikuyu has similar practices of traditional rainmaking. Kenyatta (1937) recounts how the Agikuyu community approach their ancestors in prayer, ritual and sacrifice beseeching them to intercede with God (Ngai) during times of prolonged drought and failure of rains in due season. However, if it fails to rain, inquiries are made on the defined procedure and the whole ritual is repeated by observing special care until it eventually rains. Thus, God hear, accept and answers their prayer and brings them rain. When rain eventually fall, a short planting ceremony to bless the seeds is organised by the elders to ensure good crops. Rainmaking tradition is dominant among the farming communities although pastoralist communities, like the Maasai, also has rainmakers.

From the foregoing, it is evident that traditional rainmaking is practised by many communities in Africa. It is also clear from the literature that the power to control rainfall is divine and

exercised by Supreme Beings. Traditional rainmakers are individuals who beseeches the supernatural powers to send or stop rain on behalf of the communities. The absence of rain or excess of it is perceived as punishment from the Supreme Being for sins which are atoned through sacrifices. Rainmakers offer the sacrifices on behalf of the communities. Although most rainmakers are male, there are also female rainmakers in some communities. Thus, rainmaking is not a gendered role.

Traditional rainmaking in Kenya originated from indigenous observations that has guided inter-annual and seasonal activities of the local communities for years. This knowledge has been applied to modern science in climate change by offering interpretations and observations at a much finer spatial scale by highlighting elements that may not be considered by climate experts (Nakashima et al., 2012). Predictions of rainmaking in Kenya are administered through spiritual and cultural practices like dreams, divination and visions from selected elders who perform sacrifices that mediate between the living and the dead ancestors.

Akong'a (1987) explains that rainmaking can either be a public or private event whereby communities can participate freely and publicly or the known rainmakers can diagnose the cause of either drought or too much rain in some private function and demonstrate the power to reverse the situation. He adds that regardless of its rationale, history or practice, the emerging challenge of climate change in Kenya has turned people's attention steadily to traditional practices. It is important to note that some of the communities in Kenya who practise traditional rainmaking are the Akamba, Maasai, Ameru, Agikuyu and Abaluhya.

2.6 Strategies used to mainstream traditional rainmaking

Kenya Vision 2030 is a blueprint for the country's long-term development strategies, predicting a newly industrialized middle-income country by the year 2030. It recognises Science, Technology and Innovation (STI) as an important component of industrialisation and economic

diversification. The Vision states that science must translate into technologies and innovations that focus on societal problems, and considers a competitive knowledge-based economy globally (Ayisi et.al., 2019). The current policy trend in Kenya recognises STI as an enabler for Vision 2030, hence, it is a key strategic instrument for realising the government's "Big 4 Agenda" of food security, manufacturing - mainly on job creation, affordable housing and access to affordable universal healthcare to address sustainable development through economic and social transformation (Hoka, Njogu & Obiero, 2018). In addition, the "Big 4 Agenda" is mandated to provide the rural development planning a new impetus as the Government allocates resources for the implementation of some of the rural-based development sectors such as proper healthcare, food security, industrial take off, for instance, job opportunities, and ensuring enough housing for the communities. The constitution of Kenya (2010) acknowledges the role of science and indigenous technologies in national development and advances the Intellectual Property Rights (IPR) of Kenyans. The STI Act of 2013 was enacted to realign STI programmes to national goals and for strengthening the National System of Innovation (NSI). Three strategic organisations namely the National Commission for Science, Technology and Innovation (NACOSTI), National Research Fund (NRF) and Kenya National Innovation Agency (KeNIA) were created by the Act (GoK, 2013a).

The successful manner to convey the effects of climate change is by combining adaptation measures into sustainable development plans to lessen the demand on natural resources, revamp environmental risk management, and raise the social well-being of the poor (Heltberg, Jorgensen & Siegel, 2008). Humans are influenced directly by climate change through impacts of the risk of extreme events on lives, health, livelihoods and human settlements, and indirectly through the viability of natural resource-based economic activities and impacts on food security (Biazen, 2014). Available scientific evidence indicates that climate change presents very serious global risks and urgent action is needed to address it (Weber & Stern, 2011). Climate

change in Kenya has been recognised as a serious threat to economic development and the government has set out to address it (Adano, Dietz, Witsenburg & Zaal, 2012). Domestic concerns, as well as international obligations, have propelled efforts to address climate change. The current national development blueprint “the Vision 2030” recognises the need to address climate change. It states that Kenya aims to provide its citizens with a clean, secure, and sustainable environment by the Year 2030 to support the social pillars. Some of the strategies aimed at achieving these goals include the promotion of environmental conservation to assist in achieving the unmet targets of the MDGs and improving waste management and pollution by applying economic incentives and commissioning Public–Private Partnerships (PPPs) to improve sanitation delivery and water efficiency. Kenya aims to improve disaster preparedness in all disaster-prone areas that are occasionally affected by floods, landslides and the capacity for adaptation to the impacts of global climate change. The country is to harmonize environment-related laws for better environmental planning and governance (GoK, 2007).

2.7 Theoretical framework

The study is rooted in the indigenous worldview by Fleer (1999). The model illustrates that knowledge can be grouped into two worldviews, which are the Aboriginal (indigenous) and the western which refers to scientific knowledge. The model refers to indigenous knowledge as the traditional worldview produced to maintain the particular needs of the society, whereas the Western worldview originates from modern science. From this study, indigenous knowledge, in particular traditional rainmaking and modern science will complement each other. The model states that the two types of knowledge area illustration of one’s worldview. It explains that western science seeks power over people and nature whereas IK seeks to co-exist with the same. Western science is seen as being materialistic, individualistic and competitive, whereas Aboriginal knowledge is spiritual, holistic, communal and cooperative. Although there appears to be some difference between the two worldviews, it is not sensible

because they engage with and motivate each other. Aboriginal knowledge can be investigated and validated to produce the same knowledge as western science. In addition, it can also be documented just like western science.

In this study, indigenous worldviews by Flerer represents the theoretical framework of the study. The researcher used the model to explain how the application of traditional rainmaking practices in Western Kenya can be used in confronting the consequences of climate change.

2.8 Conceptual framework

A conceptual framework is defined as an interconnected set of ideas regarding how a phenomenon works or is related to its parts (Antonenko, 2015). It also provides a context for interpreting the findings of a study to be conducted.

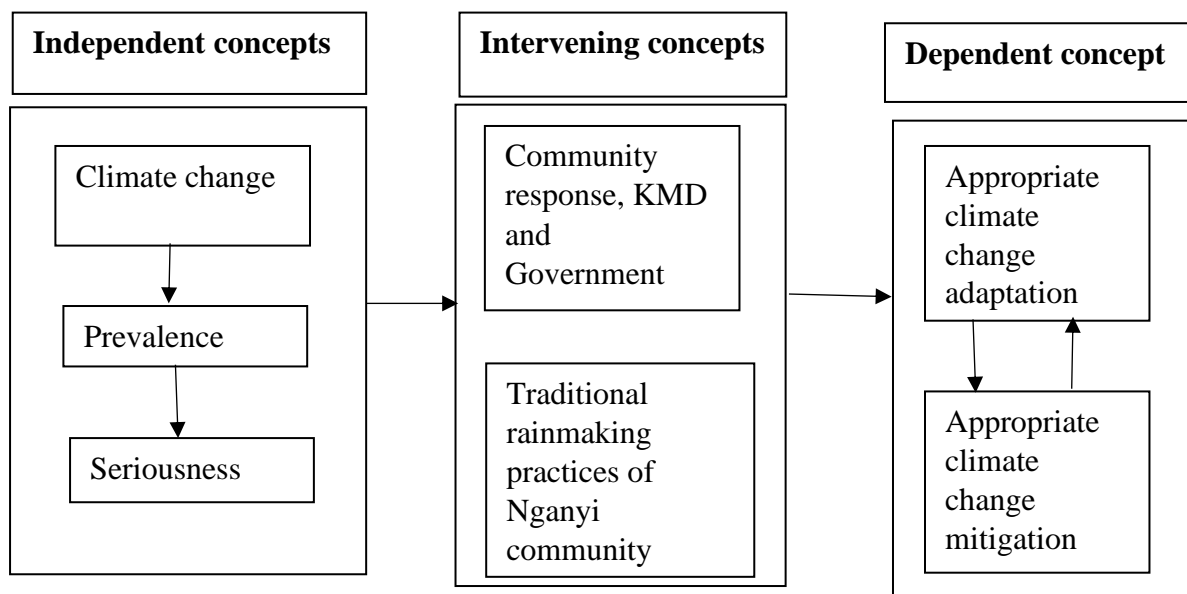


Figure 3: Conceptual framework

In this study, climate change prevalence and climate change seriousness are the independent concepts which affect communities in Western Kenya. Therefore, communities with the assistance of the Government and KMD can use the traditional rainmaking practices of the Nganyi community which can be done through better climate adaptation, and climate mitigation with the two influencing each other.

2.9 Literature gap

The study by Pettengell (2010) focus on social and political marginalisation, poverty, and limitations on access to information that hinders the local communities' capacity to adapt to their changing environment while this study sought to focus on documentation of traditional rainmaking practices. The study by Nath and Behera (2011) focus on the importance of the vulnerability of developing countries to climate change that should be reduced by adapting the capacity raised to implement national adaptation plans. This study aims at developing strategies that can be used in mainstreaming traditional rainmaking in building climate change resilience in line with the SDGs, Vision 2030 and the "Big 4 Agenda" in Kenya. The main aim of this study is, therefore, to advance the practice of mitigation and adaptation strategies using traditional rainmaking practices. The introduction of modern science and new technologies has failed to recognise the importance of traditional rainmaking by referring to it as outdated. This study was also motivated by the fact that there is a dearth of scientific literature on the topic. The study by Parham and Michael (2010) on the inconsistency of rainfall as a result of unpredictable weather due to changes in climate and temperature globally is a challenge to rainmakers since their initial knowledge of weather operation is proving to be obsolete and non-functional in the new climatic realities. The yearly re-occurrence of changes in climate which are unpredictable requires that studies be conducted to assess issues to do with traditional rainmaking practices and how they can be applied in modern science in confronting climate change hence the reason for conducting this study. Mitigation and adaptation strategies through traditional rainmaking practices are gaps that this study is intended to bridge. Owuor (2007) states that IK generally remained on the fringes of Kenya's decision-making processes and is regarded as outdated and historical rather than contemporary. This study aims at analysing ways in which traditional rainmaking practices is applied in confronting the consequences of climate change in Western Kenya.

2.10 Chapter Summary

Chapter two focused on reviewing available literature on the topic under study. The literature review was done in a thematic manner with the research objectives acting as the guiding themes for the literature review. The chapter additionally looked at the model supporting the study. The indigenous worldview was adopted as it depicts knowledge into two worldviews with indigenous being one of them. From the literature review conducted, gaps were identified and these further supported the research undertaken by the researcher to address some of the identified gaps.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.0 Introduction

This chapter presents the research methodology in terms of research approach, philosophical worldviews, research design, population and sampling, data collection techniques, sample size, data collection tools, data collection procedure, data analysis, data presentation, pilot study, reliability and validity, and ethical considerations.

3.1 Research approach

The research approach comprises a detailed method of data collection, analysis and interpretation. The different types of approaches are qualitative, quantitative and mixed approaches. Information science researchers employ different methods of research that can be categorised widely into qualitative and quantitative (Bryman, 2017). Qualitative researchers believe that real-world phenomena need to be assessed from the context of reality. Qualitative research is important because it studies minimal number of cases in-depth, and can describe a combination of occurrences. Thus, it provides information on an individual case and conducts comparison, understanding and description of personal experiences of phenomena (Zucker, 2016). This study employed a qualitative research approach because it allowed for a limited number of cases to be studied in-depth and was able to understand rainmakers' personal experiences with traditional rainmaking. It relied on non-numeric data such as interviews and observation.

3.2 Philosophical worldviews

According to Wang (2018), philosophical worldviews are basic sets of beliefs that guide action. The four well-known worldviews are positivist (or post-positivist), constructivist (or interpretivist), advocacy/participatory, and pragmatist. The positivists seek an objective reality

that exists in the world and is independent of participants. The research methods used are controlled experiments, case studies and surveys. Data collection is quantitative with random sampling. The interpretivists seek subjective reality constructed by participants whose research methods are case studies, surveys and interviews. The data collection employed is both quantitative and qualitative with random and purposeful sampling. The pragmatists seek the truth that is practical and works at the time. It uses mixed methods research with qualitative and quantitative approaches employing random and purposive sampling. Advocacy and participatory applies the interpretive philosophical worldview because it is subjective and constructed by participants. It relies on the views of the informants. In this study, the researcher depended on participants' ideas, opinions and interpretations in regards to the phenomena.

3.3 Research designs

Johnson, Adkins and Chauvin (2020) perceive qualitative research designs to include narrative, phenomenology, grounded theory, action research, case study, ethnography, historical research, and content analysis. The structure of a case study should be the problem, context, issues, and lessons learned (Creswell, 2014). According to Starman(2013), case studies have the potential to achieve high conceptual validity, strong procedures for the development of new hypotheses, usefulness for closely examining the hypothesized role of causal mechanisms in the context of individual cases and their capacity for addressing causal complexity. The study used a case study design because, it enabled the researcher to explore the issues under study in-depth (Mohajan, 2018). Case studies use open-ended questions where interviewees freely shared their experiences. The researcher remained neutral during data collection and analysis to avoid the subjectivity of interviewees in terms of their opinions, attitudes and perspectives. To avoid biases, research findings were validated with key informants (Nganyi elders) and recorded interviews. In addition,at least two research assistants not known to each other were engaged and interviewees were required to use either Kiswahili or English languages.

Interviews were done until a point of saturation was achieved. However, the researcher assumed that not all interviewees in this study were subjective.

3.4 Population of the study

The population of the study comprises a group of individuals who have common characteristics that a researcher is interested in (Kothari, 2004). This study focused on the rainmakers from the Nganyi community and KMD expert weather forecasters. The Nganyi is classified among the Banyore clan, a sub-clan of Abasiekwe who reside in Vihiga County of Western Kenya. The Banyore occupy the western part of Vihiga County with over 20 clans and reside in two sub-counties, namely Emuhaya which according to the 2019 census recorded 46,507 male and 50,633 female, and Luanda which recorded 51,525 male and 55,165 female. From this figure, the number of Nganyi was unknown to the researcher and for that reason snowballing sampling was adopted by the researcher.

The researcher got a contact person from the Kenya Meteorological Department (KMD) Kakamega website to get information about the organisation structure in Western Kenya. She was informed that every county has a KMD department. Vihiga Metrological Department had one County Commissioner, one officer in charge of the station known as Nganyi Ranet Station (a radio network), two volunteer climate monitors, five volunteer climate informants and two volunteer observers whose responsibility was to collect weather data such as temperature and rainfall. From the information gathered, Vihiga Meteorological Department had only two staff and the rest were volunteers who were not on the payroll. This study used census sampling for KMD experts because the researcher had intended to interview all the 11 staff but on arrival got only 5 who were interviewed

3.5 Sampling technique

A sampling technique is a series of actions that are undertaken by a researcher in selecting a sub-group from a population to participate in a study. It involves selecting several individuals who are a representation of the large group for a study (Ogula, 2005). The rationale of using a sampling technique is that it saves time and provides higher accuracy than a census because data collection from fewer cases allows a researcher to collect more detailed information (Pandey & Pandey, 2021). It is part of statistical practice concerned with the selection of individuals who are intended to yield knowledge about the population of concern with the main purpose being statistical inferences (Kothari, 2020). There are two main sampling techniques: probability and non-probability sampling. Probability sampling techniques include random, stratified and cluster sampling. Non-probability sampling techniques include purposive (judgemental), convenience, quota and snowballing sampling. The researcher identified the interviewees using non-probability sampling technique whereby the researcher inquired from the Vihiga Meteorological Department office at Nganyi about rainmakers and KMD experts. Vihiga Meteorological Department office identified one rainmaker, the researcher used the one identified to get others.

One of the most well-known forms of non-probability sampling is the snowball sampling method, which is particularly suitable when the population of interest is hard to reach and compiling a list of the population poses difficulties for the researcher (Heckathorn, 2015). Snowballing is applied where the population to be studied is unknown and rare. Through snowballing, a researcher identifies a participant who is referred to as a primary data then collects the information required. The interviewee then identifies others (Marcus et al., 2016). The study used snowballing sampling technique because the rainmakers were unknown to the researcher. Census was used for KMD experts because the researcher had intended to interview all the 11 staff but on arrival got only 5 who were interviewed. The three types of snowballing

are: linear snowball sampling in which a researcher recruits a single participant, while the second nominee recruits the third participant, and so on. The second type is exponential non-discriminative snowball sampling where every recruited participant in the research work recruits another participant. In the exponential discriminative snowball sampling, not every recruited participant recruits another participant; the chain is discriminating. The researcher in this study used exponential discriminative snowball sampling. This is because only rainmakers who knew other rainmakers introduced them to the researcher.

3.6 Sample size

The concept of concentration is the most significant factor when making sample size decisions in qualitative research as has been argued by a majority of scholars (Johnson, Adkins & Chauvin, 2020). Saturation relies on many factors such as selection criteria, aridity of the population to be studied, comparability of the population being studied, and researcher's timeline (Hennink & Kaiser, 2021). The selection criteria that the researcher used to arrive at the sample size was identifying the first rainmaker from the Vihiga Meteorological Department office who was well informed of the presence of rainmakers in the area. The referred rainmaker then identified others to the researcher and the selection pattern stopped at saturation. KMD professional weather forecasters were identified through census from Vihiga Metrological Department. The interviewees referred to were mostly elderly informants in rainmaking who had much experience in the practice of rainmaking. The study targeted Nganyi clan members only and KMD experts.

3.7 Data collection techniques

Data collection techniques include interviews, observations, questionnaires and relevant documents (Yin, 2014). Interviewing is an important approach to data collection in that it permits the researcher to have control over data construction and the flexibility to allow issues

that emerge during the interview to be pursued (Roberts, 2020). Interviews were conducted one-on-one, face-to-face. The researcher asked the interviewees open-ended questions and recorded their answers using the mobile phone recorder which was important in allowing more consistent transcription. Interview techniques were of significance in this study by uncovering the story behind the interviewees' experience, knowledge and pursuing in-depth information about traditional rainmaking.

3.8 Data collection tools

Data collection tools are referred to as instruments that are used in collecting data. The tools include an interview guide, checklist, data compilation forms, eyes and other senses, tape recorder, and questionnaires (Yin, 2014). An interview guide is a set of questions that the researcher asks during the interview (Rassel et al., 2022). An interview is a face-to-face conversation involving a researcher and interviewee entailing the transfer of information to the interviewer (Cresswell, 2012). This study used an interview guide tool with open-ended questions which allowed interviewees more options for answering.

3.9 Data collection procedure

The researcher engaged a translator as a local research assistant since the interview was administered in English, Kiswahili and Luhya languages. The research assistant's duty was to act as a translator in cases where the interviewee (s) did not understand English. The research assistant was conversant in all the three languages. The researcher used interview guides with unstructured questions as shown in Appendix 1. The interview was a conversation administered face-to-face between the researcher, research assistant and interviewee. Open-ended questions were asked during interviews to obtain impartial answers, while closed-ended questions forced interviewees to answer in a particular way since the answers were limited to either yes or no (Cresswell, 2012; Rassel et al., 2022). The interviews were unstructured with interviewees

narrating their knowledge and experience in traditional rainmaking. A mobile phone was used to record the participants' responses.

3.10 Data analysis

Data analysis is a critical examination of data that is assembled and grouped to study the characteristics of the research to be conducted and for determining relationships and patterns among the variables relating to the study topic (Kothari, 2004). According to Meyer and Avery (2009), qualitative researchers are usually overwhelmed by the amount of data they collect from the field. The researcher analysed primary data using NVivo a qualitative data analysis (QDA) package (Rooney, Lawlor & Rohan, 2016). The coding method consisted of interview transcripts from participants, and field notes gathered from observation (Deterding & Waters, 2021). The study collected data by listening to the participants telling their stories in relation to the study theme. The interview session was captured and recorded using a reliable phone recorder for later analysis. In this study, data was in three (3) languages. Data was aligned with the data collection methods used in qualitative studies. After data collection, the data was analysed. Processing involved editing, coding, classification then tabulation.

3.11 Data presentation

Kuckartz (2019) states that the creation of visual displays is a significant part of qualitative data analysis. Figures and tables are potent ways of communicating ideas to others. The researcher documented, recorded and presented data in form of figures representing the participants and area of study. The aim was to enhance an understanding of the data collected and communicate easily to other scholars.

3.12 Pilot study

According to Teijlingen et al.(2001), a pilot study directs a researcher on the best way a study is to be conducted. It is essential in preventing some problems that may not be expected before data collection. It entails the development and testing of the appropriateness of research tools,

feasibility rating, designing and testing the protocols for the larger study, testing and establishing sampling and recruitment strategies, collecting preliminary data, obtaining effective size information, and training research assistants.

3.13 Reliability

Reliability is the extent to which the same results are obtained using the same instruments several times. It entails other researchers coming up with the same results using the same research methods (Babbie, 2010). Mugenda and Mugenda (1999) define reliability as the extent to which a research instrument produces undeviating and uniform results or data after it has been repeated. In this study, the researcher ensured consistency in the data collection process by framing the interview questions the same way for every participant. The researcher shared the tools with the supervisors who ensured that there was consistency in the interview questions. The researcher compared the results of the study to those of other researchers.

3.14 Validity

To achieve validity which is concerned with accuracy, aestheticism, applicability, and changelessness of research, the study ensured that the research instruments (interview guide) well represented the phenomenon under study (Pallant,2011). The validity of this study was achieved by discussing with experts the instruments for them to rate the interview questions. It was to show the best approximation of the truth about the conclusion that the study had arrived at with the interview questions matching the study objectives which were ascertained by experts, for instance supervisors. The validity of this study was confirmed through by the researchers supervisors through checking the content of the tools.

3.15 Ethical consideration

The importance of ethics in any research is that it acts on the merits of individuals and the standard of data gathered in that the information collected from the interviewees has been

developed by the researcher in a reliable, truthful and honest way. Collecting data was designed primarily to rightfully protect participants from unfavourable or adverse consequences (Huberman & Miles, 2014). The researcher sought informed consent from the interviewees before the interview commenced to ensure and address ethical matters. The study ensured confidentiality of the data gathered as well as respecting the culture of the informants during the interview process. The researcher omitted the names and addresses of the interviewees in the data collected and the interviewees were assured that there was no right or wrong answer and this allowed them to gain confidence and participate effectively. The data collection procedure was a guideline on how the researcher was to collect data and how the authority to collect data was sought. Data was collected from Nganyi village, Bunyore in Vihiga County of Western Kenya and KMD offices in Vihiga County headquarters. Research approval was obtained from the Department of Information and Knowledge Management in the School of Information and Communication Studies at Technical University of Kenya and the School of Graduate and Advanced Studies. The permit was obtained from the National Commission of Science, Technology and Innovation (NACOSTI) and ethical clearance from a registered Institutional Review Board (IRB) before commencing the study. The interviewees in this study were ensured of voluntary participation. Cultural consideration was adhered to by showing respect to the interviewees' traditions and language.

3.16 Chapter Summary

Chapter three has delved deeper into the aspect of the research methodology that was employed in conducting the research. The chapter looked at the philosophical world view, the research design employed as well as the research method. Aspects of the study population and sampling have been discussed at length. Additionally, the chapter looks at the data collection methods and instruments as well as data management and analysis procedures and methods. Also

covered are the ethical considerations that the researcher put into consideration while conducting the research.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION

4.0 Introduction

This chapter presents the data collected from the Nganyi key informants and the KMD weather forecasters through interviews. As explained earlier, interviews were conducted one-on-one, and face-to-face. The results were analysed according to the research objectives, which were to:

- i. Identify and document traditional rainmaking practices which can be used for climate change mitigation and adaptation in Western Kenya.
- ii. Investigate the prevalence, evidence, seriousness and effects of climate change in Western Kenya.
- iii. Analyse the local community's response to the effects of climate change in Western Kenya.
- iv. Examine how the traditional rainmaking practices can be used to confront the consequences of climate change in Western Kenya.
- v. Explore strategies that can be used to mainstream traditional rainmaking in building climate change resilience in Western Kenya in line with the Sustainable Development Goals (SDGs), Vision 2030 and the "Big 4 Agenda" in Kenya.

The data herein was analysed using NVivo data analysis software (Version 12) and presented using tables, figures, tree maps, explore diagrams and word clouds.

4.1 Response rate

The researcher used snowballing method to identify interviewees from the rainmakers. A saturation point was reached at 37 rainmakers. The researcher sought to establish the exact number of rainmakers from the rainmaking interviewee who introduced the researcher to other rainmakers. The interviewee approximated the number at 50 rainmakers

The researcher used the census method to get KMD interviewees and managed to get 5 KMD interviewees out of 11. In terms of gender, all the rainmaker interviewees were male, while KMD interviewees consisted of 4 males and 1 female. According to the Nganyi traditions, only the male gender can participate in rainmaking.

4.2 Background information

4.2.1 Demographics of the interviewees

The researcher sought to establish the ages of the interviewees involved in the research. This was only applicable to the rainmakers and not interviewees from KMD. Of the 37 rainmakers interviewed, only 12 of them shared their age.

The youngest interviewee among the rainmakers was 65 years old, while the oldest interviewee was 85 years old. The majority of those who responded to the question were 4 aged 65 years, followed by 2 who were aged 81, while there was 1 interviewee for each of the ages 70, 71, 76, 78, 80 and 85 years old. However, as pointed out earlier, this data represents only those interviewees who shared their ages. A total of 25 of the interviewees did not provide data on their age. The non-response for age did not affect the researcher's data because the interviewees were well informed before the interview that participation was voluntary as was indicated in the consent form and this could have been the reason why some of the interviewees were hesitant in providing their age.

4.2.2 Years in rainmaking

The researcher sought to establish the number of years the rainmakers had been involved in the practice of rainmaking.

majority 7 of the interviewees have been involved in rainmaking for at least 30 years, followed by 20 years (4) Those who had 50 years' experience were 3. Additionally, there were 12 of the interviewees who each had experience spanning 10, 15 and 25 years. Equally important is the

fact that 11 of the interviewees did not respond to this particular question. The researcher sought to get more information about the interviewee who was aged 85 years but with an experience of 70 years implying that the interviewee started rainmaking at the age of 15 years and was consequently informed that the interviewee was assisting the father or grandfather in collecting the herbs and mixing them through the guidance of the elderly at a tender age. Therefore, when the interviewee reached the age of 15 years and due to the ageing factors of the parents, he had already been shown the skills at that early age such that at the time of the parent's death, the son was able to continue with the activities.

4.2.3 Clan and acquisition of rainmaking skills

The researcher sought to know the clans of the rainmakers. It was established that all the 37 interviewees were from the Nganyi. The researcher further sought to know how they became rainmakers or where they acquired the skills from. Most of the interviewees said that they inherited it from their fathers; others said they inherited the skills from their grandfathers; while the rest said it was inborn. Generally, the practice was inherited from ancestors.

4.2.4 Clan's awareness of rainmaking practice

The researcher sought to know if the clan members were aware of the rainmaking practice being conducted in the community. All 37 interviewees said that indeed the community is aware of the rainmaking practice.

4.2.5 Prediction of rain

The researcher sought to know from the rainmakers how they predict rain. This was important to establish whether the prediction was part of rainmaking. Over 30 interviewees out of the 37 said that it is predicted through observation, using plants, animals, movement of wind, morning dew, rainbow, frogs, the appearance of the moon, and insects like safari ants. Two interviewees said it is predicted through plants shedding their leaves and observing clouds in the sky.



Figure 5: Bus stop for the shrine

Source: Researcher (2021)

There are various routes to Luanda but the researcher was more conversant with the Kisumu route. From Kisumu, one boards a *matatu* going to Luanda and alights at Esibila Secondary School where there is a signboard which is approximately 10 metres away written Esibila Hills and Abasiekwe Rainmakers' Shrine (see Figure 6). Next to the gate are the KMD offices and the Radio Ranet station located in the same compound .



Figure 6: Location of the rainmaking shrine

Source: Researcher (2021)

The shrine is in an isolated place which is surrounded by indigenous trees; animals cannot graze there. The shrine has neither a fence nor a gate but it has a title deed that shows boundaries. It is a restricted place and regarded as holy. It is open for tourists to visit at a cost throughout the week from 9.00 am to 4.30 pm, booking is done in advance at the office found at Radio Ranet. Such visits limits women who are not allowed to enter the place where rainmaking is done but can get the information they require. Visitors are not allowed to access the rainmaking section as it is regarded as holy and only accessible to the rainmakers. The rainmaking section is marked with a traditional pot where herbs are placed. Some cleansing rituals like slaughtering a sheep are conducted before the visit. The indigenous trees surrounding the shrine are believed to have started growing since Nganyi was buried there

around 1919. Even if a tree falls down, it cannot be moved or cut because of the belief that the place is holy.

4.2.7 Participants in rainmaking rituals

The researcher sought to establish from the interviewees who attends the rainmaking rituals in the Nganyi community. The tree map in Figure 8 shows the responses received from the interviewees.

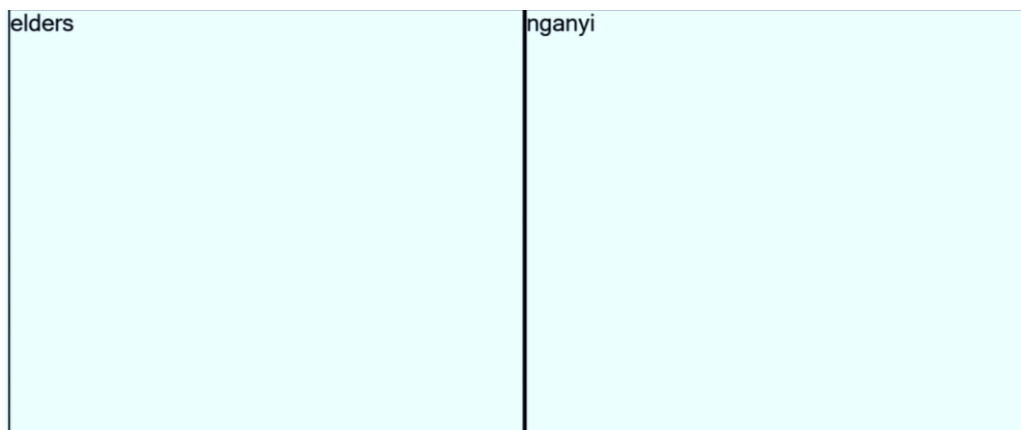


Figure 7: Attendees of rainmaking rituals

Figure 7 shows that rainmaking rituals are attended by Nganyi male elders specialising in rainmaking, who must be over 76 years of age. The ones below that age accompany them for training purposes so that when they reach the mandatory age, they will have acquired the rainmaking knowledge through observation and experience. Rainmaking is not conducted by one person, according to the interviewees. The rituals performed during rainmaking are conducted by 6–7 elders. In terms of the specific elders, there were varying responses. Some of the responses received included:

“Selected men above 60 years.” [Interviewee 4]

“Nganyi elders above 50 years.” [Interviewee 5]

“Nganyi elders above 60 years.” [Interviewee 15]

“Nganyi elders 80 years.” [Interviewee 34]

“6 or 5 Nganyi elders.” [Interviewee 23]

“Nganyi elders.” [Interviewee 36]

To qualify for rainmaking, one must be above the age of 76 years; below that age are trainees to whom the knowledge is passed on so that when they reach the mandatory age, they can continue with the practice so that it does not die or remain implicit with the rainmakers. Only 1 or 2 interviewees indicated 50 years as the mandatory years of practice before one qualifies as an elder for rainmaking. According to all the interviewees, rain is made by Nganyi elders at the shrine. One of the interviewees said that at the shrine “they do their things”. When performing the rituals, elders pray to God to help them because they require the power of God. One of the interviewees gave the story of Moses in the Bible who was given a stick that he used to bring water out of a rock. Rainmaking and worshipping have some similarities as they both require God’s intervention.

4.2.8 Belief in God

The researcher sought to establish whether the traditional rainmakers believed in God. The researcher established from the analysed data that all the 37 rainmakers interviewed used the same terminology which showed that they believed in the Christian God who directs them. Some attributed their success in rainmaking to God. They viewed it as a God-given talent that was passed to the Nganyi only after Nganyi welcomed a woman who had been chased away from her home, and in return of the good reception, on nearing death showed Nganyi the secret behind making rain. It is interesting to note from interviewees 36 and 37 that a woman is not allowed to acquire the knowledge of rainmaking even though the art of making rain came from a woman. The elders then must have quickly thought that for the knowledge to remain with the Nganyi clan only, rainmaking should be for men only since a woman can get married elsewhere and share the knowledge.

4.3 Nature and effects of climate change in Western Kenya

4.3.1. Nature of climate change

The study sought to know the nature of climate change in Western Kenya as observed by the KMD interviewees. It was established that there has been a change in the climate over the years. The word cloud in Figure 8 presents the data.



Figure 8: Nature of climate change

From Figure 8, the most common word from the five KMD interviewees was “changed”, depicting a change in the nature of weather patterns in Western Kenya, as cited by the interviewees. Some of the responses recorded included:

“The climate has drastically changed over time due to the changes in the atmosphere in the region.” [Interviewee 1]

“There has been a drastic change in the climate of the region and I can attribute this to global warming. This has, in turn, affected the rainy seasons.” [Interviewee 11]

“There has been an evident change in the rainfall patterns. Currently, the rains come earlier than expected or sometimes come very late.” [Interviewee 15]

“There has been a change in the weather patterns and I can attribute this to pollution, cutting of trees and the rising of industries that affect the rain seasons.” [Interviewee 33]

4.3.2 Effects of climate change

The researcher sought to establish the effects of climate change in Western Kenya. The interviewees from the KMD identified various effects of climate change including its effects on preparation and planting seasons in the region; negative impact on rainfall patterns; drought in the region; low yields; delays in planting; increased cost of living; and lack of food for the animals. Figure 9 presents the most cited words by the interviewees.



Figure 9: Effects of climate change (KMD interviewees)

Figure 9 shows that the most identified effects of climate change had something to do with planting, changes in seasons, drought, delayed activities and preparation of land for planting. The following are some of the responses from the interviewees.

“Effects of climate change include delay in land preparation and planting change of season, and drought causing animals and humans not to have food; cost of living also goes high as a result.” [Interviewee 21]

“Droughts come unexpectedly affecting livestock and farmers as they are unable to plant their crops; low yields due to lack of rain; as well as a negative effect on their lifestyle.” [Interviewee 37]

The rainmakers, in identifying the effects of climate change when it does not rain in the area, contrasted both the positive and negative effects of rainfall and the challenges faced due to lack of rain. The interviewees said that when it does not rain, the community is faced with drought hence the animals have no grass for feeding due to the dry land. There may be famine where the locals starve and, worst of all, die of starvation, and without water available for their daily use in homes and even on the farms. The word cloud in Figure 10 presents the positive impact of rainfall on the area.



Figure 10: Impact of rainfall

Figure 10 shows that most of the interviewees with regards to the effect of climate change on rainfall included planting, farm preparation, and water, among others. The following are some of the verbatim responses about the positive impact of rainfall.

“Locals are happy to plant their crops and graze their animals as the rains ensure there is food and grass for the animals.” [Interviewee 1]

“Locals harvest water from the rain which they use for various activities.” [Interviewee 3]

“They also prepare and plant on their farms.” [Interviewee 9]

“People plant crops.” [Interviewee 11]

“Grass is available for animals.” [Interviewee 30]

“Locals get employment in people’s shambas.” [Interviewee 33]

“No sacrifice is made.” [Interviewee 34]

On the negative impact of climate change, the interviewees mentioned that lack of rain had various negative effects on the locals. Some of the interviewees noted the following as the negative impacts of lack of rainfall.

“Lack of rains lead to starvation as a result of drought in the land.” [Interviewee 6]

“When the rains do not come, there is starvation, diseases, hunger and sometimes we even have deaths associated with the same.” [Interviewee 15]

“Locals experience food shortage when the rains do not fall.” [Interviewee 21]

“Animals also lack grass that they rely on for survival.” [Interviewee 34]

The tree map in Figure 11 provides further information on the effects of climate change.

drought	animals	causes	used	water	affected	become			
		grass	beings	blow	bluish	changing	death		
	shortage			herbs	immediate	leaves	part		
food		human	livestock						
	locals			rain	slaughte	winds	access	crops	
		hunger	plant			destroy	disast	diseas	dorma
				samadi	starts				
						elders	life	poor	proble
starvation	experience	suffer	shrine	sheep	stirred	farms	revisit	weather	
						hence	rivers	yield	

Figure 11: Effects of climate change

The analysed data in Figure 11 indicates that drought is the most cited effect of changes in climate by the rainmakers. Shortage of food, starvation, lack of water, suffering and death are just some of the effects of climate change as cited by the interviewees. This shows that indeed climate change affects the locals of the Nganyi community. Some of the responses received include:

“We have experienced a lot of droughts due to the effects of climate change over the years.” [Interviewee 23]

“Food shortage has been a major effect of climate change in this area. We used to have a lot of food but nowadays we hardly have enough for ourselves.” [Interviewee 37]

“Many people have been starving because of the negative effects of climate change. Animals sometimes die due to starvation.” [Interviewee 5]

4.4 The effects of climate change on locals in Western Kenya

This section sought to establish how the locals respond to the effects of climate change. Response to the effects of climate change in this study refers to how the locals cope with the problems.

4.4.1 Local community's response to climate change

The researcher sought to establish the local community's response to the problem of climate change. Some of the responses included the planting of drought-resistant crops that can withstand the changes; planting of trees to assist in bringing in rainfall as well as relying on the KMD weather reports. Some of the responses given included:

“The community is relying on the KMD weather reports to plan for their activities.”

[Interviewee 10]

“The community is slowly accepting the negative changes of climate which have affected the productivity of crops.” [Interviewee 21]

“Communities are responding by planting trees to cope with the changing climate.”

[Interviewee 22]

“Planting of trees has helped in dealing with the adverse effects of climate change but has not completely solved the issue of climate change” [Interviewee 27]

“In response, the community are planting trees and drought-resistant crops.”

[Interviewee 35]

4.4.2 Effectiveness of the responses

The interviewees were asked about the effectiveness of these responses employed by the locals to counter climate change. Among the responses noted from the interviewees included:

“Climate changes are so unpredictable and it is hard to tell whether the locals are doing the right thing thus making it hard to predict effectiveness.” [Interviewee 3]

“Sometimes we respond in a certain way but things turn out differently, for example, preparing the land in anticipation of the rains only to realise the rains are not here yet. This renders the efforts ineffective.” [Interviewee 7]

“It has become harder to predict the patterns of the rains and this in turn negatively affects the locals' preparation for these climate changes.” [Interviewee 12]

“People are buying food in bulk in anticipation of a shortage and this has helped many people. Purchasing during plenty so that it can be used during drought is effective and normally goes a long way in helping the community to have enough food.” [Interviewee 37]

4.4.3 Challenges hampering the effectiveness of community response

The researcher also sought to establish the level of effectiveness of the community’s response to climate change. This was directed to the interviewees from KMD weather forecasters who disseminate weather information to the community after consultation with the Nganyi rainmakers who work with them. Interviewee 42 identified 3 challenges (drought, poor yields, flooding); Interviewee 40 identified 2 (ineffectiveness of KMD information, drought) challenges; while Interviewees 38, 39 and 41 each identified one challenge (lack of capital, low quality of seeds, scarcity of animal food, respectively). The challenges identified included drought, the ineffectiveness of KMD information, poor yields, flooding, lack of capital to implement the strategies, low quality of seeds and scarcity of food for livestock. The following are some of the responses received on the challenges associated with the clan’s response.

“The community is not sure of when the rain will come and drought is realised in between the planting season instead of in January to February. Sometimes, it is the issue of poor yields or even flooding.” [Interviewee 42]

“KMD is not effective in providing weather information. Drought is also a serious challenge.” [Interviewee 40]

“I would say lack of capital.” [Interviewee 38]

“Floods.” [Interviewee 39]

“Drought affecting animals and livestock.” [Interviewee 41]

4.4.4 Traditional rainmakers' perception of the KMD

The researcher sought to establish the traditional rainmakers' perception of the KMD interviewees. Out of the 37 interviewees, 36 responded to the question on perception. The majority of them expressed a negative perception of KMD, and gave the following responses:

“The perception is that KMD is always inaccurate whereas Nganyi is accurate.”

[Interviewee 2]

“KMD is scientific while Nganyi is traditional.” [Interviewee 3]

“Nganyi rainmakers predict and stop rain while KMD only predicts.” [Interviewee 6]

“All of us can predict but KMD cannot make rain. This means traditional elders have an upper hand in the activities.” [Interviewee 13]

“KMD gives wrong information at times while rainmakers' prediction is always accurate.” [Interviewee 15]

“KMD is not accurate and rainmakers can complement it if given resources since our predictions are always accurate.” [Interviewee 19]

“Our prediction is mostly accurate as compared to the KMD.” [Interviewee 22]

“Elders use traditional knowledge which is accurate while KMD uses scientific knowledge which is prone to errors. That's why they get it wrong a number of times.” [Interviewee 29]

“KMD staff are paid by the Government while Nganyi are not paid.” [Interviewee 34]

4.4.5 Perception of traditional rainmakers by the KMD

The researcher sought to establish the KMD's perception of the traditional rainmakers. All five participants from KMD responded to the question on their perception of Nganyi rainmakers. They gave a positive view on the specific question. The responses were distributed as per Figure 12.

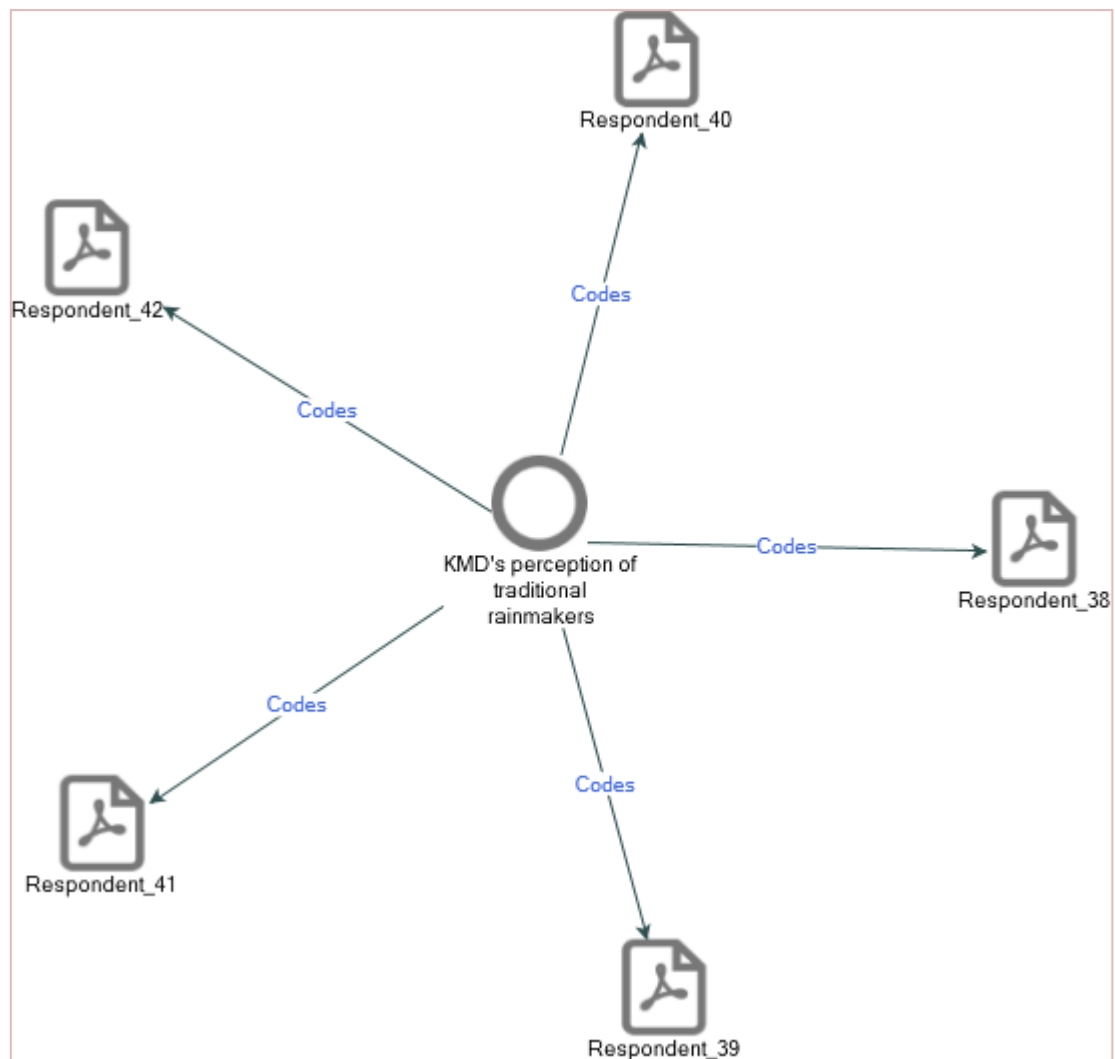


Figure 12: KMD’s perception of traditional rainmakers

From Figure 12, all the KMD staff responded to the question with all of them giving a positive view of the specific question. The responses recorded included:

“The traditional rainmakers are accurate in weather forecasting.” [Interviewee 38]

“Traditional rainmaking is real because they predict what will happen.” [Interviewee 39]

“Traditional rainmaking is real because the rainmakers predict what happens.” [Interviewee 40]

“Traditional rainmaking is real and effective and most locals rely on them.” [Interviewee 42]

4.4.6 Collaboration between the KMD and Nganyi rainmakers

The KMD weather informants collaborate with the traditional rainmakers. All the five interviewees advocated for collaboration and emphasised its advantages as shown in Figure 13.



Figure 13: Collaboration between KMD and rainmakers

Figure 13 shows that the words “yes”, “collaborate”, “scientists” and “traditional rainmakers” were the most used by the interviewees, indicating their willingness to collaborate with the rainmakers through seminars and workshops, among others. In these forums, they would ideally come together and exchange information on how to collaborate with and complement each other in their respective roles. The following are the recorded responses from the interviewees.

“Scientists should collaborate with traditional rainmakers.” [Interviewee 38]

“Scientists should collaborate with traditional rainmakers to mitigate climate change.”
[Interviewee 39]

“Yes, scientists can collaborate with traditional rainmakers through seminars and workshops where they meet to change ideas on weather prediction, for instance, when

there is going to be floods, the community living in dangerous zones is informed via the radio station to vacate to safer ground.” [Interviewee 40]

“Scientists’ collaboration gives room for exchange of ideas between the KMD and traditional rainmakers.” [Interviewee 41]

“Yes, scientists can collaborate with traditional rainmakers.” [Interviewee 42]

4.5 Rainmaking practices for climate change mitigation and adaptation

The Nganyi community of Vihiga in Western Kenya are known for their capacity to predict rain as well as its knowledge of making and stopping rain. These practices can be effectively used for climate change mitigation and adaptation.

4.5.1 Contribution of rainmakers

The researcher sought to establish from the interviewees from the KMD of the potential contribution of rainmakers in mitigating the effects of climate change in the area. The responses from the excerpts of KMD participants were confirmed by the word cloud as shown in Figure 14.



Figure 14: Contribution of rainmakers to mitigation of climate change effects

The analysed data in Figure 14 shows that the word “yes” was recorded by all five interviewees from the KMD, depicting their agreement on the contribution of the traditional rainmakers to the mitigation of the effects of climate change.

The following are their responses:

“Yes, traditional rainmakers can positively contribute to the mitigation and adaptation of climate change efforts in Western Kenya. This is because the practice often gives accurate interpretation which can be used in planning.” [Interviewee 38]

“Yes, traditional rainmakers can predict, make rain fall and also reduce it when it is too much as the rainmakers have special rituals for reducing rainfall. That way, they contribute to the efforts of mitigating the effects of climate change.” [Interviewee 39]

“Yes, when rainmakers give information to the locals that rain is about to fall, they always follow and prepare for farming.” [Interviewee 40]

“Yes, traditional rainmakers are accurate and therefore provide a reliable source of information.” [Interviewee 41]

“Yes, traditional rainmakers contribute by passing important information to the locals who always listen to them and act as per their instructions.” [Interviewee 42]

4.5.2 Process of predicting rain

The researcher also sought to understand the process of predicting rain by the elders. The analysed data indicated that predicting rain involves the use of plants, insects and animals, complemented with observation as shown in the tree map in Figure 15.

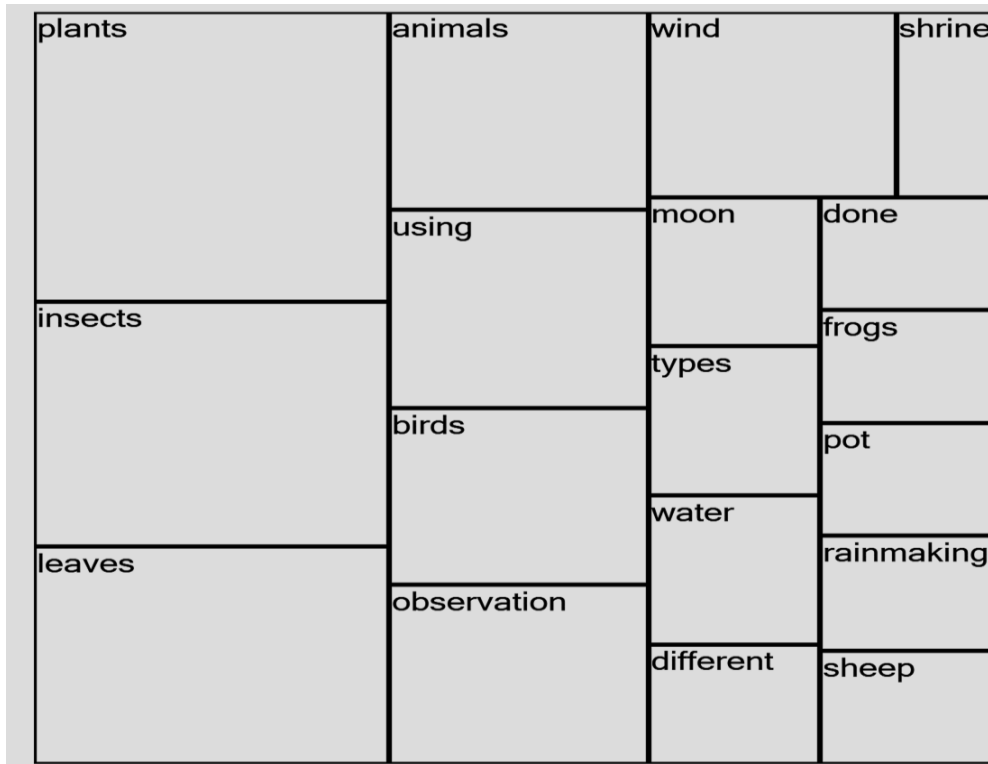


Figure 15: Rain prediction tree map

Figure 15 shows that the majority of the responses indicated the words “plants”, “animals”, “insects”, “observation” and “birds”, among others, as the most prevalent words in the prediction of rain among the interviewed traditional rainmakers in the clan. The following are some of the interviewees’ responses.

“Observation of plants, insects, the behaviour of birds, trees, checking if the water in the pot at the shrine is hot or cold.” [Interviewee 3]

“Miracle from God to Nganyi clan when rains come with too much wind, black rain, hailstorm, they pray to God at the shrine to help them control the rain the way they were taught by forefathers. They learn from the Pacific Ocean through the radio that strong wind is coming then they perform rituals to block it.” [Interviewee 37]

“Using reptiles such as frogs, type of plants, insects such as safari ants, movement of wind, clouds observation and moon appearance.” [Interviewee 17]

“Observation of trees shed leaves, the croaking of frogs, movement of wind, clouds in the sky, behaviour of birds.” [Interviewee 29]

“Observation of plants, movement of insects, birds, reptiles, blowing wind, the appearance of moon and rainbow.” [Interviewee 23]

“Observation of insects, moon, the behaviour of animals, birds, morning dew, movement of the wind.” [Interviewee 7]

4.5.3 Process of making rain

The researcher sought to understand the process of making rain from the elders. The rainmaker interviewees were asked to give a brief description of how rain is made. Figure 16 shows some of the responses.



Figure 16: Process of making rain

From Figure 16, the most cited words included “water”, “leaves”, “pot”, “plants”, “mixed”, “herbs”, “crushed” and “sheep”. While the wordings were different, there was a consensus on the process and what it involves. Interviewee 18 indicated that rainmaking is a secret that was inherited and thus cannot be shared with other parties. The following are some of the other responses given concerning the specific question.

“Rainmaking is the secret of the rainmakers which cannot be exposed. Nganyi got the blessing from a woman who was chased from her home whom Nganyi welcomed; so, when she was about to die, the woman showed him the secret of making rain using a certain leaf which is crushed and mixed with water.” [Interviewee 5]

“The leaf can be around you but, you cannot identify it and to be a rainmaker you must be very holy and a person who does not move around with women. In the event that you do bad things, your eyes will not be able to identify the herbs for making rain even if you as a rainmaker knew it before.” [Interviewee 37]

“Rain is made by stirring different leaves of plants and using a virgin girl to fetch water from a river near the shrine.” [Interviewee 15]

“Rainmaking involves mixing leaves then crushing them and putting the pulp in a pot where it produces water bubbles that evaporate to make clouds in the sky.” [Interviewee 11]

“Crushed leaves mixed in a pot with water brought by a virgin girl then stirred with a traditional reed.” [Interviewee 12]

“Mix leaves of plants, water brought by a virgin girl, reeds and traditional pot.” [Interviewee 23]

“Mixture of leaves and plants mixed with certain herbs and water.” [Interviewee 33]

4.5.4 Seasons for making rain

The researcher further sought to establish the rainmaking practices in terms of the months when rain is made. Analysed data from multiple responses shows that the majority 32 of the interviewees indicated that rain is made during the month of March. This was followed by August 26 (34%), September 9 (12%), February 3 (4%); while April, June and December each had 1 (1%) of the interviewees.

4.6 Traditional rainmaking practices in confronting the consequences of climate change

The researcher sought to establish whether traditional rainmakers had a joint venue where the traditional rainmakers and the KMD weather informants meet as they do almost similar work.

The analysed data from the research is presented in Figure 17.



Figure 17: Meeting forums

Figure 17 shows that “seminars” was the most cited word for the meeting forum for the Nganyi rainmakers’ interviewees and KMD interviewees. Also cited were the words “shrine”, “Ranet radio station”, “workshop” and “celebration”.

Another meeting place is in the Nganyi Ranet Radio station as shown in Figure 18 for the Nganyi rainmakers’ interviewees and KMD interviewees.



Figure 18: Nganyi Ranet radio station (Meeting place)

Source: Researcher (2021)

Generally, the meeting was by virtue of the Nganyi rainmakers’ interviewees and KMD interviewees sharing a compound and a few meetings to discuss weather issues in the region.

The Nganyi Ranet Radio is also referred to as Anyole Radio tuned at radio waves channel 101.2 FM, which is branded as “OmwoyoKwefwe” preferred by the Anyole (Banyore) clan, including the Nganyi sub-clan. The station broadcasts in the Luhya language and specifically “Olunyole dialect of the Luhya language.

4.7 How the Government came to know about the Nganyi rainmaking practices

The researcher sought to establish from the rainmaker interviewees whether the government is aware of the rainmaking practices and the possibility of using these practices to benefit the larger community by involving the government. All 37 interviewees indicated that the government is aware of the rainmaking activities in the area. The interviewees were probed further on how and why the government became aware of the activities. Multiple or different responses were recorded. The word cloud in Figure 19 shows the responses received with regards to the question.

“When the Colonial Government arrested Nganyi in 1914; and when Kenyatta invited the elders to Nairobi to make rain.” [Interviewee 20]

“When the Colonial Government arrested Nganyi and took him to Kisumu for refusing to make rain.” [Interviewee 28]

“In 1975 when rainmakers were invited by Mzee Jomo Kenyatta to Nairobi to make rain.” [Interviewee 29]

“During the reign of Mzee Jomo Kenyatta when drought was experienced in 1971, the Nganyi were invited to the State House to make rain.” [Interviewee 30]

“During the colonial era, Nganyi was arrested by the colonialists. He was first arrested in 1916 and again in 1919 when he was severely tortured and taken to Kodiaga Prison. Upon his arrest, there was heavy rainfall in the area. Before his arrest, it was believed that he used to send people to bring rain in Bondo, Homa Bay, and Kakamega and that is why the white colonialists mistreated him. Before his killing, he was fed cement and sand because of giving himself honour and not God. After he was killed, the brother collected his body from Kisumu and took it to Bunyore and buried him at one of the three shrines, called Nganyi shrine, which is located at a place called Duka Moja in the area. The two other shrines are Oluchiri and Asubwi; Namunya shrines are at the Skotwe, Abaisekwe sub-location.” [Interviewee 37]

The researcher further sought to establish how these practices can be beneficial in tackling the challenges of climate change. In addition, the researcher sought to establish where the government comes in and how the two can work together to the benefit of the greater Western Kenya community and the nation in general. The interviewees were asked how the government and the traditional rainmakers can collaborate. The explore diagram in Figure 20 shows the interviewees who gave ideas.

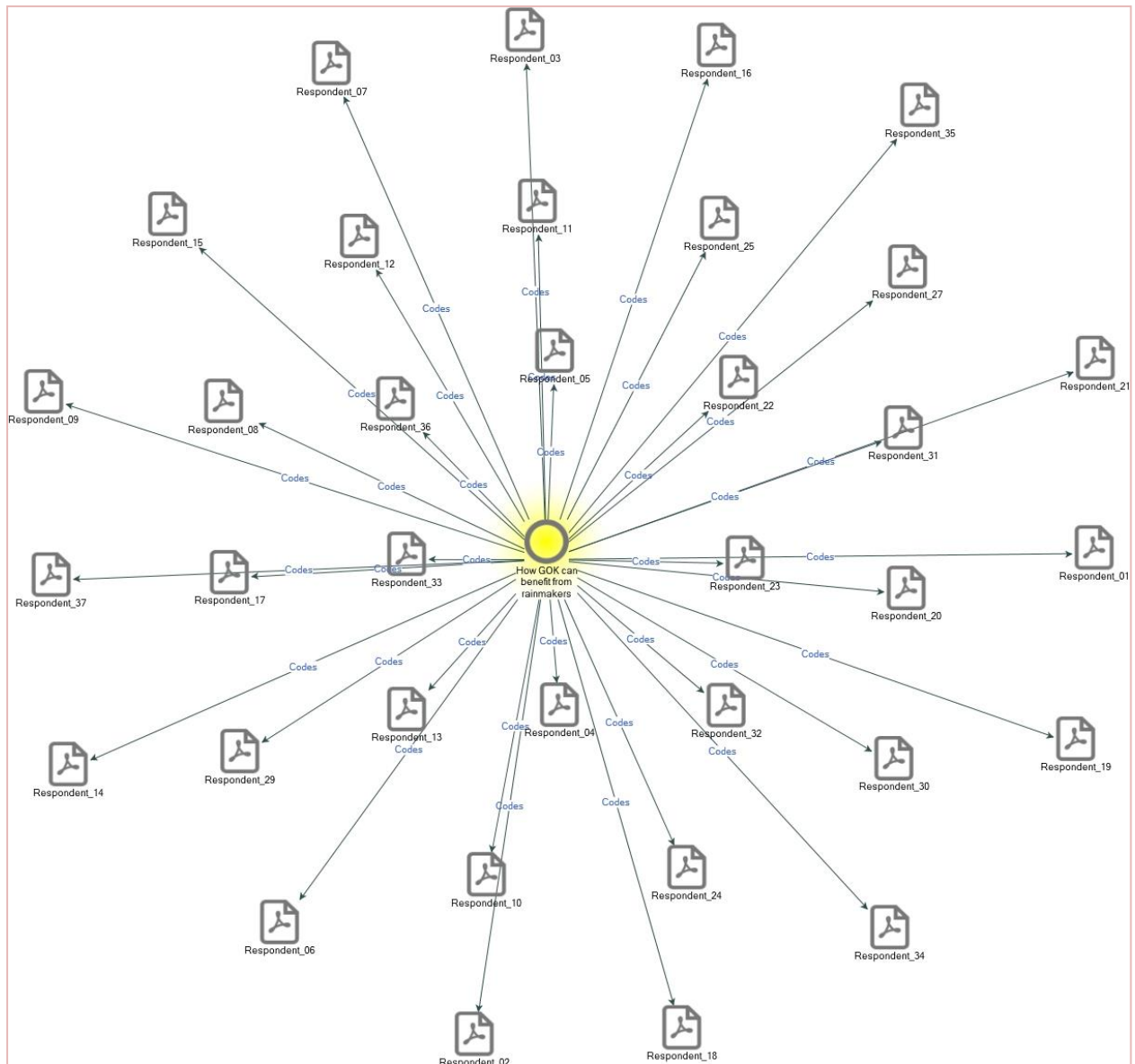


Figure 20: Co-existence of government and traditional rainmakers

Figure 20 shows that 36 out of the 37 interviewees had an idea of how the government and the rainmakers can use the latter’s skills to tackle the challenges of climate change. Some of the interviewees recorded included the following:

“Government benefit from health and agriculture, and when there is too much rain children are advised not to cross rivers. The rainmakers have knowledge of natural lightning arresters. They plant certain trees to act as lightning arresters.”

[Interviewee 35]

“When the rain comes with thunderstorm and hailstorm, they inform the community in case of strong wind people living in the dangerous zones are told to relocate in terms of early warning.” [Interviewee 34]

“The government can benefit by using the rain to plan for farmers’ activities. This way, the farmers will be informed in advance as they plan for their activities.” [Interviewee 23]

“The government uses rainfall patterns to plan for the year’s agricultural activities since farming needs some prior planning.” [Interviewee 33]

“The government to work with Nganyi rainmakers to bring rain in dry areas. There are areas in Kenya that are adversely affected by drought. The elders can be used to bring rain in such areas and thus boost food production in the country.” [Interviewee 37]

“By utilising information and plan for agriculture.” [Interviewee 5]

4.8 Mainstreaming traditional rainmaking in building climate change resilience

The researcher inquired how traditional rainmaking can be mainstreamed to assist in building climate change resilience in Kenya. Figure 21 shows the tree map for the responses received regarding the question.

rainmaking	workshops	strengthen	team	artifacts
seminars	collaborate	enhance	future	generation
		guard		
traditional	combined	forecast	harmonise	skills
				strategies
				water
		forest	scientists	source
				weather

Figure 21: Streamlining rainmaking practices

In proposing strategies to mainstream rainmaking practices in Kenya, the most cited words as shown in Figure 21 included “rainmaking”, “seminars”, “collaborate” “combined” and “strengthen”, among others. The following are some of the recorded responses from KMD interviewees on strategies to streamline rainmaking practices in Kenya:

“Yes, by having workshops as a team to strengthen the skills of traditional rainmaking and safeguard the forest which is the water source.” [Interviewee 3]

“Yes, by having combined seminars to harmonise the weather forecast to strengthen the collaboration of KMD and traditional rainmaking.” [Interviewee 9]

“Yes, by having combined seminars, workshops and the preservation of artefacts for future generations.” [Interviewee 18]

“Yes, strategies should enhance seminars and workshops. We need to be working together so that we are aligned since we are doing an almost similar thing but differently.” [Interviewee 36]

“Yes, scientists can collaborate by teaming up with traditional rainmakers. This will enhance the accuracy of the predictions and help the country to plan better.”

[Interviewee 37]

Further, the KMD interviewees were asked to indicate the strategies that could be integrated into the Sustainable Development Goals, Kenya Vision 2030 and the “Big 4 Agenda”. All the KMD interviewees shared strategies that can help integrate rainmaking practices to Sustainable Development Goals (SDGs), Vision 2030 and the “Big 4 Agenda” in Kenya. Specific responses given included:

“By setting up common objectives for Kenya Vision 2030 and the ‘Big 4 Agenda’, and to protect and maintain climate change, the Government should protect all forests in Kenya and plant millions of indigenous trees in Western Kenya.” [Interviewee 38]

“By strengthening the collaboration between KMD and traditional rainmaking to set up common goals and equip the traditional rainmakers by conserving the shrines and planting indigenous trees.” [Interviewee 39]

“Involve the young generations to gain in the fields of agriculture, health, security and infrastructure for Vision 2030. Researchers in Kenya should also come up with accurate information by using reliable scientific equipment for weather prediction and to maintain Kenyan culture and practices of predicting rain and not relying on Western culture.” [Interviewee 40]

“Forging a positive collaboration in agriculture, health and employment will contribute to vision 2030 and the ‘Big 4 Agenda’.” [Interviewee 41]

“Strategies include joint workshops and seminars between Nganyi rainmakers and KMD to exchange ideas.” [Interviewee 42]

4.9 Chapter Summary

Chapter Four presented the data collected by the researcher. In total, 42 interviewees were interviewed and provided rich data that was analysed and presented in this Chapter. Analysis was done using NVivo and presented using tables, tree maps, explore diagrams and word clouds.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.1 Introduction

This chapter discusses the findings presented in Chapter Four. The study examined the prevalence, evidence, seriousness and effects of climate change in Western Kenya; analysed the local community's response to the effects of climate change in Western Kenya; identified and documented traditional rainmaking practices which can be used for climate change mitigation and adaptation in Western Kenya; analysed how the traditional rainmaking practices can be used to confront the consequences of climate change in Western Kenya; explored strategies which can be used to mainstream traditional rainmaking in building climate change resilience in line with the Sustainable Development Goals (SDGs) as well as Kenya's Vision 2030 and the "Big 4 Agenda".

5.2 Background information, demographic information, and years in rainmaking

The study was conducted in Ebusiekwe, Bunyore in Vihiga County of Western Kenya and focused on the Nganyi who are from the Abaluhya ethnic community; a sub-ethnic clan of the Abanyole, residing in Bunyore, Vihiga County. The Nganyi are known for their prowess in traditional rainmaking. This is documented in a study by Ottichilo and Khasilwa (2016) which emphasises that the Nganyi are Abaluhyas who are known for their power to predict rain. The researcher established that Nganyi rainmakers acquired the skills from their ancestors. The finding is in agreement with that of Akunda (2010) who states that the Nganyi are the only family associated with rainmaking practices in Western Kenya.

The researcher established that for one to qualify to be a rainmaker among the Nganyi, one has to be 76 years of age and above. The findings of this study confirmed that only 6 interviewees had reached that mandatory age of rainmaking. The study also confirmed that the ones below that age were allowed to accompany their fathers to the shrine to be taught the art of

rainmaking. Thus, they acquire the knowledge from the elders so that by the time they reach the accepted rainmaking age, they are well equipped. This study confirmed that the rainmaking practice is inherited and starts at a tender age of 15 years. It emerged that at this age, the youth help their fathers in collecting the herbs and mixing them with the guidance of the elderly. In this regard, indigenous knowledge is passed on from generation to generation. The researcher also established that all the interviewees acquired the skill from their fathers while they were still young.

5.3 Nature and effects of climate change in Western Kenya

From the researcher's findings, climate change has created concerns both locally and globally. In Western Kenya, the climate has drastically changed over time due to the changes in the atmosphere just like in the rest of the world. The researcher established that climate changes have affected the rainy seasons. There was evidence of change in the rainfall patterns where rain falls earlier or later than is expected. This disorients the farmers. There is more rain in January when the locals have not prepared the farms and more again during harvest time when they want the maize to dry in the fields. The situation is even made worse when the farmers plant the crops then the rain disappears. This is a great loss because without rain, germination will not take place and the seeds will be lost.

During harvest time, the rains are not required because at that time, the crops require sunlight and when this happens the productivity is affected causing low or poor yield. This is a great loss to the locals thus affecting agriculture and the economy as a whole. Other researchers have also said the same. For instance, Masinde et al. (2012) explain that changes in rainfall patterns has greatly affected agriculture. The changes have also led to the disappearance of primary forests due to uncontrolled logging, farming, as well as oil exploration and exploitation. The current study established that the situation has not improved because the population is growing

bigger and the land is small. It is for this reason that the locals engage in logging to build houses hence the situation cannot improve.

The researcher also found out that the climate changes are due to pollution, cutting down of trees and the rise of industries that have affected the rainfall patterns. The findings are in agreement with Speranza (2010) who conducted a study in Western Kenya and found that human activities such as deforestation, the burning of fossil fuels like coal, oil and natural gas are superimposed on the fluctuation of natural climate. Other researchers, like Weyesa (2020) who conducted a study in South West Ethiopia confirms that expansion for agricultural land, firewood, illegal and poorly regulated timber extraction, social and environmental conflicts, increasing urbanisation and industrialisation are some of the causes leading to deforestation.

The researcher established that the effects of climate change in Western Kenya has led to unpredictable land preparation and planting seasons in the region; erratic rainfall patterns; long droughts in the region; low agricultural yields; delays in planting; increased cost of living; and inadequate food for the animals. This is in agreement with the study of the coastal zones and Western Kenya by Uramaand Ozor (2010). The study reveals that wide-ranging effects are experienced in the environment and socio-economic sectors including food security, water resources, agriculture, human health, terrestrial ecosystems and biodiversity. Severe water shortage and flooding are likely to be experienced due to changes in rainfall patterns which come as a result of deforestation.

The researcher further established from the majority of the interviewees that the most identified effects of climate change were related to planting. If rain does not fall as expected, the farmers have no alternative but to postpone their farm work. This is because the farmers rely heavily on rain which has to fall for them to start preparing their farms. Therefore, changes in seasons affect the local community. For instance, some of the interviewees explained that when rain

falls early, like in January, it affects them because they will not have prepared the farms. For the farms to be prepared, they require capital for buying seeds, paying the labourers, and getting the labourers who have to be informed early. Unexpected droughts also affect livestock since the farmers will be required to search for pasture for the animals so that they do not die of hunger. The findings also established that farmers get low crop yields. Similarly, the animals will not be able to produce milk. The farmers ordinarily use the milk as part of their food and sell the surplus to get money to buy other necessities for their families. Therefore, lack of rain affects their lifestyle negatively.

The findings from this study also established that climate adaptation through the practice of rainmaking is of significance to the local community. Planting in the region is in two seasons – March and August – when the farmers are about to start farm preparation. The rainmakers cause rain to fall when they sense that drought may occur. This finding is in agreement with Haile (2005) that agriculture in Sub-Saharan Africa (SSA) extremely relies on the weather patterns of the region, hence, if drought strikes millions go hungry. Drought has continued to affect communities in the region for a while. Examples of major droughts that have affected the region occurred in 1997, 2000 and 2004 (Rocchi, 2006). The dilemma is due to the inadequacy and ineffectiveness of the region's disaster preparedness (Masinde, Bagula & Muthama, 2012). Disaster preparedness is of significance both locally and globally to avoid the effects of drought such as hunger. Rainmaking plays a key role in helping the local communities adapt to the frequent climate change.

The researcher established that the locals are happy when rain falls since they will be in a position to plant crops and graze their animals easily. They also harvest water from the rain which they use for various activities on both the farms and homes. Additionally, the members of the community can get employment on the farms as labourers where they are paid daily

wages depending on how they have worked. They are also able to work gainfully on the farms when rain falls as expected. This can be achieved through forest conservation and climate adaptation like rainmaking practices. Through rainmaking, a community can respond to the devastating effects of climate change as well as aid in environmental conservation.

5.4 Local community's response to climate change

The researcher established that the local community's response to the problem of climate change is through the planting of drought-resistant crops that can withstand the changes; planting of trees to improve rainfall; as well as relying on the KMD's weather reports to get information on weather changes. The researcher also established that even though the planting of trees and drought-resistant crops has assisted the community in dealing with the adverse effects of climate change, it has not completely solved the challenges emanating from climate change in Western Kenya. Therefore, other strategies, including traditional practices, should be incorporated. The frequency and severity of the hazards emanating from climate change are rising globally and the effects are seriously felt in local communities. It is uncertain or not easy to enhance the understanding of the available response options that are being selected by the communities (Thornton et al., 2014). Local communities are reporting the consequences of climate variations in their areas and responding to the new conditions as best as they can.

The American Association for the Advancement of Science (2019) suggests that governments, businesses, community members, scientists, and non-profits should utilise their knowledge and inventiveness to respond to changes in the climate by coming up with solutions that would assist the community. For instance, the researcher establishes that in response to the reoccurring floods, a number of initiatives are being implemented such as river draining, construction of water pans for water harvesting and construction of dykes. According to Ojwang and Shilenje (2015), early warning in weather forecasting provides effective and timely weather information that allows communities, organisations and individuals who are exposed to likely weather

hazards to take action or precautions that reduce their exposure to the risks such as moving to safer areas.

5.4.1 Effectiveness of the responses

The researcher established that climate change cannot be predicted. It is normally difficult to tell whether the locals are doing the right thing. At times, locals prepare the land in anticipation of the rains only for the rains to delay or fail entirely. This finding is in agreement with Masinde et al. (2012) who explains that climate change has greatly affected agriculture.

Lack of financial support also hinders the locals from responding effectively to the effects of climate change. The locals require seeds, fertiliser and human input which are costly to prepare for their farms. The American Association for the Advancement of Science (2019) argues that climate change mostly affects elderly people who are most vulnerable to the health effects of rising temperature. The low earning locals experience challenges of poor infrastructure and may have fewer resources for upgrading it.

Human activities that are not friendly to the environment such as overgrazing and cutting of trees for firewood also hinder the locals from responding effectively to climate change. Timber is a source of earning among the locals of Western Kenya. They plant trees to sell and in return, the money is spent on school fees and other household commodities. The GoK (2010) in their assessment reveals that human activities such as poor soil use, unsuitable agricultural practices, water management, pollution, overgrazing and deforestation make up the most motivator of environmental decline in Kenya.

5.4.2 Traditional rainmakers' perception of the KMD

The researcher established that the traditional rainmakers view the KMD weather forecasting as being scientific. They rely on predictions such as the movement of wind and the appearance of the moon. Nganyi rainmakers, on the other hand, rely on the traditional ways like predicting

rain, rainmaking and preventing rain from falling. Traditional rainmakers believe that their practices have never failed them and are always accurate. The researcher established that the rainmakers have to give their findings first and share them with the KMD after which they compare the findings. It is after this that they announce the weather readings via the Anyole radio.

This is indeed complimentary because the KMD have to rely on the rainmakers for weather predictions yet they are the meteorologists. The findings of this study are in agreement with those of other researchers (Guthiga, 2016) who found that the Nganyi rainmakers viewed themselves as the custodians of the 'sacred' knowledge that they held on behalf of their community. Guthiga (2016) further states that rainmakers predicted rain using phenomena such as croaking of the frogs, movement of termites, and leafing of particular trees. This interpretation has been transformed by the Nganyi as a ritual art hovering between science and legend.

Guthiga (2016) opines that KMD is recognised nationally as the authoritative source of weather information in the country because their approach is scientific and verifiable. Despite this, KMD faces challenges in providing location-specific accurate weather prediction due to the limited number of distributed weather recording stations on the ground. In addition, KMD provides information in a language that is technical and complicated for the farmers to understand and use for making decisions or managerial purposes. The provision of precise and comprehensible information has achieved significance, mostly due to the effects of climate change that have disarrayed the known weather patterns.

5.4.3 KMD's perception of traditional rainmakers

The findings of this study confirms that the KMD's perception of traditional rainmaking is that the traditional rainmakers give accurate information. It was confirmed that the locals rely on

the predictions of the rainmakers. These findings contradict researchers such as Owuor (2007) who laments that IK is regarded as outdated and historical rather than contemporary. In the current study, IK in the form of traditional rainmaking is perceived to be up to date and is relied upon both locally and globally as an effective means of responding to current issues such as climate change. It is actually contemporary because even in this present time, rainmaking is practised, meaning it cannot be thought of as being outdated. A study by Koigi (2016) also reveals that as changes in weather patterns affect farms and food production across East Africa, scientists and meteorologists are turning their focus to traditional rainmakers and weather forecasters to strengthen the accuracy of weather predictions.

Moore (2010) reveals that modern climate experts in Africa are looking up to African indigenous knowledge as probable salvation from the current catastrophic effects of climate change. This is in contrast to the views that the African rainmakers are sorcerers and that Nganyi rainmakers of Western Kenya, with their meteorological equipment which consists of trees, pots and herbs that were enlisted to mitigate the effects of climate change are not effective in making rain. Rainmakers are acknowledged by modern climate experts as nature observers and not just as mystics. The KMD specialists held the view that the rainmakers were nature observers and their predictions were largely informed by science such as the flowering patterns of trees. They observed that as much as the practice of traditional rainmaking seemed traditional, there was some element of science in it.

Akong'a (1987) explains that traditional rainmaking practices among the Abanyala community is regarded as a form of magic or prayer, whereby, human beings influence weather conditions to cause rainfall or not to bless or curse a community. This study does not agree with the rainmaking of the Abanyala which is regarded as magic to the Nganyi it is a talent that they believe is God given and inherited from ancestors.

5.4.4 Collaboration between the KMD and Nganyi rainmakers

The researcher established that KMD weather forecasters and the rainmakers work jointly and that both have their offices located near the shrine. From this study, it was established that the KMD and rainmakers work together in responding to climate change by sharing ideas and the knowledge they have. This information is passed on to the locals who respond appropriately and avoid losses from hostile climatic conditions and thereby improving their wellbeing. Kaya (2016) explains that the Nganyi were offered a way of reviving their traditions through a project funded by Britain and Canada. The project aimed at using indigenous knowledge to prevent disasters. The project brought together the Kenya Meteorology Department (KMD) and traditional rainmakers to work together to come up with accurate information. The project report gave important recommendations that are being implemented by the KMD specialist in their weather prediction activities. Guthiga (2016) explains that the Nganyi community was found to be among the most advanced in their climate observation knowledge in Kenya, and has a long history of rainmaking among the other communities practising rainmaking. As a result, the project created a link between rainmakers and KMD. This study confirms that the Nganyi rainmakers actually work together and share an office with KMD to come up with joint weather forecasts. Guthiga (2016) argues that coming up with a community centre with a set up of weather observation centres has given rise to continued collaboration and has enhanced trust between the two parties. The formation of the resource centre has not only impacted the rainmakers but also Christians who have a contrary opinion and believe that rain comes purely from God.

The study established that Professor Ogallo, a researcher, together with other researchers contributed to the establishment of offices that are now being used by both the rainmakers and KMD in providing weather information to the local communities in Western Kenya. Guthiga (2016) asserts that the IGAD Climate Prediction and Applications Centre (ICPAC) were a lead

player in the collaboration of the rainmakers and KMD in the project under the leadership of Professor Laban Ogallo, a prominent meteorological scientist and champion of the role of IK in coping with impacts of climate change.

5.5 Origin of rainmaking practices in Western Kenya

The study established that the art of rainmaking came from a woman who was chased away from her home and was welcomed by Nganyi. When she was nearing her death, and in appreciation of the good reception she had received, she showed Nganyi how to make rain. It is ironic that even though the practice came from a woman, women are not allowed to engage directly in rainmaking practices. The findings are in agreement with those of Ottichilo and Khasilwa (2016) who states that even though narratives have confirmed that their skills in rain prediction originated from a woman, the larger Nganyi clan is protective and disregards women, especially those who were childless in matters rainmaking. The biasness expands into cultural inheritance like rainmaking among the Nganyi into which only men are initiated yet it originated from a woman. This, to some extent, contradicts the current researcher findings in that none of the interviewees gave the childlessness of a woman as a reason for not participating in rainmaking. Instead, they explained that women were not part of the rainmaking practice because they could leave their husbands and go elsewhere to remarry. In such cases, they would reveal the secrets of traditional rainmaking to the other community where they would be remarried in.

Oswago (1991) narrates a similar story of *miaha* (bride) in the Luo garden of Eden and the location of the flood mythology of Simbi Nyaima concerning a woman who came across a drinking party and gate-crashed by asking for a morsel of food. The party celebrants shoved her off but not before she alerted them of a possible flood and in her presence, the rains fell and the village sank with its inebriated inhabitants, all except one. Oswago (1991) further report of a similar story based in Gwassi in Homa Bay County of Nyamgondho the son of Ombare.

The story goes that Nyamgondho, who was a poor man, went fishing from the lake and brought home an old woman in his catch. The woman is said to have translated his poverty into wealth in terms of cattle, wives and children. The man enjoyed the wealth until one day when he came home drunk and his wives refused to open the gate for him. He insulted them and the old lady packed her belongings and returned to the lake with all the wealth in tow. From the original flood, mythology has sprung many variants of the poor fisherman, the lost woman and its dispersal into the Bunyore hills where it is associated with the rainmaking prowess among the Nganyi.

The current study noted that although women are not allowed to participate in the actual rainmaking, in a way, they contribute to it when a woman is tasked with identifying a virgin who fetches water used in the act of rainmaking. In essence, this implies that rainmaking is not possible without the participation of a virgin girl who is herself identified as a woman.

5.5.1 Participants in rainmaking rituals

The researcher established that rainmaking is conducted by at least 3 to 7 elders. This is because they have to work as a team to look for the herbs from within or far from home and the materials that are required to administer the work. The study also confirmed that each rainmaker is assigned duty during that process. Nonetheless, the current study as well as that of Ottichilo and Khasilwa (2016) finds that women are not allowed to participate directly in rainmaking in spite of the fact that the tradition was passed down by a foreign woman who had sojourned with Nganyi. This is because their marriage surety is not constant since a woman can be divorced or separated from the husband and take the knowledge elsewhere. In addition, it is a clan tradition from the ancestors which has to be adhered to.

The researcher established that Nganyi rainmakers acquired the skills from their ancestors. The finding is in agreement with that of Akunda (2010) who states that the Nganyi are the only family associated with rainmaking practices in Western Kenya. The study established that only

male elders aged 76 years and above conduct the rituals of rainmaking because they are regarded as mature and wise. Those below that age may accompany the elderly rainmakers for training purposes. Thus, they gain the knowledge and experience so that once they reach the required age, they can continue with the tradition.

5.5.2 Rainmaking

From this study, traditional rainmaking practices can be divided into three parts namely: prediction of rain, actual rainmaking and prevention of rain from falling. Semanya (2013) states that rainmaking methods differ from place to place and depend on the seriousness of the drought. Boddy-Evans (2010) opines that the Ba-Lovedu tribe of Limpopo province in South Africa, is well known for making rain and that since 1800, six rain queens of the Ba-Lovedu tribe have existed. The rain queens presided over rainmaking ceremonies held annually in the month of November. The Pedi tribes, also known as Northern-Sotho speakers of South Africa also have rainmaking rituals as their ways of invoking the god of rain. The rainmaking traditional doctor is called *moroka*. During drought, the village chief calls a meeting to discuss the problem. The *moroka* sets his or her price for invoking storm-free rain and each household in the village pays an amount of money, donates a sheep, goat or cow which could be one of the requests by the *moroka*. So the villagers had to make their payments before the rain is released. Amongst the Pedi tribes of South Africa, rainmakers are women hence the reference to rain queens. As explained above, they are paid before any ritual of rainmaking can be administered. This is in contrast to the current study which established that only men make rain. Similarly, the Nganyi rainmakers are not paid directly to make rain.

It is evident from the foregoing that this tradition of rainmaking is not only practised in Kenya. Other countries also practice it albeit in diverse forms. Nzenza (2014) notes that before the white men came to Zimbabwe, prayers for rain were held at the Njelele shrine on Matopos Hill

near Bulawayo. People travelled with *zviyo* (red or finger millet: *Eleusine coracana*) from all parts of the country to participate in the rainmaking ceremonies. Elderly women who were no longer sexually active brewed traditional beer using the finger millet which was then poured on the ground to attract the rain. Matsuhira (2013) found that the rainmaking ritual was held at a shrine of a female spirit medium annually. The spirit medium had powers of rainmaking, curing diseases and appointing the chief.

This study established that rainmaking involves mixing a specific type of herb, with water, then crushing and putting the pulp in a pot where it is stirred using a traditional reed (type of plant found in the swampy area) for an estimated twenty to thirty minutes until it mixes well. The researcher established from the interviewees that the mixture produces bubbles and the colour that forms from the bubbles determines the weather condition, that is, whether the rain is about to fall or not. The light bluish colour indicates no rain while greyish white indicates rain.

The researcher established that the importance of the pot in the shrine is that it is used for weather observations and recording and to show when there will be a dry spell and wet season. During the dry season the herbs in the pot are stirred with water to make bubbles which then attracts the formation of the rain clouds in the sky to cause rain to fall. The pot is also a symbol of unity for the living and dead.

The study established that if drought strikes, the rainmakers are tasked with identifying a virgin girl through an elderly woman from the region who is honest and faithful. The elderly woman has to confirm that the girl is a virgin and then requests her to fetch water using a 10-litre bucket from a river near the shrine. The virgin girl, aged between 9 to 12 years, then takes the water to the shrine and hands it over to the rainmakers. The girl is then set free after which the process of rainmaking begins. The mixture of herbs and water is put in a specific traditional pot in the shrine. The researcher established that before performing the ritual, prayers must be conducted

to the Christian God for the rain to fall. This can be compared to the findings of the study by Akong'a (1987), which reports that amongst the locals of Kitui South and Kitui Central, the practice of rainmaking starts at the youthful stage. A girl and a boy presumed to be virgins were given a goat or bull, respectively, which they rode around the surrounding hill at the site of the ritual seven times and on the close of the seventh round, the animal without deformities on its skin or hide colour was stained with blood assembled in calabashes by the old men. The married women took some of the blood, milk, and seeds of all types of plants that were to be planted in that season together with cooked food. In addition, they also carried the alcohol in calabashes that were brought by the old men to the sacrificial site which they poured jointly into the Ithembo (shrine that is occupied by ancestral spirits). The men mentioned the names of particular ancestral spirits as they poured the alcohol, engaging the *aimu* (spirits) to the feast. They prayed to them for provision of adequate food and rain, and in addition blessing of many children and liberation from all wickedness. The body of the animal that was slaughtered was split up into two. The first part was cut into pieces and mixed with blood and then cast into and around the Ithembo for the ancestral spirit to consume. The remaining part was shared amongst the participants of the rituals which included all the old people and the two youths. The married, fertile women who took the food and seeds to the spirits did not partake of the sacrificial meat. After the sacrificial offering, the women went ahead to perform the *kilumi* dance and the men together with the women who had reached menopause were left behind to roast and consume the meat. It was believed that the dance was performed for 3 evenings and that it would pacify the spirits.

In this study, the rainmakers train their male children to be rainmakers so that when they are approaching death they will have acquired the skills. The researcher also established that all the interviewees acquired the skill from their fathers. The finding in this study does not agree with the study by Herero et al. (2010) that rainmakers among the Nganyi practise it secretly in

the absence of their heirs leaving the power only when approaching death. The findings also disagree with the study by Nakashima et al. (2012) that the prediction of rain in Kenya is administered through spiritual and cultural practices like dreams, divination and visions from selected elders who perform sacrifices that mediate between the living and the dead ancestors. This is because the current study established that the Nganyi rainmakers do not predict rain through dreams, divination and visions.

The researcher further established that rainmaking rituals are performed in the shrine because it is believed to be the dwelling place of the ancestors; it is where Nganyi and other rainmakers were buried. The shrine has very old indigenous trees that are regarded as sacred and cannot be cut even if they fall; the herbs used for rainmaking are also found in the shrine. The study further established that the trees at the shrine cause rain to fall hence the rainmaking practice contributes to the conservation of the forest and regeneration of vegetation and land. This enhances climate change response and ways of adaptation and mitigation.

Other communities like the Akamba community also practice rainmaking rituals differently from the Nganyi rainmakers. They believe that dances and sacrificial food will appease the ancestral spirits whom they believe must be annoyed with their deeds hence causing rain not to fall. Then they open up the sky that will halt the suffering of the community. The sacrifices and dance are referred to as *kilumi* which implied praying for rain during drought. Rainmakers or prophets conduct the prayers since they are believed to possess the power of directing and redirecting rain. After this, they go ahead to perform the *kilumi* dance and the old men and women who have attained menopause are left to roast and consume the animal with each person receiving a tiny piece. While all this is taking place at the *ithembo*, which is a sacred ground and hence a shrine inhabited by ancestral spirits, youth comprising of boys and girls perform their own dance (Akong'a, 1987). Korster (2011) and Akong'a (1987) explain that *kilumi*

dances are also accompanied by sacrifices such as spilling the blood of animals, milk, seeds, crops, beer or cooked food to appease the spirits. Most *kilumi* rituals are done publicly and require the participation of all members of the community (Akong'a, 1987; Korster, 2011). Indeed, Akong'a (1987) explains that rainmaking days are selected and made known in advance by the rainmakers with the day kept holy and community members required to observe peace, purity and abstain from sex. From these study findings, the researcher confirms that rainmaking is performed by various communities and in different ways.

Prediction of rain

The study established that the Nganyi rainmakers predict rain by observing specific types of plants, the behaviour of birds and animals, movement of wind, morning dew, rainbow, croaking of frogs, the appearance of the moon, and insects like safari ants, plants shedding their leaves, and observing clouds in the sky. This finding partially contradicts Herero et al. (2010) who states that the Abanyole community observe the flora and fauna in the Nganyi forest shrine in Esibila village to predict weather conditions, and this has helped the locals to predict weather conditions for generations. Their study does not specifically focus on the rainmakers but instead focuses on the community as a whole. Phibion (2013) explains that in Zimbabwe some types of birds are associated with rain and they include the *njelele* (eagle), *nyenje* (white stork), *makololwani* (storkbirds) and *nyenganyenga* (swallows). He adds that these birds are usually sighted around the rainy season.

Accordingly, farmers in Malawi and Botswana use indigenous forecasts which are believed to be more precise and are easily understandable than scientific forecasts which require sophisticated equipment, formal education, training and financial investment (Briggs & Moyo 2012; Kolawole et al., 2014; Onyango, 2009; Ouma, 2009). The farmers predict rain using tree phenology, animal behaviour, wind circulation, and cloud cover. The prediction gives them an

opportunity of knowing when the rain will start to prepare their farms. This shows some similarity with the findings of this study.

According to the studies administered in southern Africa, if certain trees bear fruit at certain periods then this indicates either a good or poor rainfall season, for instance, in Botswana, a certain shrub called *Moretlhwa* and known in English as Brandy bush/Raisin bush (*Grewiaflava*) bears fruits twice a year. When it produces early fruiting in November to early December, it indicates that the area will experience low rainfall, and late fruiting from February to March implies a good season and no fruit at all indicates a serious drought (Kolawole et al., 2014). Whereas in Zimbabwe, the disappearance and delayed fruiting of trees such as *Maroro*, *Tsambatsi* and *Hute*, and the profuse fruiting of the *Muhacha* tree, including the delayed regrowth of grasses from August to October have for a long time indicated droughts to come (Mapfumo et al., 2015).

In Southern Africa, the singing, nesting and chirping of certain birds are significant indicators of the onset of the rains (UNEP, 2008). In addition, the arrival of migratory birds, particularly the southern hornbill (*Bucorvusa byssinicus*) in Zimbabwe, Zambia and northern parts of South Africa (Orlove et al., 2010) with use of the movements of fronts to provide them with tailwinds (Liechti, 2006) are indicators of lots of rain. Sounds from precise insects that appear from overwintering and hibernation (Mapfumo et al., 2015) prompt the start of a season and planning by farmers in Botswana and Zimbabwe. There are similarities in the prediction of rain such as the singing of birds, animal behaviour and movement of the wind. The Nganyi predict rain for instance through the shedding of leaves in certain trees while in Zimbabwe by fruiting of a particular tree.

Prevention of rain

From this study, during heavy downpour, the Nganyi rainmakers are tasked with stopping rain from falling. Rain is prevented using certain herbs which clear the clouds and cause rain to disappear or other herbs that cause the strong wind to blow the rain and changes its direction of falling. This is usually during important functions such as weddings, burials and harvest time when crops such as maize are required to dry. This is done mostly during ceremonies such as weddings, funerals, fundraising and when it falls daily again it has to be reduced so that the crops can do well.

Semenya (2013) explains that in South Africa amongst the Pedi tribe a rainmaking traditional doctor, *moroka*, is tasked with preventing either rainstorms or rain from falling. The *moroka* has to be paid by the villagers. Semenya (2013) adds that the rituals of preventing rain can also be performed by other ordinary village members. Rain prevention rituals are also performed by ordinary members of the village during wedding ceremonies, and important functions, and every village has its way of rain prevention rituals. In the past, the forehead skin of a cow would be used to prevent rain. Shoes were made out of it since it was regarded to be strong to withstand pricks and were durable (Semenya, 2013). When the rain prevention ritual was being performed, an old or middle-aged woman in the family would carry the shoe on her back till the end of the ceremony. They noted that at times it would start raining as soon as the shoe is removed from the back.

5.5.3 Belief in God

The researcher established that the rainmakers believe in the Christian God who directs them in rainmaking. In fact, they attribute their success in rainmaking to God. They view it as a God-given talent that was passed to the Nganyi only after Nganyi welcomed a desolate woman. Some of the interviewees argued that every human being on earth was created by God who directs their ways. They further compared rainmaking with the story of Moses in the Bible

where he struck a rock with a stick and produced water for the people to drink. This statement was confirmed by Interviewee 37 who is a church member and rainmaker. The study is in agreement with the findings of Akong'a (1986) that Bunyore where the Nganyi community resides is an area which came under the influence of missionaries, specifically the Church of God mission at Kima and Church Missionary Society (Anglican) at Maseno and in this regard they all claim to be Christians regardless of their deeds. The main rainmaker interviewee in this study was a reverend at the Pentecostal Assemblies of God (PAG) church.

In comparison to the beliefs of other communities regarding rainmaking, the study of Kenyatta (1938) explains that the Agikuyu directed their prayers towards *Mogai* (God). Despite the fact that the sacrifices for rainmaking were performed near a *Mugumo* (fig) tree, they had to face Mt. Kenya which they believed was God's residence. Additionally, the Akamba of Kitui directed their prayers to named ancestral spirits, dubbed the *aimu* or *maimu*, whom they considered as the intercessors between them and *Ngai* (God).

Phibion (2013) explains that among the Bakalanga of Botswana and Zimbabwe, rain praying dances are performed annually at the beginning of the wet season to request for adequate rains as either too much rain or too little can spoil the crops and lead to famine. The early months of the rainy season when field preparation and crop planting are done is termed an anxious period whereby the slightest abnormality in weather patterns inspires the people to perform the rainmaking rituals.

This study found that the Nganyi are always equipped with information in regards to the condition of weather in the region. This is reported via the vernacular Anyole Radio. With the information gathered, the locals can prepare their farms at the appropriate time.

5.5.4 Seasons for making rain

In communities that practise traditional rainmaking both globally and locally, there are farming calendars which assist the locals to identify the months or seasons for planting and harvesting. Rainmaking amongst the Nganyi is usually conducted in the months of March and August. During this period, locals commence the farm preparation whereby the farms have to be dug or ploughed depending on the affordable means. For this to be done, the fields require a wet environment because digging cannot be done on dry land. It is for this reason that if the ground is hard and the season for farm preparation has reached, the rainmakers are tasked to perform the rainmaking rituals (Korster, 2011).

In this study, there are two planting seasons in the months of March for long rains and August for short rains. Most communities have two planting and harvesting seasons. This finding concurs with studies of other researchers like Akunda (2010) who explains that Bunyore experiences two planting and harvesting seasons in a year. Most communities in Kenya and even outside have two planting seasons. For instance, Mbula (1974) posits that the rainmaking ritual in Kitui was conducted in the months of August or early November when the long rains were expected.

5.6 Consequences of climate change

The researcher also established that the interviewees had various views on how the government can benefit from traditional rainmaking practices to confront the consequences of climate change. Through the rainmaking practices, the government could adequately prepare for the changes in the climate to reduce its effects by planning well in advance. Such preparations could include storing food for future use for both humans and animals.

It was established that the rainmakers also have knowledge of natural lightning arresters. They plant certain trees that act as lightning arresters in such a way that when lightning strikes it is

arrested before doing any damages. The same plant also prevents thunderstorms as well as hailstorms during the rains. When lightning strikes, it destroys the lives of both human beings and animals. It also damages homes leaving communities in a devastating state. It also causes fear and panic amongst the locals. This can lead to poor health conditions due to the trauma. Hailstorms too destroy crops in the farm and the result is prolonged hunger.

Other consequences that come about as a result of climate change are droughts. The effects of droughts are drastic as both human beings and animal experience a shortage of both water and food. Every living thing requires water and food and lack of it can be heavily felt even beyond Western Kenya.

The researcher established that overgrazing has contributed to climate change which in turn has drastically affected the locals. Lack of enough grazing land is an issue because the animals do not get enough pasture and this can also lead to soil erosion. When rain is not adequate, the animals wander all over in search of grazing land and end up eating from garbage which is not healthy.

Floods like the ones experienced in Kano Plains and Budalangi are also a result of climate change. This is because the lands in these areas do not have enough trees that could help in absorbing the water during the rainy seasons. In some places, there has been a lot of deforestation which also contributes to climate change. All these are some of the consequences that come along with climate change. This is in agreement with the findings of Akong'a (1987) that the challenge of climate change in Kenya is turning people's attention steadily to traditional practices.

5.7 Mainstreaming traditional rainmaking in building climate change resilience

The study established from the interviewees that rainmakers and KMD can work together in coming up with the right weather predictions for locals to be productive in agriculture. With

proper agricultural practices, the health sector will also improve and there will be employment opportunities. All these factors, if looked into appropriately, will contribute to the realisation of Kenya Vision 2030 and the “Big 4 Agenda”.

This study established that traditional rainmaking practices can be mainstreamed by the government. The government could do this by enhancing the conservation of the environment through the planting of trees and ensuring that the locals do not cut trees so that there can be plenty of rain water; the locals should be educated on the importance of trees such as attracting rain; and they need to be informed that cutting of trees has many disadvantages such as poverty, drought and sicknesses. The government can equally bring the rainmakers and the KMD specialists to work together as a team.

Stakeholders should also popularise the traditional rainmaking practices both locally and globally through sponsoring the rainmakers to go and perform the rituals in the dry areas where locals are dying of starvation and diseases as a result of lack of food. Awareness can also be created through the Anyole Radio, publications, and meeting forums such as weddings and funerals. Communities will believe information that has been documented or else if not well informed they will not see the seriousness of the matter. The finding concurs with Spreranza (2010) that creating awareness is important and beneficial when it comes to rainmaking, and that several communities in Zimbabwe had benefited from popularising traditional rainmaking in the country because it made the communities appreciate traditional rainmakers. The research further established that traditional rainmaking practices can contribute to both the SDGs, the Kenya Vision 2030 and the “Big 4 Agenda” by contributing to measures applied in dealing with the effects of climate changes in the country.

5.8 Summary

Climate change has a serious effect globally. According to climate change researchers, a remedy to this disaster has to be found or else people's lives are at risk due to poor health as a result of a shortage of food and water. Developing countries like Kenya are at a higher risk because of a lack of financial and technological resources that would enable them to adapt effectively. From the findings of this research, locals are trying to counterfeit this by planting trees and drought-resistant crops. The Government should also encourage adaptation and mitigation by engaging rainmakers and also come up with strategies for mainstreaming climate change.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

This chapter presents a summary of the findings, conclusions and recommendations of the study. The study examined the prevalence, evidence, seriousness and effects of climate change in Western Kenya; analysed the local community's response to the effects of climate change in Western Kenya; identified and documented traditional rainmaking practices which can be used for climate change mitigation and adaptation in Western Kenya; analysed how the traditional rainmaking practices can be used to confront the consequences of climate change in Western Kenya; and explored strategies which can be used to mainstream traditional rainmaking in building climate change resilience in line with the Sustainable Development Goals (SDGs), Vision 2030 and the "Big 4 Agenda" in Kenya.

6.1 Summary of findings

This section summarises the findings of this study according to the objectives and key themes investigated.

6.1.1 Nature and effects of climate change in Western Kenya

The study established that there have been changes in the climate of Western Kenya. Consequently, the rainfall patterns have significantly changed over the years. The study found that the changes to the climate have been caused by various factors including human behaviour such as deforestation, pollution and the rise of industries in the region. These changes have altered the crop planting patterns whereby rain falls for 2 or 3 days and then disappears leaving the locals stranded because the already planted crops will not germinate. Additionally, when short rains are expected the locals plant legumes which are affected when there is a heavy downpour. Consequently, the seeds rot instead of germinating because of too much rainfall in the region. This has affected the farmers in the region who depend on stable climate patterns

to make decisions. Additionally, the region has experienced negative effects of climate change such as poor crop yields, droughts, frequent hailstorms and lightning, delayed planting, increased cost of living, lack of food for animals and people, and reduction of forest cover in the region. In some instances, people die after eating animals that might have eaten poisonous things due to a lack of food for them. Thus, climate change negatively affects Western Kenya as a region. The consequences of climate change limits the region's capacity to attain food security which is one of the core elements of the SDGs, Kenya's Vision 2030 and the "Big 4 Agenda". Climate change also leads to hostile conditions which trigger or exacerbate disease outbreaks thereby also affecting targets related to improved healthcare due to frequent and increased cases of sicknesses. Targets in manufacturing are hampered by a lack of local raw materials as people lose jobs and become economically desperate. It can be concluded from this study that climate change in Western Kenya and other parts of the country poses a critical risk to the government missing on its own and international socio-economic development plans and agenda. This menace, therefore, needs to be addressed as a means of safeguarding national and regional development.

6.1.2 Local community's response to climate change

The study revealed that the local community has devised myriad ways of responding to the effects of climate change in Western Kenya. On the farming front, the community has resorted to planting drought-resistant crops that can withstand harsh climatic conditions. They are also building dykes both to harvest rain water and prevent soil erosion. They are also planting trees to enhance rainfall in the region. The study also revealed that the community is now relying more on the weather reports given by the KMD staff in the region than before. However, these efforts have not been entirely successful, although they have significantly reduced the negative effects of climate change. Therefore, this study concludes that the community response thus far, which is supported by the KMD and other agencies, has not yielded the desired results.

Thus, the community is still vulnerable to the consequences of climate change. There is a need for alternative or complementary strategies to strengthen their response to climate change through appropriate mitigation and adaptation mechanisms. Indigenous knowledge such as traditional rainmaking can be considered in this response.

6.1.3 Traditional rainmaking practices in Western Kenya

Traditional rainmaking practised in Western Kenya has three components. These include prediction of rain, making of rain and prevention of rain. Rain prediction practices enable the rainmakers to foretell rainfall patterns. This information helps the community to determine the farming seasons and plan accordingly. For instance, they determine when to plant which crops. Additionally, the information helps them to harvest-ready crops and preserve them from heavy rains. When there is drought, the rainmakers also cause rain to fall. Thus, they mitigate droughts which can cause great losses to the community through poor yields. Rainmakers also increase rainfall when it is low. They can also prevent rainfall when it is too much or when there is a scheduled important event or ceremony. This enables the community not to suffer the consequences of no or little rainfall. Similarly, they also avoid losses that would result from heavy rainfall. This study revealed that the art of rainmaking was bequeathed to the Nganyi clan by a foreign desolate woman their ancestor hosted. Ironically, women are forbidden from participating directly in rainmaking although the skill was learned from a foreign woman. Only elderly men are the custodians and practitioners of the tradition.

6.1.4 Confronting the consequences of climate change with traditional rainmaking

The effects of climate change are manifested in hostile weather patterns. These significantly affect the volume and patterns of rain. A common consequence of this is drought when people and animals experience shortage of both water and food. Severe drought leads to the death of both animals and human beings. Traditional rainmaking can be used to enhance the

community's capacity to mitigate and adapt to climate change. When there are droughts, rainmakers can cause rain to fall and mitigate the dry spell. Similarly, the prediction of rain can help the community to adapt to the emerging rainfall patterns and thereby avoid losses. Rainmaking can also help the community to mitigate natural disasters such as floods, hailstorms, thunderstorms and lightning. The rainmakers know natural lightning arresters. They plant certain trees that act as lightning arresters in such a way that when lightning strikes it is arrested from doing damage. The same plant also prevents thunderstorms as well as hailstorms during heavy rains. When lightning strikes, it destroys the lives of both human beings and animals. Hailstorms too destroy crops in the farm leading to prolonged hunger.

6.1.5 Mainstreaming traditional rainmaking in building climate change resilience

Through traditional rainmaking, the community under study has been able to mitigate and adapt to the changes in climate to some extent. However, the study revealed an inadequate collaboration between the traditional rainmakers and the KMD staff. The weakness was particularly observed on the side of the traditional rainmakers. The difference emerges from their two approaches to handling rain. On the one hand, are rainmakers who use traditional practices while on the other hand are KMD staff who use scientific approaches. Despite the efforts being made to bring the two teams together, including sharing a compound, optimum collaboration has not been achieved. Nonetheless, the KMD staff think very positively of the traditional rainmakers and view them as playing a critical role in the weather prediction and rainmaking processes. As part of the efforts to mitigate the effects of changing climate, the two parties are encouraged to work jointly for the common good of the community. There is a need to strengthen this collaboration to enhance the community's response appropriately to the consequences of climate change.

A key element of this research was to explore how the traditional rainmaking practices can contribute to the realisation of the "Big 4 Agenda" and Vision 2030 in Kenya. This study has

shown that traditional rainmaking can contribute to food security, improved manufacturing through the provision of raw materials, healthy livelihood, social security, increased employment through sustainable agriculture, as well as safeguarding houses from thunder and floods. For this to happen, there is a need to mainstream traditional rainmaking in the national response to climate change. This can be done by documenting, popularising and validating the practice. An important link to mainstreaming traditional rainmaking is to create a partnership between the rainmakers and the KMD. Good efforts in this regard have been observed. For instance, the researcher established that traditional rainmakers and KMD weather informants meet during seminars and workshops, and at the Anyole radio station where they share offices. These collaborations should be scaled up and formalised to enhance the accuracy of weather forecasts. The government can equally use the traditional rainmakers to rally the community members to practise activities that help in the conservation of the environment in the region and beyond.

6.2 Conclusion

The study established that climate change has been a global concern, not only in Western Kenya. Rainfall patterns have changed over the years in Western Kenya. Because rainfall is unpredictable, locals can no longer determine when the rain will fall. For instance, rain falling in the month of December or during harvest time when it is least expected. The study found out that the changes are mainly caused by human behaviour such as deforestation, pollution and the rise of industries in the region. Consequently, human and animal life is greatly affected. The study also revealed that locals are responding to climate change by planting drought-resistant crops that can withstand the harsh climatic conditions, building dykes both to harvest rain water and prevent soil erosion, and planting trees to enhance rainfall in the region. However, these efforts have not been entirely successful. Vulnerability to the effects of climate change persists. The study established that traditional rainmaking practices of predicting,

making or stopping rain can be used to confront the consequences of climate change by understanding and controlling rainfall patterns. This will contribute to better food security, health, industrialisation and livelihoods. These benefits can be enhanced by mainstreaming traditional rainmaking in the country's response to climate change.

6.3 Recommendations

The study makes the following recommendations to strengthen the community's response to climate change by mainstreaming traditional rainmaking in addressing climate change.

- i. The government should appreciate and motivate traditional rainmakers for their efforts in rainmaking. The government should recognise the practice and seek strategies for motivating them to participate actively in contributing to the national response to climate change. The county governments of Vihiga and Kakamega are best placed to spearhead these efforts before escalating the same to the national government.
- ii. The government should encourage both the traditional rainmakers and KMD to work hand in hand as they perform their respective duties in rainmaking and weather forecasting to ensure that they complement each other and enhance the reliability of providing accurate and precise information. This can be achieved through collaborative projects. Relevant policy and legal frameworks which facilitate this collaboration should be explored and pursued.
- iii. The government through the Ministry of Environment should collaborate with the rainmakers to increase the preservation of natural ecosystems and conserve the environment. Recognising the fact that traditional rainmakers prohibit the cutting down of indigenous trees, the Ministry should maximise on this to promote tree planting and reforestation. This will ultimately improve forest cover and rainfall.

- iv. The government should sensitise traditional rainmakers on how they can contribute to the realisation of the short-term and long-term developing blueprints such as the “Big 4 Agenda” and Vision 2030. They can also be educated on the key targets of these blueprints which are relevant to or depend on their practice.
- v. The government should recognise and enlist the traditional rainmakers as community champions on the use of information-based planning for agriculture. This includes the use of accurate weather forecasts as well as planting drought-resistant crops and raising appropriate animal breeds.

6.4 Suggestion for further research

This study focused on traditional rainmaking among the Nganyi clan of Western Kenya. Further research should be done on how other communities in Kenya practise traditional rainmaking and if other forms of indigenous knowledge could be applied to address other socio-economic challenges. The findings can be collated and used by the government to develop a national framework that would guide traditional rainmaking practices in Kenya.

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APPENDICES

Appendix I: Work Plan/Time Frame

Activity	Details of activity	Timeframe
Topic Identification	Literature review	Nov 2019
Topic Identification	Literature review	Dec 2019
Chapter One	Proposal writing	Jan 2020
Chapter Two	Proposal writing	Feb 2020
Chapter Three	Proposal writing	March 2020
Chapter One – Three Correction	Proposal writing	April 2020
Chapter One – Three Correction	Proposal writing	May 2020
Chapter One – Three Correction	Proposal writing	June 2020
Chapter One – Three Correction	Proposal writing	July 2020
Chapter One – Three Similarities Correction	Originality report correction	August 2020
Chapter One – Three Similarities Correction	Originality report Correction	September 2020
Chapter One –Three Final Draft Correction	Proposal	October 2020
Proposal Defence	Defense	November 2020
Defence Correction		December 2020 –January 2021
Clearance From	Introduction letter from the Technical University of Kenya Institutional Review Board NACOSTI	February 2021
Training research assistants		February 2021
Pre-testing of tools	Questionnaires	February 2021

Data collection	Nganyi village, Vihiga County in Western Kenya	July–August 2021
Chapter 4 Data Analysis	The study was analysed using NVivo	November–December 2021
Investigator	Engaged in data collection	November 2021
Chapter 4 Dissertation Writing	Immediately after data collection	December 2021
Chapter Five		December 2021 – March 2022
Chapter Six		March 2022 – April 2022
Intent to submit dissertation		6 th May 2022
Dissertation submission	After completion of dissertation writing and with the approval of the supervisors	From 23 rd May 2022
Dissertation defence	Undetermined	2022

Appendix II: Budget

Budget items	Quantity	Unit cost	Amount (Kshs)
Printing paper	1	600.00	600.00
Data recording	–	4000.00	4000.00
Photocopying	50	10.00	500.00
Pens	30	20.00	600.00
File folders	6	50.00	300.00
Training assistant	1	7000.00	7000.00
Pre-testing data collection tool	–	–	1000.00
Allowance for data	–	–	10000.00
Supervisors	2	10000.00	20000.00
Entrants			
Travels	2	5000.00	10000.00
Office space	1	5000.00	5000.00
Laptop	1	60,000.00	60000.00
Accommodation	2	5000.00	10,000.00
Coordination internet	–	–	2000.00
Airtime	–	–	5000.00
Dissemination & report writing	–	–	5000.00
Miscellaneous	–	–	10,000.00
Total			151,000.00

Appendix III: Interview Guide for Nganyi Informants

- **Which** clan are you from? How did you become rainmakers or acquired the skills?
- **Why** did you want to become a rainmaker?
- **How many** are your years of practice?
- **Are** the community members aware of your practice as a rainmaker?
- **How** do you predict rain?
- **What** is involved in the prediction?
- **In which** seasons and months do you perform rituals for rain?
- **Who** attends the rainmaking rituals?
- **Where** are the rituals performed and why there?
- **Does** GoK know that you predict rain?
- **How** did the GoK know about you and why?
- **What** is the elders' perceptions of the work of the KMD and what they can offer?
- **How** can GoK benefit from rainmakers or elders who predict rain?
- **What** is the relationship or where is the meeting point between rainmakers and KMD?
- **How** is rain made?
- **What** is involved in rainmaking?
- **What** happens when rain falls?
- **What** happens when it does not fall as expected?
- **Do you** believe that God is the maker of rain?
- **Would** you like to add anything else?

Appendix IV: Interview Guide for Meteorological Forecasters

Research question: KMD

Interview questions

- **What** is the nature of climate change in Western Kenya?
- **What** are the effects of climate change in Western Kenya?
- **How** is the community responding to climate change?
- **How** effective are the community's responses to climate change?
- **What** challenges hamper effective community response to climate change?
- **What** is your perception of the concept of traditional rainmaking?
- **Can** traditional rainmaking contribute to climate change mitigation or adaptation?
- **Can** scientists, like yourself, collaborate with traditional rainmakers to enhance community response to climate change?
- **Are** there strategies that can be used to mainstream traditional rainmaking in building climate change resilience at the national level?
- **If** there are, how can they be mainstreamed in line with the Sustainable Development Goals, Vision 2030 and the "Big 4 Agenda" in Kenya?
- **Is** there anything else you would like to add?

Appendix V: Informed Consent

Title of the study: The potential of traditional rainmaking practices in Western Kenya to confront the effects of climate change

Principal investigator: Bilha Omuhambe

Department: Technical University of Kenya

Address: 75698–00200

Mobile Phone: 0727464528

Email: bilhaomuhambe@yahoo.com

Purpose of the study: The purpose of the study is to investigate the potential of traditional rainmaking practices in Western Kenya, particularly among the Nganyi clan, to confront the consequences of climate change in the same region.

Study procedures

Activities

If you agree to participate in this research, you will be asked to participate in an interview for about 1 hour 15 minutes and you will be asked open-ended questions where you will be allowed to talk about your experience with rainmaking.

Eligibility

To be eligible to participate in this research, you must be a Nganyi elder who is knowledgeable in rainmaking and agree to have the audio recorded.

Confidentiality

The study will ensure confidentiality of the data gathered as well as respect the culture of the informants during the interview process. The researcher will also omit the names and addresses of the interviewees' in the data collected and the interviewees will be assured that there is no right or wrong answer. This will allow them to gain confidence and participate effectively.

Voluntary participation

Interviewees' participation in this study is voluntary and if you decide to participate in this study you will be asked to sign a consent form and you are free to withdraw at any time without giving a reason. Interviewee withdrawing before the study is completed will lead to the data being returned to him or destroyed.

Contact information

In case of any questions concerning the study or would like to add more information that you feel you forgot to share during the interview, kindly email the researcher at bilhaomuhambe@yahoo.com or call 0727464528.

Risks

A participant declining to answer some or all questions will be a risk to the researcher because of a lack of enough information. Measures that can be taken to minimise the risk are to try as much as possible to be friendly to the participants.

Benefits

There will be no direct benefits to the participant however, the researcher is optimistic that information obtained from the study may, when need be, disclose alternative procedures which might be of advantage to the participant.

CONSENT

I have read and understood the provided information and provided the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and at no cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's signature _____ Date _____

Investigator's signature _____ Date _____

Appendix VI: NACOSTI Letter



THE TECHNICAL UNIVERSITY OF KENYA

Haile Selassie Avenue, P. O. Box 52428, Nairobi, 00200, Tel: +254 (020) 343672, 2249974, 2251300, 341639,
Fax: 2219689, E-mail: vc@kenpoly.ac.ke, Website: www.tukenya.ac.ke

Office of the Director School of Graduate and Advanced Studies

REF: AIIU/03923P/2018

8th March, 2021

The Chief Executive Officer
National Commission for Science, Technology and Innovation
NACOSTI Building, Off Waiyaki Way
P.O. Box 30623 - 00100
Nairobi, KENYA
Tel: 020 400 7000/0713788787/0735404245

Dear Sir/Madam,

REF: APPLICATION FOR RESEARCH PERMIT

This is to inform you that Ms. Bilha Omuhambe is a registered Masters' student in the Department of Information and Library Sciences, School of Information and Social Studies, The Technical University of Kenya. The course is offered by, Coursework, Research and Dissertation. The title of her dissertation is "**The Potential of Traditional Rainmaking Practices in Western Kenya to Confront the Effects of Climate Change.**"

Ms. Omuhambe has defended her research proposal and is currently proceeding for field work which will involve data collection using approved surveys and research methods.

This is to kindly request you to issue her with a research permit.

Prof. Joseph O. Lalah
Director- School of Graduate and Advanced Studies
File Copy: SGAS Student File
JOL/smm



Appendix VIII: Ethical Review Committee Letter



2nd June 2021

Mrs Omuhambe Bilha,
omuhambeb@gmail.com

Dear Mrs Omuhambe,

RE: The Potential of Traditional Rainmaking Practices in Western Kenya to Confront the Effects of Climate Change


This is to inform you that SU-IERC has reviewed and approved your above master's (Technical University of Kenya) research proposal. Your application reference number is SU-IERC1034/21. The approval period is 2nd June 2021 to 1st June 2022.

This approval is subject to compliance with the following requirements:

- i. Only approved documents including (informed consents, study instruments, MTA) will be used
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-IERC.
- iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-IERC within 48 hours of notification
- iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-IERC within 48 hours
- v. Clearance for export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to SU-IERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://research-portal.nacosti.go.ke/> and also obtain other clearances needed

Yours sincerely,


for: Dr Virginia Gichuru,
Secretary; SU-IERC

Cc: Prof Fred Were,
Chairperson; SU-IERC



4.2.1

Ole Sangale Rd, Madaraka Estate. PO Box 59857-00200, Nairobi, Kenya. Tel +254 (0)703 034000
Email admissions@strathmore.edu www.strathmore.edu

Appendix IX: Plagiarism Report

ORIGINALITY REPORT

25%

MILARITY INDEX

21%

INTERNET SOURCES

11%

PUBLICATIONS

12%

STUDENT

PRIMARY SOURCES

1

mafiadoc.com

Internet Source

2

hdl.handle.net

Internet Source

3

Submitted to Mount Kenya University

Student Paper

4

docplayer.net

Internet Source
