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FAKULTÄT I
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The Opportunities and Challenges for Climate Change Education at Universities in the African Context: A Comparative Case Study of Makerere University (Uganda) and University of Dar es Salaam (Tanzania)

Thesis

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Declaration

I, David Ssekamate (Matrikelnummer 3867797) hereby declare that this thesis titled *The Opportunities and Challenges for Climate Change Education at Universities in the African Context: A Comparative Case Study of Makerere University (Uganda) and University of Dar es Salaam (Tanzania)*, submitted to the Faculty of Education and Social Sciences of Carl von Ossietzky University of Oldenburg, as a requirement for the award of Doctor of Philosophy (PhD), is my own original work and has not been submitted by me for any academic award at this or any other tertiary institution before. All sources cited or quoted in this thesis are indicated and acknowledged with a comprehensive list of references.

Signed:

_____

Oldenburg, date. 18.07.2018

July 2018

Selbstständigkeitserklärung

Hiermit versichere ich, David Ssekamate (geb. am 08.02.1978), dass ich die vorliegende Arbeit mit dem Titel *„Opportunities and Challenges for Climate Change Education at Universities in the African Context: A Comparative Case Study of Makerere University (Uganda) and University of Dar es Salaam (Tanzania)“*, eingereicht bei der Fakultät I – Bildungs- und Sozialwissenschaften – der Carl von Ossietzky Universität Oldenburg zur Erlangung des akademischen Grads *Doktor der Philosophie* (Dr. phil) selbständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt und die allgemeinen Prinzipien wissenschaftlicher Arbeit und Veröffentlichungen befolgt habe. Der Inhalt der vorliegenden Arbeit wurde nicht im Rahmen einer anderen Qualifikationsarbeit verwendet.

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List of Abbreviations and Acronyms

CC	Climate Change
CCE	Climate Change Education
CERMESA	East and South African German Centre of Excellence for Educational Research Methodologies and Management
DAAD	Deutscher Akademischer Austauschdienst (German Academic Exchange Programme)
ESD	Education for Sustainable Development
GHG	Greenhouse Gases
GOU	Government of Uganda
GOT	Government of United Republic of Tanzania
IPCC	Intergovernmental Panel on Climate Change
MAK	Makerere University
MUCCRI	Makerere University Centre for Climate Change Research and Innovation
MTA	Tanzania Meteorological Agency
NGOs	Non-Governmental Organizations
OECD	Organization for Economic Cooperation and Development
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SARUA	South African Regional Universities Association

SIDA	Swedish International Development Agency
UDSM	University of Dar es Salaam
UNMA	Uganda National Meteorological Authority
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development

Abstract

This study examined the opportunities and challenges of climate change education at universities within the African context. Specifically, it analysed the current academic, research and community engagement programmes on climate change implemented by the universities of Makerere and Dar es Salaam; the key challenges faced by the implementing units in carrying out these programmes and the success factors and opportunities for climate change education at the case universities.

Using a social constructivist approach, the study adopted a qualitative comparative multiple case study design with Makerere University (Uganda) and University of Dar es Salaam (Tanzania) as comparative cases. With the help of Ostrom's Institutional Analysis and Development (IAD) framework, the study collected data using semi-structured in-depth interviews, Focus Group Discussions (FDGs) and document review. A total of 18 semi-structured in-depth interviews and 5 Focus Group Discussions were undertaken, collecting data from 58 participants in Uganda and Tanzania. The data was analysed using thematic analysis based on the V. Braun and V. Clarke (2006) model with the help of MAXQDA software.

The findings revealed that both universities run various training programmes on climate change including short courses, seminars and workshops as well as long courses and specialised academic programmes at undergraduate and postgraduate levels. The findings also showed that the universities carried out research on climate change mainly on adaptation with far less on mitigation. Most of the research projects focused on adaptation aspects in agriculture, pastoral communities, coastal areas and semi-arid areas in Uganda and Tanzania. With respect to community engagement, the findings revealed that these universities organised annual climate change festivals; engaged in local adaptation initiatives in communities; developed decision making tools and adaptation plans for district and village leaders, and identified and trained community climate change champions to support and be the link between the university and communities on CCE programmes.

In addition, the study findings revealed various challenges that the implementing units at these case universities face. These included limited access to reference materials and facilities by students on climate change programmes at the universities; inadequate funding support by government and local sources towards climate change education programmes implemented by the case universities, and the challenge of conceptualising climate change among local

communities. Other challenges included bureaucratic delays in approving and accrediting new programmes; lack of proper coordination as well as conflict over which academic unit should host the climate change education programmes, and failure to adopt climate friendly management practices on campus despite having climate change education programmes and courses at the universities. These require serious attention from the university management.

The study found various drivers for climate change education work. These included: multi-disciplinary teams and approaches; strong partnerships and collaborations; strong African social and cultural systems like Ubuntu philosophy that motivates those who are involved, and effective involvement of stakeholders in the design and implementation of the climate change education programmes at the case universities. The study findings revealed many opportunities that case universities need to tap to effectively strengthen climate change education work as well as strategies on how to improve their programmes.

Based on these findings, the research made various recommendations to the university management that require attention. The study contributed to existing theory by proposing a model linking university education to climate change interventions within the African context; empirical evidence on climate change education and policy, as well as practice for action. It is expected that this work will also ignite a discussion among universities that are yet to begin climate change education programmes within the same context. Finally, the study proposed areas for further research on climate change education in the African context.

Key words: Climate change, climate change education, university education, sustainability education, African context

Zusammenfassu

Die vorliegende Arbeit untersucht die Möglichkeiten und Herausforderungen von Bildungsangeboten zum Klimawandel an Universitäten im afrikanischen Kontext. Insbesondere werden die an den Universitäten Makerere und Dar es Salaam aktuell vorhandenen akademischen Studienprogramme, Forschungsprojekte und Communityprogramme zum Klimawandel analysiert. Im Fokus stehen dabei die Herausforderungen, die Erfolgsfaktoren und die Möglichkeiten der Universitäten bei der Durchführung von solchen Bildungsangeboten zum Klimawandel.

Im Rahmen dieser Arbeit wurde eine konstruktivistische Herangehensweise gewählt. Mithilfe eines qualitativen Untersuchungsdesigns (multiples Fallstudiendesign) wurden vergleichende Fallstudien an der Makerere Universität (Uganda) und der Dar es Salaam Universität (Tansania) durchgeführt. Unter Berücksichtigung des Ansatzes von Ostrom *Institutional Analysis and Development (IAD) framework* wurden mittels teilstrukturierter Tiefeninterviews, Fokusgruppendiskussionen und einer Dokumentenanalyse Daten erhoben. Insgesamt wurden mit 58 Teilnehmerinnen und Teilnehmern aus Uganda und Tansania 18 teilstrukturierte Tiefeninterviews und fünf Fokusgruppen-Diskussionen durchgeführt. Die *Thematic Analysis* von V. Braun und V. Clarke (2006) diente als Methode der qualitativen Datenanalyse. Das Datenmaterial wurde unter Verwendung des Software-Programms MAXQDA ausgewertet.

Die Befunde verdeutlichen, dass beide Universitäten verschiedene akademische Studienprogramme zum Klimawandel durchführen. Dazu zählen Intensivkurse, Seminare, Workshops, semesterbegleitende Kurse sowie spezielle akademische Programme auf Bachelor- und Master-Niveau. Darüber hinaus kann aufgezeigt werden, dass die an den untersuchten Universitäten durchgeführten Forschungsprojekte zum Klimawandel sich überwiegend auf die Anpassung an den Klimawandel und weniger die Abschwächung des Klimawandels fokussiert. Der Großteil der Forschungsprojekte konzentriert sich auf die Anpassung in den Bereichen Landwirtschaft, ländliche Gemeinden sowie Küsten- und Halbtrockengebiete in Uganda und Tansania. Hinsichtlich der Communityprogramme kann gezeigt werden, dass beide Universitäten jährliche Klimawandelfestivals organisieren, sich für örtliche Initiativen in den Gemeinden engagieren, Instrumente zur Entscheidungsfindung und Aktionspläne für Bezirks- und Dorfvorsteher sowie für ausgewählte und ausgebildete Multiplikatoren zum Klimawandel in den Kommunen entwickeln, um die Verbindung zwischen Universität und Gemeinden in Bildungsangeboten zum Klimawandel zu unterstützen.

Des Weiteren heben die Befunde verschiedene Herausforderungen hervor, die die ausführenden Organisationseinheiten der beiden Universitäten zu bewältigen haben. Dazu zählen a) der schwierige Zugang der Teilnehmerinnen und Teilnehmer der Bildungsprogramme zu relevanten Materialien und zentraler Literatur, b) die unzureichende Finanzierung durch die Regierung und lokale Fördertöpfe sowie c) Verständnisprobleme in den Kommunen zur Bedeutung des Klimawandels. Weitere Herausforderungen betreffen bürokratische Hürden bei Genehmigungs- und Akkreditierungsverfahren neuer Programme, Koordinationsprobleme, Zuständigkeitsprobleme zwischen den beteiligten

Organisationseinheiten zu den Bildungsprogrammen sowie Misserfolge bei klimafreundlichen Aktivitäten auf dem Campus – trotz der bestehenden Bildungsangebote zum Klimawandel. Es bedarf daher, so die Studie, einer besonderen Aufmerksamkeit seitens der Universitätsleitung.

Die Untersuchungsergebnisse geben auch Auskunft über Erfolgsfaktoren für Bildungsangeboten an den Universitäten zum Klimawandel. Dazu zählen interdisziplinäre Teams und Herangehensweisen, stabile Partnerschaften und eine enge Zusammenarbeit, starke Sozial- und Kultursysteme (z.B. Ubuntu, einer afrikanischen Lebensphilosophie, die Beteiligte motiviert) und die effektive Beteiligung von Interessensvertretern in der Gestaltung und Durchführung der Bildungsangebote an den Universitäten. Die Untersuchungsergebnisse zeigen viele Möglichkeiten auf, die die Universitäten nutzen sollten, um effektiv Bildungsangebote zum Klimawandel zu stärken. Darüber hinaus werden Strategien zur Verbesserung der Bildungsangebote aufgezeigt.

Basierend auf den empirischen Befunden gibt der Verfasser der Arbeit verschiedene Empfehlungen für die Hochschulleitung. Die Arbeit kann als ein Beitrag zum bestehenden Theoriediskurs verstanden werden, da ein evidenzbasiertes Modell vorgeschlagen wird, welches universitäre Bildungsangebote mit Klimawandelinterventionen im afrikanischen Kontext verbindet und Hinweise zur praktischen Implementierung liefert. Es wird erwartet, dass durch diese Arbeit eine Diskussion unter denjenigen Universitäten angestoßen wird, die Bildungsangebote zum Klimawandel in einem vergleichbaren Kontext initiieren möchten. Letztlich regt die vorliegende Arbeit eine weiterführende Forschung zu Bildungsangeboten zum Klimawandel im afrikanischen Kontext an.

CHAPTER ONE: INTRODUCTION TO THE PROBLEM AND ITS CONTEXT

Introduction

This chapter presents an overview and background to the study on the opportunities and challenges that African universities face in addressing climate change issues in their programmes. The chapter begins with providing the background to the study and the statement of the problem. Then it highlights the intended objectives as well as the research questions posed in the study. It also provides definitions of the key terms and concepts, and the scope of the study. The chapter ends with outline of the thesis.

1.1 Background to the study

This study examines the opportunities and challenges that African universities face in addressing climate change issues in their programmes. The problem of climate change has generated a lot of literature by researchers, writers and several international organisations because of its importance to the wellbeing of the human race and nature. Experts that comprise the Intergovernmental Panel on Climate Change (IPCC) have created awareness globally about this issue through their scientific reports on climate change. Scholars such as Farmer and Cook (2013), Filho (2010b), Stern (2008) and others have also written about this global problem. Stern (2008 p. 3) reported that, "an overwhelming body of scientific evidence now clearly indicates that climate change is a serious and urgent issue. The earth's climate is rapidly changing, mainly as a result of increases in Green House Gases (GHG) caused by human activities." This illustrates the graveness of the problem of climate change and the urgent need to take action.

The problem of climate change in African is equally worrying. The continent is expected to pay a huge price as a result of rampant drought, flooding and destructive storms arising from effects of climate change. Stern (2008 p. 4) warned that, "all countries will be affected. The most vulnerable—the poorest countries and populations—will suffer earliest and most, even though they have contributed least to the causes of climate change."

Furthermore, IPCC (2014 p. 1203) observed increased evidence of warming over the land across the African continent. The report projects that mean annual temperatures will exceed 2˚C and most likely rise faster than global land average especially in more arid regions. The same report indicated that globally, average land and ocean surface temperatures were 0.85˚C (0.65-1.06) during the period 1880 to 2012. This kind of warming is alarming and has had serious effects on societies and economies across the continent. The report also revealed that

oceanic uptake of CO2 has led to acidification of the waters, decreasing their PH by 0.1. This has increased ocean water acidity by 26%. Moreover, between 1901 and 2010, the global mean sea level rose by 0.19 (0.17-0.21) (See p. 4).

The ecosystems on the African continent have been greatly affected by climate change. Water resources are under stress and agricultural systems are more vulnerable especially in semi-arid areas, with the cereal crop productivity seriously reduced; a threat to food security on the continent. Undoubtedly, climate change will increase the burden of climate related health problems because it makes people more vulnerable to lack of clean and safe water, quality health care and quality basic education. Many are expected to suffer from hunger and famine (see chapter 22 of the IPCC report 2014). Therefore, all stakeholders as individuals, organisations, governments and institutions must devise effective ways of addressing the problem of climate change on the continent.

The IPCC (2014, p. 26), for instance, has indicated that "adaptation and mitigation are complimentary strategies for reducing and managing the risks of climate change." Scientists have argued for adoption of mitigation measures against climate change:

> Adaptation and mitigation responses are underpinned by common enabling factors. These include; effective institutions and governance, innovation and investments in environmentally sound technologies and infrastructure, sustainable livelihoods and behavioural and life style choices (ibid).

Speranza and Scholz (2013) have indicated that in Africa, adaptation measures are still a challenge due to a number of factors:

> Adapting to climate change is a challenge in Africa considering the prevailing conditions, the wide spread poverty and food insecurity, the varying adaptive capacities, the weak institutional frameworks and the exposure to multiple stressors, which range from volatile financial and commodity markets and violent conflicts to extreme events (page 471).

These challenges call for exploring an effective combination of strategies and interventions that can be adopted to supplement the limited mitigation and adaptation measures. One of the key responses to the problem of climate change is using education to promote mitigation and adaptation to the problem.

This is what is referred to as climate change education. Fumiyo Kagawa and David Selby argue that education has a crucial role to play in raising people's consciousness about the problem:

> At such a moment of enormous human challenge, formal, non-formal, and informal education have a potentially crucial role to play. In both school age and adult learning communities, learners of all ages can be invited to take up the challenge of understanding and re-thinking the world, of shattering assumptions, shibboleths and the taken for granted, of deliberating where to go at this critical fork in the road (Kagawa & Selby, 2010, p. 5).

The authors underscore the important role formal and informal education at all levels can play to address issues of climate change. To them, the education system can be a very useful tool for promoting mitigation and adaptation to climate change. Others such as Boyde and Hume (2015, p. 78) recognise the fact that "education at all levels and particularly at higher level should play a key role in addressing existing and emerging ecological and socio-economic challenges including climate change." Universities are key actors in this struggle. According to Cordero, Todd, and Abellera (2008, p. 870) universities could engage in "educating students about climate change" by linking it to various socio-economic issues such as food security, accessibility to safe water and sustainable use of renewable and non-renewable energy in their livelihoods.

While reporting about climate change in Africa's higher education context, Kotecha (2010, p. 133) argued:

> African universities can significantly contribute to knowledge production on climate change issues through research, empowerment of local communities, leaders and practitioners on climate change issues, through teaching and community engagement, but also change attitudes of students as well as behaviour towards existing practices that are not sustainable leading to climate change.

Kotecha implies that African universities could engage in training and capacity building on climate change mitigation and adaptation through offering short courses, academic and research programmes and working with communities and policy makers through outreach interventions. Moreover, Virtanen (2010) notes that as mitigation and adaptation interventions are being developed, universities could take the lead by promoting behavioural change among actors. They can also cause change "through institutional practices that are environmentally

friendly and mitigate as well as adapt to climate change" within their campuses and operations (p. 232).

Scholars have debated the role of universities in addressing climate change. For example, a world climate change survey in universities explored "the extent to which climate change was being dealt with in the context of university programmes" (Filho, 2010b, p. 1), while another case study assessed the impact and adaptation to climate change in Sub-Saharan West Africa (Sanni, Adejuwon, Olegeh, & Siyanbola, 2010). In all these studies, however, there was no empirical examination of the opportunities and challenges of higher education institutions in addressing climate change issues in their academic, research and community engagement programmes. These aspects are key to enhancing the role of African universities in addressing climate change mitigation and adaptation issues.

This study, therefore, explored the challenges higher education institutions face as well as opportunities they have in addressing climate change in the context of Africa. The scope of the study was limited to existing academic, research and community engagement programmes on climate change, the challenges universities face in implementing these programmes, and their success factors for adequately addressing climate change issues in these programmes.

1.2 Statement of the problem and rationale of the study

Higher education institutions in developing and developed nations have a critical role to play in climate change education in their academic, research and community engagement programmes (Anderson, 2012; Filho, 2010b; Lemons, 2011). This is because of the serious effects of climate change on almost all aspects of life for humans and nature in general. This kind of education is new in empirical research. Very few evidence based studies have been carried out, with many of these focusing on theoretical analysis of the issue in the context of developed nations and very few on developing nations (Anderson, 2012, p. 197).

Studies on the subject have mainly focused on international peer collaboration approaches to climate change education (Slotta, 2015). Others have addressed leadership and its role in building capacity for interdisciplinary climate change teaching at universities and status on climate change education in various countries (Gale, Davison, Wood, Williams, & Towle, 2015). A study by Fahey, Labadie, and Meyers (2014) focused on building capacity of local practitioners on climate change adaptation in developing nations. However, there is a dearth of empirical literature on the implementation of climate change education, the challenges and opportunities for universities in Africa. This is a research gap that needed to be addressed.

Universities provide high level training of researchers, experts and professionals who usually go back to various sectors of the economy and influence policies, programmes and decisions at various levels. They also produce educators for other levels of education and their programmes on climate change would significantly have a trickle-down effect on other levels of education.

This study, therefore, bridges this gap through a qualitative multiple case study of Makerere University in Uganda and University of Dar es Salaam in Tanzania to fully understand their current academic, research and community engagement interventions on climate change. It also analyses the challenges and opportunities that exist in addressing climate change issues and explores ways of improving the programmes on climate change in these universities.

1.3 Research objectives and questions

The main objective of the study was to examine the opportunities for climate change education at universities in the African context, the challenges they face and strategies of improving the academic, research and community engagement Interventions on climate change in these institutions.

The specific objectives of the study were:

(a)To examine the current academic, research and community engagement interventions on climate change implemented by the case universities.

(b) To identify the key challenges faced by the implementing units in carrying out academic, research and community engagement interventions on climate change in selected cases.

(c)To establish the success factors that would support universities to adequately address climate change issues in their academic, research and community engagement interventions and what can be done to improve the situation.

In order to address these objectives, the study adopted Ostrom's Institutional Analysis and Development (IAD) framework to aid the analysis of these aspects in the case universities. The framework contains variables that helped in analysing the context, and the action situation with respect to climate change education and the outcomes of these interventions.

The research questions were:

a) What are the current academic, research and community engagement interventions on climate change implemented by the case universities?
b) What are the challenges faced by the implementing units in carrying out academic, research and community engagement interventions on climate change within the case universities?
c) What are the success factors that would support universities to adequately address climate change issues in their academic, research and community engagement interventions and what can be done to improve the situation?

1.4 Definition of key terms and concepts

Climate change

One of the most recognised explanation of the concept climate change has been given by the Intergovernmental Panel on Climate Change (IPCC). IPCC defines climate change as "a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer" (Hegerl, 2007 pg 667). To these scientists the causes of this phenomenon are either human or natural. Natural causes are normally ecological processes like volcanic eruptions and variations in solar radiation that happen periodically. The human causes, on the other hand, are actions related to land use, deforestation, energy generation, industrialisation, automobiles and other human activities that emit carbon dioxide leading to an increase in the greenhouse gases in the atmosphere.

In its convention on climate change of 1992, the United Nations attempted to define the concept of climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (UN, 1992, p. 3). This definition attributes the primary cause of climate change to human activity rather than natural processes, implying that although natural climate variability will take place, human activity makes the situation worse.

Nicholas Stern defines the concept of climate change as a rapid change in climate caused by a surge in the greenhouse gases mainly on the account of human actions (Stern, 2008 p.3). This explanation highlights the rapidness of the change and its main cause as human activities.

According to him, the increase in greenhouse gases in the atmosphere is a result of the environmentally insensitive activities of the human race that emit carbon dioxide on an hourly basis without due regard to sustainable prospects.

All these definitions emphasise variability in the state of the atmosphere and related changes in atmosphere composition. They also point to human activities as the major cause of this problem, although they acknowledge that natural factors could be an additional cause of it.

Climate change mitigation

This concept is one of the strategies that were widely accepted by governments to address the challenge of climate change. The United Nations Environment Programme (UNEP) defines the term climate change mitigation as follows:

> Climate Change Mitigation refers to efforts to reduce or prevent emission of greenhouse gases. Mitigation can mean using new technologies and renewable energies, making older equipment more energy efficient, or changing management practices or consumer behaviour. It can be as complex as a plan for a new city, or as simple as improvements to a cook stove design. Efforts underway around the world range from high-tech subway systems to bicycling paths and walkways. Protecting natural carbon sinks like forests and oceans, or creating new sinks through silviculture or green agriculture are also elements of mitigation (UNEP, 2016, p. 1).

Anderson (2012 p. 192) describes climate change mitigation as a strategy that involves mechanisms to deal with the main cause of the climate change phenomenon, that is, greenhouse gas (GHG) concentrations. According to the author, mitigation would involve activities to reduce or cut on emissions as well as ways to clean the atmosphere. Such mitigation activities may include afforestation and forest conservation, adoption of renewable energies and regulation of pollution from automobiles and other pollutants.

The IPCC defines mitigation as the actions of human beings to reduce the sources of greenhouse gases (IPCC, 2014). This means that individuals, organisations and governments have to engage in interventions that are focused on cutting emissions or regulating emitting processes and activities.

The most elaborate definition of climate change mitigation has been given by Nicholas Stern in his book, *The Economics of Climate Change: The Stern Review 2008*. According to him, climate change mitigation involves policy responses such as carbon pricing (through taxes, trading and regulation), encouraging low carbon and high-efficiency technologies, and investment in research and development to drive innovation in the private sector. It also includes interventions such as education, persuasion and discussion that promote behavioural change in relation to climate change (Stern, 2008).

Climate change adaptation

Climate change adaptation is one of the recognised strategies for dealing with climate change globally. The IPCC explains climate change adaptation as "the process of adjustment to actual or expected climate and its effects" (IPCC, 2014 p. 5). For IPCC, adaptation is curbing or circumventing the effects that come with climate change. Therefore, interventions to help society cope with, adjust or become resilient to effects of climate change would constitute climate change adaptation.

Anderson describes climate change adaptation as a strategy to lessen human vulnerability to climate change. In other words, adaptation interventions should aim at helping those who are vulnerable to effects of climate change to prepare, adjust and cope with these impacts in their livelihoods (Anderson, 2012). This explanation describes the concept as a set of actions aimed at minimising the level of exposure to effects of climate change by natural ecosystems and human systems. These actions would support those who are affected to adjust their lifestyle, livelihoods and operations in the face of climate change and, therefore, become resilient to the impact of climate change.

Edgar et al. 2005 (cited in Drilling (2015, p. 471) defines adaptation as "adjustment in ecological, social or economic systems in response to observed or expected changes in climatic stimuli and their effects and impacts in order to alleviate adverse impacts of change or take advantage of new opportunities". This definition calls for interventions in all the three dimensions of sustainable development (that is, the economy, social conditions and environment), to enable societies cope with the adverse effects of climate change but also explore opportunities for human beings and nature. These adjustments might require

government efforts to supplement those of individuals, because little can be achieved at individual level.

According to Nicholas Stern, adaptation in the developed world would mean governments putting in place effective policies than can regulate actions of individuals and the corporate firms to offset the effects of climate change. Such a policy would cover issues of climate information, land use planning and performance standards, provision of climate-sensitive public infrastructural services and goods, as well as a support system for the poor people in their countries. On the other hand, adaptation in the developing world would mean fighting poverty to reduce vulnerability but also promoting economic and social development through effective development policy frameworks (Stern, 2008). This definition is quite comprehensive and points to what the developed and developing world need to do to address this problem.

Climate change education

Article 6 (a) (i) of the UNFCC 1992, provides for parties to the convention to "promote and facilitate the development and implementation of educational and public awareness programmes on climate change and its effects." Article 6 (a) (iv) provides that "parties shall promote and facilitate the training of scientific, technical and managerial personnel" to address climate change and its effects (UNFCC, 1992, p. 10). These provisions clearly show the importance of education in addressing climate change among nations that are party to that convention. This article led to the development of the concept "climate change education" and several writers started associating education with climate change.

Some scholars define this concept within the framework of Education for Sustainable Development. For example, Mochizuki defines climate change education as a "processes aimed at improving the degree to which an education system is prepared for, and is responsive to, the challenges of climate change" (Mochizuki, 2015, p. 5). This definition looks at climate change education as a process through which education can be used to deal with the problem. This implies that knowledge and skills can help people in mitigation and adaptation to climate change effects. This form of education could involve formal and informal activities to create climate change awareness and its related mitigation and adaptation approaches.

On the other hand, Anderson (2012) views climate change education as being focused on enhancing mitigation through promoting behavioural change among people, and guiding policy

makers to adjust economic and other social systems that encourage excessive production of Greenhouse gases (GHG). Through such education, people would be conscious in their consumption and production activities and they would address climate change and other sustainable development issues affecting them.

Climate change education for sustainable development

This concept has been explained by several authors and agencies focused on education for sustainable development initiatives and research. UNESCO described the term as:

> a programme that uses innovative educational approaches to help a broad audience (with particular focus on youth), understand, address, mitigate, and adapt to the impacts of climate change, encourage the changes in attitudes and behaviours needed to put our world on a more sustainable development path, and build a new generation of climate change-aware citizens (UNESCO, 2011, p. 4).

This definition is a more pragmatic one because it shows the target group focus and doesn't restrict itself to the formal academic interventions. Other scholars describe the concept as follows:

> Climate change education for sustainable development must be comprehensive and multidisciplinary; it must not only include relevant knowledge on climate change, environmental and social issues, disaster risk reduction and sustainable consumption and lifestyles, but it should also focus on the institutional environment in which that content is learned to ensure that schools and education systems themselves are climate proofed and resilient as well as sustainable and green (Anderson, 2012 p. 194).

This description of the term goes beyond educating people about climate change and looks at the vulnerability of the school or education system itself to the likely effects of climate change. The institutions that are engaged in climate change education should not only transmit knowledge, skills and attitudes but also practice climate change mitigation and adaptation themselves. This is very interesting since the education institutions would have to take the lead on issues of climate change.

On the other hand, Mochizuki (2015, p. 21) explains the term climate change education for sustainable development as follows:

> In principle, climate change education for sustainable development empowers people to assume responsibility for creating a sustainable future by highlighting the multiple opportunities which exist through our individual and collective choices to initiate change and create solutions for sustainable lifestyles. It fosters active citizenship and democratic participation by engaging learners with questions about how they relate to one another and to the ecosystems that support their lives.

This definition is quite exhaustive focusing on the outcomes that are expected out of climate change education for sustainable development. This implies that whatever the content, the end result should be empowerment of people as responsible citizens who can co-exist with ecosystems in a manner that would not compromise sustainable development ideals.

1.5 Scope of the study

The study set out to examine the opportunities and challenges of universities in Africa in addressing climate change issues in their programmes. The focus on universities was mainly due to their well-known role in addressing global challenges through teaching, a strong emphasis on applied research and deeper involvement of teachers and learners in fostering change in society (Filho, 2010b). The study focused on Makerere University and University of Dar es Salaam as comparative cases.

The choice of the two universities was important for three reasons. First, Makerere University and University of Dar es Salaam are among the oldest universities on the continent and are held in high esteem as role models for other universities to follow. Secondly, the case universities have centres promoting research on climate change and are engaged in supporting academic units to address climate change issues in their academic programmes. Thirdly, in Africa there hasn't been much done by universities to effectively engage learners on issues of climate change and it is expected that the findings of this study will widen the discussion on what these case universities and other African universities can do to effectively address this issue in their programmes.

The study was limited to examining the current academic, research and community programmes on climate change implemented by these universities, identifying key challenges faced and exploring opportunities that exist for the universities to adequately address climate changes in their programmes.

1.6 Outline of the thesis

This thesis is organised into seven chapters. Chapter One gives a brief background to the the study, the problem statement and rationale for the study. The chapter also presents the main and specific research objectives, the key questions that the study sought to answer, and its scope.

Chapter Two presents the conceptual and empirical perspectives on climate change education and the role of higher education institutions in the African context. The chapter examines the problem of climate change and what has been done to mitigate it globally. It further discusses the role of education in addressing climate change issues and its link with sustainable development and environmental education. It highlights the ways in which universities are dealing with the problem of climate change in their operations and programmes.

Chapter Three focuses on the theoretical foundations for the study, its theoretical and analytical framework. The chapter gives an overview of Albert Bandura's social learning theory, Liisa Rohweder and Anne Virtanen's model of learning for sustainable development as well as Ostrom's Institutional Analysis and Development (IAD) framework and their contribution to this study.

Chapter Four focuses on the research design and methodology used for this study. It highlights the research objectives and questions that were answered using the research design and methodology. The chapter also details the data collection process, the selection of respondents, and the methods and instruments used to collect and analyse data. Finally, it explains the quality assurance framework adopted to ensure ethically acceptable results.

Chapter Five presents findings based on thematic analysis of data collected from Makerere University. The findings are presented using the key variables in the Institutional Analysis and Development (IAD) framework; that is, the contextual analysis of the case, the state of climate change education at the university, and the key drivers and opportunities presented by the climate change programmes offered. The chapter provides background information about the university's role in climate change education programmes, how these interventions are implemented, and the broad climate change situation in Uganda. It further presents challenges that the institution faces in implementing these programmes and the ways in which these programmes can be improved.

Chapter Six presents findings for University of Dar es Salaam, the second case study. Like in the first case, the findings are based on thematic analysis of data collected using the IAD

framework. It provides background information about the university and the climate change situation in Tanzania. The chapter discusses the university's role in climate change education, the programmes it is implementing, the challenges faced and possible ways of overcoming them.

Lastly, Chapter Seven presents a cross case analysis that compares emerging themes across the cases. It includes a detailed discussion of the findings presented in Chapter Five and Six, conclusions and recommendations for policy makers, as well as the study limitations.

Chapter Summary

This chapter outlined the background to the study, the research problem and objectives as well as questions the study sought to answer. It defined key concepts as well as the scope and limitations of the study. The next chapter also reviewed the conceptual and empirical perspectives on climate change education and the role of African universities.

CHAPTER TWO; CONCEPTUAL AND EMPIRICAL PERSPECTIVES ON CLIMATE CHANGE EDUCATION AND THE ROLE OF UNIVERSITIES IN THE AFRICAN CONTEXT

Introduction

This chapter provides empirical findings, and methodological approaches of prior research related to the study from a critical point of view. Based on the purpose and objectives of the study, the chapter covers the climate change problem and current responses, as well as the role of education in addressing climate change issues. The chapter also covers climate change education and its linkage to education for sustainable development and environmental education, climate change education in the university context and climate change education at universities in the African context.

2.1 The problem of climate change and responses

Many scholars have written about climate change and its effects globally. According to Stern (2008, p.47), "an overwhelming body of scientific evidence indicates that the earth's climate is rapidly changing, predominantly as a result of increases in greenhouse gases caused by human activities." He notes that, "the rising levels of greenhouse gases will have a warming effect on the climate through increasing the amount of infrared radiation (heat energy) trapped by the atmosphere." The author characterises climate change with "greenhouse gas emissions whose costs are not paid by those who create the emissions."

Climate change remains the most inevitable and urgent challenge facing humanity with far reaching implications on the achievement of sustainable development globally (Hammil, 2009, p. 1117). The author contends that, "climate change impacts will tend to intensify the forces that for decades have constrained or obstructed progress towards sustainable development in many parts of the world" (ibid). Steffen (2011, p. 21) argues that compared to other environmental problems facing humanity, climate change is the only one that requires a "strong interdisciplinary knowledge base to tackle" from all disciplines in the natural sciences, social sciences, economics and humanities. This illustrates that the problem is a concern to every unit of society. The author notes that the climate change problem is complex with "multiple driving forces, strong feedback loops, long time lags and abrupt change behaviour." It is global, human driven, associated with the "long residence time of carbon dioxide in the atmosphere," rising average temperatures, rise in sea level and accelerating extinction of biological species (ibid).

Farmer and Cook (2013) attribute it to a lot of extreme changes in nature:

> Increasing unusual weather patterns reported by the news media nearly every day indicate climate change. More floods in parts of the world and more intense droughts in others indicate climate change. Fires raging in some areas and unusual snow falls in others indicate climate change. A season of intense tornados and more intense hurricanes indicates more energy in the atmosphere and that is climate change. As the Earth's global temperature increases, rates of evaporation also increase placing more water in the atmosphere. More evaporation dries out the land, soils, forests and takes more water from the ocean. All are signs of a changing climate. A warming earth is climate change and it is affecting everyday life throughout the globe (p. 3).

The authors describe climate change based on unusual and extreme events that happen all over the globe: floods, droughts, wild fires, tornados, hurricanes, rise in sea level rise and global warming. These extreme events accordingly are indicators of climate change.

In its report, the IPPC (2013, p. 5) warned that "the atmosphere and ocean have warmed, the amount of snow and ice have diminished, sea level has risen and the concentrations of greenhouse gases have increased." It observes that "the number of cold days and nights has decreased and the number of warm days and nights has increased on the global scale" (p. 5). These environmental changes directly affect people's livelihood, the functioning of society and the ecosystem. Warm days and nights negatively affects economic activities, agricultural production, housing and health.

Calzadilla, Zhu, Rehdanz, Tol, and Ringler (2013) have observed that climate change greatly affects agricultural productivity especially in regions such as Sub-Sahara Africa where they depend on rain-fed agriculture. The World Bank report of 2008, cited by Calzadilla et al. (2013, p. 151), identified three factors through which climate change affects agricultural productivity. These include changes in temperature and precipitation, which determine fresh water and soil moisture and thus affect crop production. Other factors are increased climate variability and drought, which influence rainfall patterns and water availability for irrigation; as well as changes in surface water runoff that may lead to floods. These factors are very detrimental to the agricultural sector, which is the backbone of Sub-Saharan African economies.

Morad and Harry (2013) reiterated the potential for climate change to exacerbate existing global crises:

> Climate change is potentially the biggest challenge facing humanity in this century, not so much because of global debt, energy security, food shortages, and ecological degradation are less important, but because climate change is inextricably linked with these phenomena and has the potential to exacerbate existing crises. Climate change is affecting the poor hardest, as they tend to reside in more vulnerable areas with inadequate technical or financial resources to deal with the consequences (p. 359).

This situation is true especially in the developing nations that are characterised by high poverty rates, increasing food insecurity, conflict, low levels of technology and adaptive capacity. The authors maintain that such nations are potentially vulnerable to climate change since they are unable to deal with the impacts of the phenomenon.

Other scholars such as Greschke and Tischler (2015, p. 22) explain the magnitude of climate change effects as follows:

> The anthropogenic component of many biochemical cycles (e.g water, nitrogen, phosphorus) is as large as or larger than all natural fluxes combined. Pools of many chemical substances (Carbon dioxide, methane, nitrous oxide) have at least doubled in the atmosphere, oceans and or terrestrial ecosystems since pre-industrial times, or will soon do so.

They cite the alarming extinction rate of species on the planet (100-1,000 times higher than natural), the increase in global mean temperature to at least 2° C and more, which illustrates how serious the problem is to the ecosystem and human livelihood on the globe.

Giugni et al. (2015, p. 38) acknowledge that human activities are responsible for the increase in greenhouse gasses in the atmosphere. Activities such as deforestation and burning of fossil fuel affect the atmosphere's ability to absorb heat. The authors warn that, "if current trends in emissions persist, the amount of carbon dioxide in the atmosphere will have doubled by approximately the year 2050 (from the pre-industrial value of 280 ppm, to about 560 ppm)." These effects have serious negative consequences on human health, social life, political stability, livelihoods and economic development of countries and their populations (Tosam & Mbih, 2014). The authors argue that "increased temperatures, rising sea levels, increased air pollution, the spread of infectious diseases, increased food insecurity and water-borne diseases" are potential effects that result from global climate change. They note that global warming has greatly affected human health, intensified poverty especially in developing nations, led to

increased dependence, and endangered the health of the physical and ecological environment, thereby leading to underdevelopment in many countries.

In his book, *The Economics of Climate Change*, Stern (2008, p.65) illustrates the various ways in which climate change will affect the people around the world. Its severe impacts include melting glaciers, increasing floods during wet season, declining crop yields leading to food insecurity, ocean acidification with effects on marine ecosystems and fish stocks, rising sea levels leading to serious flooding along coastal areas, increase in death toll from "malnutrition and heat stress, and displacement due to rising sea levels, heavier floods and more intense droughts."

Maharjan and Joshi (2013, p. 26) illustrate the impact of climate change on agriculture and rural livelihoods specifically in developing countries. They cite serious effects on soil characteristics, crop yields and productivity; change in rainfall pattern leading to floods and soil erosion; increased temperatures that lead to low organic carbon which affects seed formation, crop yields and grain quality; and sea level rise that creates high storm surges, thus destroying coastal eustatic peat swamps and creating salt water lagoons. The authors also point to the possibility of pest infestations that would harm the plant physiological process. They expect climate change to lead to new crop and livestock pests and diseases that will significantly affect the agricultural sector. The effects on livestock are illustrated in terms of low pasture quality, insect infestations as well as negative effects on animal physiology and therefore poor animal products.

Hanna (2011, p. 218), on the other hand, depicted several "direct and indirect effects of climate change on human health." According to the author, the direct health effects include effects of food and water shortages; water and food-borne diseases; vector-borne and rodent-borne diseases; mental and nutritional infections; air pollution-related health effects; temperature-related illnesses and death; and extreme weather-related health effects (Ibid). The indirect health effects include effects on agro-ecosystems, hydrology, microbial contamination pathways, vector disease transmission, socio-economic and demographic changes, and infrastructure damage. All these illustrate how climate change adversely affects human health. The author concludes as follows:

> The burden of ill health attributable to climate change is likely to aggravate, and in some cases even provoke, further economic decay, social fragmentation and political

> destabilization, especially in (but by no means restricted to) the developing world and countries with unstable governments. In the face of little progress on mitigation strategies, it becomes increasingly imperative that focus is given to adaptation strategies on preparing for health issues to come, and growing capacity to protect health, and provide safe environments, food, water and shelter (p. 229).

Other scholars have discussed the effects of climate change on health as well. Tosam and Mbih (2014) note:

> Climate change destroys the people's source of food, medication, shelter and income, leading to poor nutrition and exposure to infectious diseases, more hospitalization and less working hours, and heavy financial losses. The impact of all these on African countries, which already have fragile socio-economic structures is grave (p. 789).

The authors illustrate its disastrous effects on almost all aspects of life because food, shelter and health care are basic needs that one cannot live without. Failure to feed well leads to sicknesses, which affect productivity and income levels. This makes the situation worse especially in developing nations where resources are scarce and adaptive capacity is less. Duenas and Ochoa (2016) cite six ways in which climate change greatly affects human health: changing patterns of diseases and mortality; causing food insecurity; creating water and sanitation related problems; shelter and human settlement bottlenecks; extreme weather events; and population demographics and migration patterns. Climate change affects these health related variables especially poor people's ability to adapt to effects of climate change.

Moreover, climate change does not only affect people's health; it affects their security as well. According to Busby, Smith, White, and Strange (2012, p. 464) it leads to society's increasing vulnerability to hazards where large numbers of people are "at risk of mass deaths and suffering such that local emergency rescue personnel cannot cope." Therefore, in such situations, governments have no choice but to seek domestic and foreign military support. They argue that, "in some cases such crises will make internal conflict more likely and contribute to other potential security outcomes of interest, including internal and international migrations" (ibid).

Climate change effects people's culture as well. Figueroa (2011, p. 231), for instance, explores its effects on indigenous people and culture and how it poses a threat to their "environmental identity and environmental heritage." This is because climate change threatens "physical resources that shape their living ecology and the threats to the values, beliefs, behaviours,

histories and languages." The author concludes that, "the moral magnitude of cultural loss to be faced by the most vulnerable indigenous communities is kin to the loss of cultural opportunity, knowledge and legacy available to humanity" (p. 243).

The response to climate change

Since the UNFCC was held in 1992, countries, agencies, organisations and household units have been debating how to respond to the problem of climate change. The convention brought the climate change issues to the limelight, provoked discussion and called for action. Christoff and Eckersley (2013, p. 431) note, however, that there has been no "concerted or effective collective state response to the threat of global warming" since UNFCC in 1992. Several states committed themselves in the UNFCC to respond to climate change, but only a handful of these have "risen to the climate change challenge." They also mention that a few developed nations have taken the lead in combating climate change.

The most recent commitments by global leaders of governments and states were made in 2015 in Paris France in what is popularly known as the Paris Agreement 2015. This agreement has been ratified by 157 out of 195 signatories to the UNFCC. The parties to the Paris agreement committed themselves to the following:

a) Hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognising that this would significantly reduce the risks and impacts of climate change.
b) Increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production.
c) Make finance flows consistent with a pathway towards low greenhouse gas emissions and climate resilient development (UN, 2015, p. 3).

If these commitments are honoured, countries would implement mitigation and adaptation efforts and make the world a better place to be.

The challenge of climate change has been responded to using majorly two strategies: mitigation and adaptation. Morad and Harry (2013, p. 360) indicated that "both mitigation and adaptation aim at reducing the risks of negative climate change impacts, but while mitigation focuses on

reducing the climate change effects, adaptation aims at reducing vulnerability to these effects." Mitigation is a strategy that focuses on reducing emissions to the atmosphere thereby tackling the major cause of climate change. In almost all discussions, authors prescribe activities and policies that actors at different levels need to adopt to reduce emissions of carbon dioxide to the atmosphere.

For Stern (2008, p.349), mitigation involves policy responses such as carbon pricing (through taxes, trading and regulation), encouraging low carbon and high-efficiency technologies, investment in research and development to drive innovation in the private sector, and interventions that promote behavioural change in society. Based on economic principles of dealing with externalities, the author prescribed policy responses such as introducing a tax for the emitters to pay (what he called carbon price), quantity restrictions using a "a command and control approach" that would limit the volume of emissions, a "full set of property rights allowed among those who emit and or those who suffer the effects of emission" leading to bargaining or trading, and creating a single entity to enforce the restrictions and compensations for those affected (p. 353).

In addition, Anderson (2012 p. 192) noted that climate change mitigation is one that "focuses on interventions to reduce greenhouse gas (GHG) concentrations through measures that cut GHG emissions or move carbon out of the atmosphere, which can range from investment in cleaner energies to forest conservation." This supports the thinking that for the problem to be dealt with, there is need to deal with the cause of carbon dioxide emissions to the atmosphere. The author believes that this action will require cutting greenhouse gas emissions to the atmosphere or reducing the gases that are already in the atmosphere (p. 192).

Kolstad et al. (2014, p. 205) proposes policy changes to enforce mitigation measures:

> A broad range of policy instruments for climate change mitigation is available to policy makers. These include economic incentives, such as taxes, tradable allowances, and subsidies; direct regulatory approaches, such as technology or performance standards; information programmes; government provision, of technologies or products; and voluntary actions (p. 205).

The taxes on emissions and permit trading, according to the authors, could reduce the volume of emissions since it would add a cost to their production. This would reduce their profit

margin, while subsidies on low carbon technologies and products would encourage private actors to reduce the use of high carbon technologies.

Furthermore, regulations should limit emissions at acceptable levels based on acceptable technological standards and methods. On the other hand, information programmes should sensitise producers and consumers on sustainable choices. Voluntary action would entail agreements between governments and the private sector to "achieve environmental objectives and…improve environmental performance beyond compliance" (p. 207). The prescription by Kolstad et al. (2014) is not any different from those highlighted by the previous writers, because they all advocate cutting greenhouse gas emissions to the atmosphere which is the main cause of climate change. Mitigation in this sense is more of a government or state responsibility since it has to use its power to regulate and public resources to support the private sector to cut the emissions.

Many countries are indeed implementing legislation on climate change. Moore (2012, p. 45) argues that the driver of this development is the "belief that continued increases in GHG emissions from man-made sources…are contributing to increases in global temperatures that could have dramatic climate and subsequently environmental impacts." At international level, the Kyoto Protocol 1997 established binding "GHG emission reduction targets for 37 industrialized nations and European community." The United Nations Climate Change Conference in Copenhagen 2009 (which resulted into the Copenhagen Accord) called for member states to "reduce emission levels, invest in cleaner energy technology, and implement advanced adaption programmes in light of the effects of climate change" (p. 54).

These two legislations have influenced domestic policies and efforts within member countries to mitigate climate change. There have been various regional and national programmes implemented to reduce GHG emissions, notably the European Union's Emission Trading Scheme, the North East Regional Greenhouse Gas Initiative, the Western Climate Initiative and the Mid-Western Regional Greenhouse Gas Reduction Accord. There are also many country specific programmes in States such as California, Florida, Australia, New Zealand, China, India, Brazil, Indonesia, South America and Canada that focus on reducing greenhouse gas emissions (p. 64). In their summary for policy makers in the climate change synthesis report 2014, IPCC reported:

> Mitigation options are available in every major sector. Mitigation can be more cost effective if using an integrated approach that combines measures to reduce energy use and green-house gas intensity of end-use sectors, decarbonize energy supply, reduce net emissions and enhance carbon sinks in land based sectors (IPCC, 2014, p. 28).

The authors highlighted sectors like transport, electricity generation and use, industry, construction and buildings, as well as agriculture and forestry, as critical in mitigation effort. In all these sectors, mitigation options can be explored to reduce emissions to the lowest levels possible (p. 29).

Climate change adaptation as a strategy has also been a subject of scholarly debate. For instance, Orlove (2009, p. 131) notes:

> Adaptation is a familiar word in the conversations of people who are concerned with climate change. They use it to describe the processes of adjusting to climate change and its impacts. It describes the actions that must be taken to reduce or eliminate harm, actions whose necessity is unquestionable once the realization strikes that no mitigation plan will be able to bring global warming to a quick halt (p. 131).

In essence, the author implies that climate change adaptation is a good option when mitigation is less viable. There are situations when climate change and its effects cannot be mitigated, hence the only option is to adapt.

The IPCC defines adaptation as:

> Adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation and, autonomous and planned adaptation (Orlove, 2009, p. 135).

This implies that adaptation involves actions towards reducing the effects or impacts of the phenomenon in situations where the same cannot be mitigated. There are various adaptation measures that developing and developed nations can use to deal with the problem of climate change. According to Stern (2008, p.486), adaptation in the developed world would mean governments providing a "clear policy framework to guide the activities of individuals and firms to offset the effects of climate change." Such a policy would cover issues of climate

information, land use planning and performance standards, provision of climate-sensitive public goods and a financial safety net for the poorest in society. For the developing world, adaptation would mean fighting poverty to reduce vulnerability but also promoting economic and social development through effective development policy frameworks (p. 486).

Scholars have documented the status of climate change adaptation in some countries. Ford et al. (2015) did a systematic review of 100 peer reviewed journal articles, 161 grey literature documents and 27 policy documents to extract evidence of adaptation initiatives in 47 vulnerable nations in Asia and Africa. Based on the review, authors noted:

> Adaptations are primarily being reported from Africa and low-income countries, particularly those nations receiving adaptation funds; involve a combination of ground work and more concrete adaptations to reduce vulnerability and are primarily done by national governments, NGOs and international institutions, with minimal involvement of lower levels of government or collaborations across nations (p. 801).

The authors also noted that, "there is limited evidence of adaptation initiatives being targeted at vulnerable populations including socio-economically disadvantaged populations, children, indigenous peoples and the elderly" (p. 801). The authors concluded that, "for a number of nations highly vulnerable to climate change, there is little evidence of substantive adaptation taking place" (p. 812).

The debate on climate change adaptation has been widened to cover several other issues and aspects relating to governance, technology and innovations, the role of local institutions in adaptation, vulnerability assessments and their role in adaptation, urbanisation and adaptation as well as related issues that need to be taken into consideration in designing and implementing adaptation interventions.

Regarding governance and adaptation to climate change, Finan and Nelson (2009) analysed the link between decentralisation and climate adaptation using the case study of Ceara in Brazil. They were particularly interested in how decentralised planning supports climate adaptation at local level. They conclude that, "adaptation is a complex process that is intricately related to many non-climate factors." Therefore, they agreed with IPCC on the notion that climate adaptation critically needs "local management of resources and local participation in the adaptation process." The authors emphasised the need to promote active and participatory

adaptation ensuring transparency in planning and accountability in order to increase adaptive capacity of local communities (p. 347).

Adaptive governance can only be achieved when certain conditions are in place. Nicholson-Cole and O'Riordan (2009) presented eight key conditions for achieving adaptive coastal governance: a common vision and goals, strategy and creativity, policy and political will, financial support and deliverability, coordination between stakeholders, social justice, issue salience and strong science. They also argue for "a partnership model of governance combining public, private and civil society into new coordinating arrangements which will help to address the tensions between national strategic frameworks, and local flexibility for delivery" of adaptation interventions (p. 380).

Agrawal and Perrin (2009, p. 350) analysed the relationship between local institutions, climate change adaptation and the livelihoods of the poor people in rural areas. They argued that, "if adaptation is local, attention to local institutions is critical in the design of adaptation projects and policies." Therefore, effective adaptation will take place when local institutions and their practices are integrated in such interventions. They concluded that, "without greater attention to local institutions and their role in adaptation efforts of different kinds, and the ways in which local and external institutions can be articulated in the context of adaptation, it is unlikely that adaptation interventions and investments will achieve much success" (p. 366).

However, Inderberg and Eikeland (2009) warned about the institutional constraints that could limit adaptation if "regulations, norms, values and cognitive scopes" of these institutions and their impacts are neglected in the intervention. They argue that, "even with technological, financial and human resources in place, institutional factors may still hinder their wise deployment and use in climate change adaptation." They call for an effective adaptation strategy that should carefully take into account the norms and values of institutions in order to either "measure them for legitimacy purposes or enact processes of institutional change" especially when these become barriers to adaptation (p. 445).

Culture and indigenous knowledge have a key role to play in climate change adaptation especially in developing countries. Leornard and Parsons (2013) analysed the role of Traditional Ecological Knowledge (TEK) in shaping individual and community responses to climatic and ecological changes in the East Kimberly region of North West Australia. They

concluded that TEK can play a role in adaptation and therefore there is a need "for more and deeper partnerships between TEK and western science" in implementing adaptation interventions. They observed that "mutually beneficial projects" could be developed to "address land and water management problems, strengthen the ability of indigenous groups to conserve areas of cultural and ecological importance, engage in monitoring of the environmental changes…and maintain… livelihood options for communities" (p. 197).

Climate change adaptation cannot be implemented in isolation of other development programmes. The magnitude of climate change effects on several sectors of the economy requires an integrated approach in adaptation. Chevallier (2010) examined the interface between climate change adaptation and socio-economic development in the Southern Africa. The author analysed the region's vulnerability to climate change and its adaptive capacity given the developmental challenges and the experiences of OECD and EU countries, specifically the best practices that Southern Africa could adopt in its development policy or strategies:

> Climate change negatively affects a broad range of sectors and cannot be treated as a stand-alone challenge. Decisions made at all levels, on a comprehensive range of issues, need to be integrated into development policy. …. Africa's development partners also need to incorporate adaptation into their existing socio-economic development strategies (p. 191).

According to the author, African countries need to refer to the environment and development cooperation agencies of the OECD and EU for best practices as well as expertise in integrating adaptation strategies into development policy (p. 198).

Like any other intervention, implementing adaptation interventions cannot be successful without challenges. Crick, Wandel, Maclellan, and Vincent (2013) analysed three case studies in South Africa, Canada and the Pacific Islands to illustrate their similarities in barriers and opportunities for successful adaptation in these varying contexts. Across all the cases, they identified the following challenges to adaptation work:

(a) Limited access to financial, human and social capital which increases vulnerability and reduces opportunities for effective adaptation.
(b) Lack of gender analysis in many adaptation programmes as well as non-existent donor coordination.
(c) Increased pressure on social service systems and emergency assistance funds due to increase in vulnerable population and climate migrants (p. 243).

This implies that adaptive capacity in many poor communities is limited thus complicating the situation for the poor. Therefore, government agencies and other organisations engaged in adaptation work, ought to critically analyse social structures, boost their social service systems and increase access to financial, human and social capital for poor communities to adapt effectively to climate change effects.

2.2 The role of education in addressing climate change issues

Education has a key role to play in climate change mitigation and adaptation. Stevenson, Nicholls, and Whitehouse (2017) argue that, "mainstreaming climate change education throughout formal education systems can be one of the most effective means of developing capacities for addressing the climate crisis" (p. 67). Of course educational responses to climate change should be complementary to other responses by various actors.

Article 6 (a) (i), of the United Nations Framework Convention on Climate Change (UNFCC) 1992, urges parties to the convention to "promote and facilitate the development and implementation of educational and public awareness programmes on climate change and its effects." The same article 6 (a) (iv) provides that "parties shall promote and facilitate the training of scientific, technical and managerial personnel" to address climate change and its effects (UNFCC, 1992, p. 10).

In the Paris Agreement 2015, parties reaffirmed their commitment to "the importance of education, training, public awareness, public participation, public access to information and cooperation at all levels on the matters" (UN, 2015, p. 2). The same agreement provides for climate change education in a number of articles. Article 12 states:

> Parties shall cooperate in taking measures, as appropriate to enhance climate change education, training, public awareness, public participation and public access to information, recognizing the importance of these steps with respect to enhancing actions under this agreement (p. 16).

However, the education sector has not been fully explored to address climate change. Lotz-Sisitka (2010, p. 72) proposes that:

> climate change education should seek deeper understandings of mitigation and adaptation responses so that they are socially transformative but also

strengthen practice-centered social learning approaches for creativity and empowerment of learners beyond scientific facts about climate change.

As Fernandez, Thi, and Shaw (2014, p. 53) also observe, "education is a critical element in our response to climate change. Climate Change Education (CCE) can help us plan and implement adaptations with respect to current and future impacts of climate change". They challenge stakeholders to "reconsider existing approaches to education, especially the potential to provide learners with education and training that will help them to respond to diverse situations in a rapidly changing world."

Fernandez et al. (2014) analysed the status of Climate Change Education (CCE) in the Philippines and Vietnam and identified interesting insights that other countries could learn from. In the Philippines, CCE interventions have been integrated in both formal and non-formal education. The government passed the Climate Change Act (2009) into law that explicitly requires the Department of Education to integrate climate change principles and concepts into Primary and Secondary education curricula, subjects as well as other educational materials. At University or College level, some courses and programmes on certain aspects of disaster management were being offered in a few universities. This implies that university education has not been fully explored to address climate change issues in the country. The analysis also revealed that the National Economic Development Authority (NEDA) in the Philippines has been very instrumental in "developing training modules for cities, municipalities and provinces to develop, manage and administer climate change education programmes." The Climate Change Act 2009 requires that local governments have "a responsibility to take up a leadership role in educating citizens on climate change mitigation and adaptation" (Fernandez et al., 2014, p. 54).

This initiative is a good benchmark for many countries, especially in Africa, that have not explored the possibility of engaging local governments to take the lead in providing climate change education to their constituents. This analysis indicated that teacher training on climate change education in the Philippines was a one off activity with no follow up. It is, therefore, an area that could be explored fully to improve climate change education since teachers have a pivotal role to educate learners about climate change.

The analysis identified potentials of climate change education in Philippines exploring five mechanisms of support that would lead to successful CCE in the country. These include:

a) Strong leadership in pursuing school based CCE initiatives.

b) Creating adequate school support networks to mobilise resources and partnerships.

c) Effective partnerships between primary, secondary schools and tertiary institutions on climate change initiatives.

d) Exploring the potential of engaging new media such as social media.

e) Using a cross sectoral approach in promoting CCE.

These mechanisms can be useful to other countries in advancing CCE initiatives, especially those of Africa where this study has been carried out (See pp. 58-66).

In Vietnam, the Ministry of Education and Training (MOET) recognises the impact of climate change on the sector in terms of physical damage to infrastructure, economic loss, impact to human lives and health and on quality of learning. Various CCE initiatives have been put in place covering primary, secondary and tertiary levels with great successes registered. Climate change issues have been successfully integrated in the national curriculum and teaching content on climate change for schools developed. This illustrates success in addressing climate change issues through the education system. However, even with this success, a number of challenges still affect the CCE interventions in Vietnam including the CCE policy framework; strategy and plans are not based on research and a strong foundation; the "separate inclusion of issues on sustainable development, climate change, energy and disaster risk reduction into the national curricula" is a risk since it lacks flexibility; lack of effective mechanisms for implementation and sharing of responsibilities among actors, which hampers the success of CCE in the country (see p. 67).

Lemons (2011) did a theoretical review of the status of universities in addressing global climate change across disciplines and programmes and the results showed that many of the universities were not able to comprehensively address climate change issues across their disciplines. The reasons for this failure included limited importance attached to the subject, few students interested in such courses or programmes, academic freedoms in terms of research and therefore they chose what to focus on, focus on traditional courses that are marketable and lack of social responsibility by universities. The author identified an urgent need for universities to deal with climate change issues because they have a responsibility to educate people about important social issues (Lemons, 2011, p.386).

Anderson (2012) recommends that climate change education at various levels of education comprises two components:

> First is the relevant skills and content knowledge, including critical thinking, problem solving and collaboration around environmental education, climate change and scientific literacy, education for sustainable lifestyles and consumption; disaster risk reduction and preparedness; and green technical and vocational education and training. Secondly is the safe, climate resilient and sustainable learning spaces (p. 194).

The first component relates to the training and other learning activities that take place in the education institutions. This component focuses on the learning experiences with respect to the knowledge, skills and attitudes passed on to the learners to make them climate literate and to empower them to take action. The second component calls for institutional reforms to ensure that its management practices and infrastructure are climate friendly and sustainable. Anderson calls for provision of effective learning experiences on climate change as well as climate friendly institutional practices and environment.

Mochizuki (2015, p. 5) claimed that, "although the role of education in addressing the challenge of climate change is increasingly recognised, the education sector remains under-utilised as a strategic resource to mitigate and adapt to climate change." The authors looked at CCE as a "process aimed at improving the degree to which an education system is prepared for, and is responsive to, the challenges of climate change." This line of thinking subscribes to the fact that education is a process that can be used to address the challenge of climate change. This implies that knowledge and skills on climate change issues can be helpful in mitigation and adaptation. Climate change education could be through formal and informal activities focused on climate change awareness and its related mitigation and adaptation approaches.

2.3 Climate change education and its linkage to Education for Sustainable Development (ESD) and Environmental Education (EE)

Climate change education is linked to education for sustainable development and environmental education. This linkage is illustrated below:

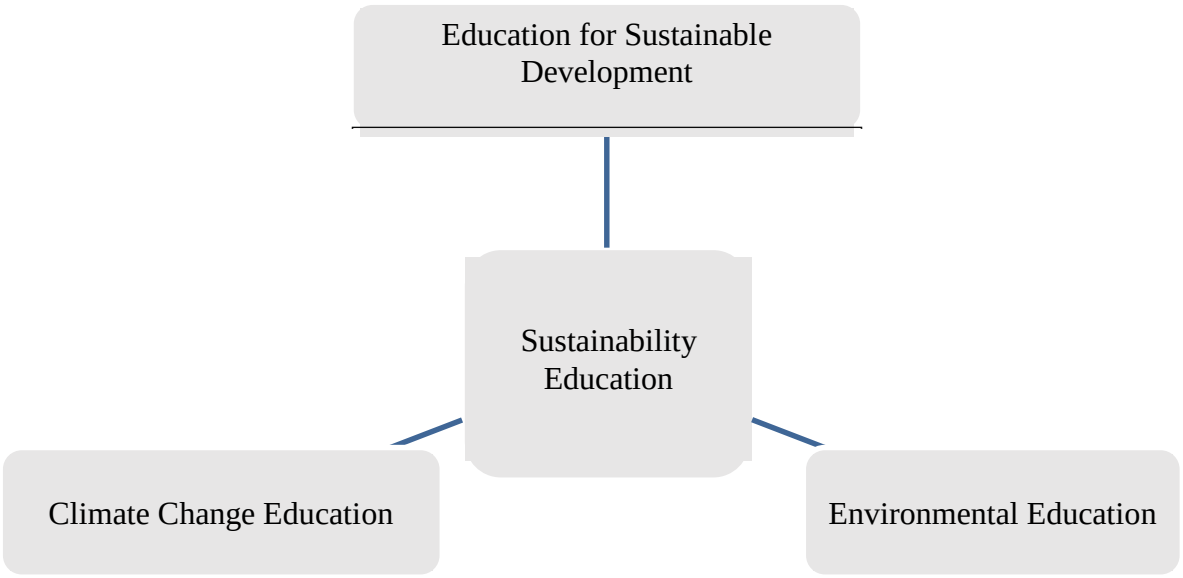

Figure 2.1. The linkage between climate change education, education for sustainable development and environmental education.

In the figure above, climate change education, education for sustainable development and environmental education are all components of sustainability education. Environmental education preceded education for sustainable development and climate change education components as early as the 1970s. Environmental education strengthened natural science education, which was previously the source of knowledge, skills and attitudes necessary for understanding and influencing actions to conserve and live harmoniously with the natural environment as well as proper management of the eco-system.

Locke, Rosso, and Muntoyo (2013) acknowledge the weaknesses of natural science education in holistically addressing environmental issues mainly because such issues are not only addressed basing on scientific facts but also on socio-cultural values and perspectives. In their view, natural science education missed out on social values and perspectives and concentrated on scientific facts, making it less effective in addressing environmental issues. The authors called for the integration of the human dimension of the environment into natural science education to enable the learners get a holistic and balanced perspective of human interactions in the eco-system and scientific facts about their natural environment.

The Tbilisi Intergovernmental Conference on Environmental Education (1977) defined environmental education as:

> The process aimed at developing a world population that is aware and concerned about the total environment and its associated problems, and has the attitudes, motivations,

> knowledge, commitment and skills to work individually towards solutions of current problems and the prevention of new ones (UNESCO-UNEP, 1978, p. 12).

The declaration identified a number of goals to be achieved in this kind of education: fostering awareness of and concern about economic, social, political and ecological interdependence in urban and rural areas; providing every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment; and creating new patterns of behaviour towards the environment (UNESCO-UNEP, 1978, p. 13).

The UN declaration of 2005-2014 made a shift from EE to ESD to promote sustainable development at all levels of education in the member countries. Barth (2015) argues that although some scholars advocate for replacing environmental education with education for sustainable development, the two concepts are complimentary. According to him, both approaches aim at addressing similar concerns and "share a vision of a better world in which the wellbeing of the environment and society is balanced and catered for" (p. 26).

In chapter 36 of Agenda 21, ESD focuses on promoting and improving the quality of education, re-orienting the existing curriculum towards one that has adequate and "relevant knowledge, thought patterns and values needed to build a sustainable world." It also focuses on raising awareness on the concept of sustainable development in order to develop "enlightened, active and responsible citizenship at all levels" as well as training the workforce to adopt sustainable modes of production and consumption (UNESCO, 2009).

Filho and Pace (2016) described ESD as:

> The process of equipping students with the knowledge and understanding, skills and attributes needed to work and live in a way that safeguards their environment and economic wellbeing, both in the present and for future generations (p. 2).

The authors thus look at ESD as a process that promotes the kind of knowledge, skills and attitudes that enhance sustainability. They call for contextualising learning and encouraging reflection on one's lifestyle and actions, as well as balancing economic, social and environmental activities for the welfare of the current and future generations. It is the kind of education that should promote social justice, ethics and a cordial relationship between society and ecosystems (ibid).

One of the key aspects of ESD is the need to address climate change issues through education. This is termed as "climate change education for sustainable development." (UNESCO, 2010, p. 4) described climate change education for sustainable development as:

> A programme that uses innovative educational approaches to help a broad audience (with particular focus on youth), understand, address, mitigate, and adapt to the impacts of climate change, encourage the changes in attitudes and behaviours needed to put our world on a more sustainable development path, and build a new generation of climate change-aware citizens.

This explanation of the concept calls for innovative approaches and methodologies by educators to enable students to comprehend climate change, its causes and the available strategies to mitigate and adapt to the effects. The educators also need to provide an environment where students can effectively reflect on their practices, and adjust their consumption and production as well as lifestyles for sustainable wellbeing. The programme should, therefore, be a behavioural change-focused intervention for the learners.

Climate change education requires multidisciplinary approaches to promote climate change literacy. Educators need to explore ways of bringing different disciplines together to integrate climate change issues and review the institutional environment and practices for climate friendly and resilient surroundings (Anderson, 2012).

Mochizuki (2015, p. 21) argues that, "climate change education for sustainable development, empowers people to assume responsibility for creating a sustainable future by highlighting the multiple opportunities which exists through our individual and collective choices to initiate change and create solutions for sustainable lifestyles." This implies that education institutions have a responsibility to empower students through climate change education and training to assume responsibility for sustainable livelihoods but also to influence various sectors of society to ensure sustainable lifestyles.

Therefore, it is apparent that environmental education, education for sustainable development and climate change education are components of sustainability education. They complement each other and are focused on achieving the same goal.

2.4 Climate change education in the university context

University education has been, and continues to be, key in climate change mitigation and adaptation efforts across the globe. As its key functions, the university offers training, conducts

research and community outreach to society. Through these core functions, the university can significantly contribute to the climate change awareness campaign. Universities across the globe are playing their role in addressing climate change issues in their programmes.

Filho (2010a) conducted a global survey on climate change at universities to identify "the general level of awareness of and needs of university students about climate change in university programmes world wide" (p. 1). The survey found that one of the climate change education initiatives at universities at international level was the "European Climate Teach-In Day" organised by the Hamburg University of Applied Sciences as part of the International Climate Change Information Programme (IICIP) (p. 3). This annual event was organised to disseminate scientific information on climate change; raise awareness among students on issues related to climate change; provide an opportunity to introduce projects and initiatives on climate change undertaken by various schools and universities; and to discuss problems, barriers and opportunities related to climate change at all levels (p. 3).

The world survey also found that many climate change issues (including research) were somehow taken seriously in Europe and North America but not in Africa and Latin America. In Africa, the survey revealed that over half of the sample stated that there were no study programmes with topics on climate change. The other key findings was that across the globe, "emphasis on climate change in campus activities was very low" implying that even the universities that had some courses on climate change were not practicing climate friendly activities at campus (Filho, 2010a, p. 14). Even fewer university programmes that contained aspects of climate change were predominantly technical and natural sciences. Less content was covered in ecological, economic and social science related programmes. The researchers concluded that climate change education at universities should be deliberately integrated in all university activities.

In Australia, a study by Davis et al. (2012) in the universities of Tasmania, Wollongong, Murdoch, and South Wales, showed that these universities had strong climate change education programmes based on the distributed leadership methodology. The approach engaged community members in "peer-led professional learning, collaborative curriculum and pedagogical development and to facilitate wider institutional change" (p.98). The universities registered several outcomes including "transformation of climate change curriculum, professional development in interdisciplinary pedagogy, innovation in student-led activities, and participation in institutional decision making related to curriculum reform" (ibid).

2.5 Climate change education at universities in the African context

In Africa, however, few studies have been carried out on how universities are addressing issues of climate change in their programmes. Sanni et al. (2010) conducted a study on the Assessment of Impacts and Adaptations to Climate Change (AIACC) project at Obafemi Awolowo University, to "advance scientific understanding of climate change vulnerabilities and adaptation options for developing countries" (p. 23). They argue that the climate change education approach for universities, which was developed with the support of the AIACC project, is a capacity building model to enhance climate change education. The model involves training, mentoring and networking and is being adopted by other universities in West Africa. The findings of this study point to the fact that some West African universities are slowly getting on board to address climate change issues in their programmes.

Boateng and Boateng (2015) carried out another study on climate change education at the University of Ghana and University of Professional Studies. The study aimed at "examining the extent to which tertiary institutions cover issues related to climate change in their curriculum and to determine implications for such coverage on climate change awareness in the public domain" (p. 99). They reviewed curricula for the Colleges of Agriculture and the Faculties of Science at both universities. The findings showed that at University of Ghana, out of 1,478 courses in the two academic units, only 14 courses had aspects of climate change. For the University of Professional Studies (UPSA), out of 322 courses offered by the academic units studied, none of these had aspects of climate change (p. 102).

These findings support those of the world survey presented above, especially the fact that in many African countries, there are few or no courses and programmes on climate change; a serious gap that needs to be filled. The authors conclude that "due to the limited coverage of climate change issues in the curriculum of these institutions, graduates from such institutions may not be knowledgeable in climate change issues" (p. 99). This is a serious issue since climate change affects all aspects of life.

However, despite the minimal contribution of the continent to climate change issues, universities in Africa recognise the need to contribute to climate change mitigation and adaptation measures on the continent and globally. In his introduction to the South African Regional Universities Association (SARUA) leadership dialogue series 2010, Piyoshi (2010) wrote:

> Higher education institutions in Africa, while recognizing that Africa's contribution to the damage inflicted on the global climate regulatory system is less when compared to developed regions of the world, nevertheless have an important responsibility given the precarious position of Africa as one of the most vulnerable continents to climate change. This responsibility pivots around educating and preparing the present and future leaders and members of society, through scholarship and scientific research, with the ideas and imagination as well as the social, technical and managerial capabilities for creating the conditions for long-term sustainability (p. 3)

Piyosho's argument is that despite the minimal contribution, the continent is more vulnerable to the problem compared to other continents given its low adaptive capacity to the phenomenon. Therefore, African universities have a responsibility to shape knowledge, skills and attitudes through training and conducting scientific research on aspects of climate change and environmental sustainability.

Makungwa (2010, p. 72) urges African universities to review their colonial curriculum and "transform the higher education systems in the region in order to remain relevant and become competitive and responsive to the challenges and needs of the modern society." Coleen Vogel (2010, p. 119) agrees with the need to globally integrate climate change issues into curricula including developing specific postgraduate courses solely on climate change. Indeed, many universities in Australia offer Master's degree programmes on climate change and sustainability. Few universities on the African continent have started similar postgraduate programmes and these include a programme on disaster mitigation for sustainable livelihood at University of Cape Town, the climate systems analysis group at the University of Witwatersrand, and Water net training courses in Mozambique.

In addition, some countries in African have integrated aspects of climate change in curricula for various education levels. Boakye (2015, p. 7) carried out a study on the role played by Ghana's pre-tertiary education in addressing climate change. The author analysed the science curricula of Primary, Junior and Senior high school levels. The author argues that only the science curricula of Junior and Senior high school levels had aspects of climate change but noted that these aspects were poorly and inadequately taught.

However, a number of organisations and institutions have initiated training and capacity development programmes in various countries in order to empower researchers, policy makers

and practitioners on issues of climate change mitigation and adaptation in various sectors. Scheltinga and Geene (2011), for instance, documented the "experiences around the development, implementation and follow up of a two weeks training course" delivered by scientists from Wageninger UR in collaboration with African partners in Addis Ababa in 2009. The African partners included the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASERECA), the East African Regional Office of the International Union for the Conservation of Nature (IUCN-EARO), and the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). According to the authors the training was part of the LNV policy support programme whose aim is "to develop the capacities of scientists, policy makers and practitioners in East Africa to address the issue of climate change adaptation" (p. 114). The study does not provide evidence of how universities in Africa were engaged in addressing climate change issues in their programmes as well as challenges they face. Rather, it documents the experiences of the specific short-term training programme delivered on climate change adaptation in East Africa.

A number of universities on the continent have established climate change centres. O'Keeffe (2016) reported on universities in Ethiopia that established such centres and were engaged in research and other climate change mitigation and adaptation interventions. This is a good innovation, which other universities on the continent could emulate to push forward climate change education. Some African universities also have climate change courses in their disciplines (Filho, 2010a).

In some countries in Africa, however, climate change and environmental education are not included in national policies on education. Nwankwoala (2015) found that there is "a complete negligence of climate and environmental education in many countries' education systems including Nigeria" (p. 224). If national education policies do not provide for climate change education, it is unlikely that universities and other levels of education will provide this much needed education to learners and society at large.

With respect to research, low levels of funding affects research on climate change in these African countries. Mazvimazi (2010) admits that few universities on the continent are engaged in research on climate change and these are mostly from South Africa. According to the author, "other countries in southern Africa, have presented very few studies on climate change and they are not either featuring in online databases that capture peer reviewed papers on climate

change and water resources" (p. 93). Additionally, Akinbami and Akinbami (2017) reported that most of the research on climate change carried out in Nigerian universities focused on mitigation rather than adaptation. These authors do not evaluate more comprehensively the research situation in the selected case universities and the contextual realities on climate change.

Mazvimazi (2010, p. 94) contends that universities in Sub-Sahara Africa have low level of engagement with local communities due to the "uncertainty regarding the nature of impacts of climate change at specific locations" in the areas where universities are located. This undermines the role of universities in communities and the fight against the challenge. Sisitka (2010, p. 113) concluded that the complexity of the challenge requires:

> re-orientation of community engagement, from models of re-active responsiveness to existing community needs and interests, to more pro-active, preventative engagement with potential future risks and development of competences for adaptive management and risk prevention.

Thus Sisitka points to the fact that the universities' level of community engagement on climate change issues on the continent is not very effective and therefore needs to be strengthened.

2.6 The research gap

From the review of related literature above, we note that several scholars recognise that climate change is a serious challenge for all countries. Developing countries are more affected due to their low capacity to mitigate and adapt to effects of climate change. Education can play a great role in addressing climate change issues in university curricula. Higher education institutions should carry out research on climate change and reach out to communities with information on enhancing mitigation and adaptation. Literature also shows a clear link between climate change education and education for sustainable development as well as environmental education. A number of higher education institutions have indeed started integrating climate change issues into their academic programmes. However, very few universities on the African continent are engaged in research and community outreach activities on climate change.

However, all these studies do not comprehensively give empirical evidence on existing academic, research and community engagement programmes at African universities, specifically Makerere University in Uganda and University of Dar es salaam in Tanzania. They do not explore the key challenges that implementers of climate change education programmes

at the universities face in their work, nor do they clarify the key drivers or success factors for climate change education work at these universities. The authors cited above also do not give strategies that African universities can adopt to improve their climate change education work. This study, therefore, aimed at filling the knowledge gap regarding these issues, and the findings are expected to significantly contribute to existing literature on climate change education at universities in the African context.

Chapter summary

This chapter reviewed empirical evidence from various sources on issues under study. It explored the climate change problem and how individuals, organisations and governments are responding to it. It also surveyed literature on the role education can play in addressing this environmental challenge, especially in supporting mitigation and adaptation campaigns. The chapter showed the linkage between climate change education, education for sustainable development and environmental education.

The chapter has surveyed various scholarly works on climate change education in the African context and more specifically, the state of climate change education in African educational institutions. It cited in detail examples of climate change interventions in several universities in Africa and other parts of the world. The proceeding chapter will explain the theoretical framework that informed this study.

CHAPTER THREE; THEORETICAL FRAMEWORK FOR CLIMATE CHANGE EDUCATION AT UNIVERSITIES IN THE AFRICAN CONTEXT

Introduction

The theoretical framework for this study was mainly informed by Albert Bandura's social learning theory (1977), and supported by Liisa Rohweder and Anne Virtanen's model of learning for sustainable development (2009) and Elinor Ostrom's Institutional Analysis and Development (IAD) framework (2011). In this chapter, I discuss the three models in detail and how they relate to the study.

3.1 Social Learning Theory

This theory is attributed to the work of Albert Bandura in his book, *Social Learning Theory* (1977), which is based on behavioralist foundations. Originally, the theory was developed within the field of psychology focusing on individual behaviour and how situations shape it. Bandura argued that, "in the social learning system, new patterns of behaviour can be acquired through direct experience or by observing the behaviour of others" (Bandura, 1977, p. 3). According to him, "social learning is an individual learning process that is triggered through social contexts such as other people, social situations and institutions" (Siebenhuner & Heinrichs, 2010, p. 191). This kind of learning is based on observation, real life experience in the environment and copying the behaviour of others or actively reflecting on events that the individual attends (ibid).

The key premise of the theory is that one's behaviour is shaped by one's personality and the circumstances or "situation" around the individual (Richard, Crittenden, & Crittenden, 2013, p. 19). The theory is explained by the four step pattern where the individual observes a certain behaviour in the surrounding, attempts to "remember that behaviour", then reacts by "producing a behaviour", and "the environment delivers a consequence" (ibid).

Bandura believed that humans can "learn through observation without the need for imitation; learning could be either direct or indirect (vicarious) in that one could learn through observing other's behaviours and the consequences of those behaviours" (Gibson, 2004, p. 195). Siebenhuner and Heinrichs (2010, p. 191) also contends that:

> Bandura's model maintains that individuals copy or attempt to copy those kinds of behaviours that they observe to have positive consequences for the actors. In this process of imitation their learning depends on the given circumstances due to selective

perception, their motivation to learn, and their capacity to capture and memorize the elements of this behaviour.

Gavazzi (2011) argues that the theory focuses "attention on how learning takes placed through observation of other's behaviour and especially those behaviours that are perceived as being incentivised in some way" (p. 59). The author contends that rewards or punishments do shape behaviour of individuals because they behave according to the consequences the rewards or punishment will yield.

According to Barth (2015) the social learning theory is useful in understanding the learning process and the consequences derived from that process. In understanding the learning process, the approach posits that an individual's learning is dependent on social interaction and the individual behaviour is modelled on the behaviour observed within the social environment (p. 164). The other view relates to the consequences derived from the learning process. It explains the approach in terms of how groups and communities or even organisations "learn as a whole" through collaborations and reflections on what they experience as entities and hence move towards social change (ibid).

Social learning theory can be applied to situations that involve several people or those that involve problem solving in majorly adult learning. The theory is based on four propositions:

(a) Observational learning variables like attention, retention, behaviour production and motivation.

(b) Reciprocal determinism where the learner, learning and environment are determinants of each other.

(c) Self-regulation of behaviour where human behaviour is to a certain extent controlled by self-regulation.

(d) Self-efficacy or the belief that success can happen amidst challenges, depending on one's judgement (Gibson, 2004).

The theory fits in well with UNESCO's prescriptions of the nature of Education for Sustainable Development (ESD). According to UNESCO (2011) :

> Learning in ESD occurs in a wide variety of social contexts. It includes what happens in the formal education system but also into daily and professional life…. Community learning practices are more recently cited in sustainable development literature as

> learning opportunities arising out of social networking groups, but many other learning arenas are seldom recognised (p. 20).

Social learning theory, therefore, is an important framework for explaining various aspects of sustainable development especially those relating to education. The theory is useful in understanding how groups and communities or organisations deal with emerging complex phenomena such as climate change that involve many actors (Barth, 2015).

Within the context of climate change education, social learning theory offers a theoretical lens for organisational behaviour in the universities selected for this case study. The approach is suitable for this study because it goes beyond individual learning and behaviour to groups and entities.

Barth (2015) provides a framework for sustainability based on the social learning theory. This framework provides a lens through which social learning supports individuals, groups and entities to "contribute actively to a more sustainable future and deal with uncertainty and complex situations" like climate change (p. 168). The author identifies two dimensions of learning within the framework: the social dimension of learning and learning from single to triple-loop. The social dimension was particularly of interest because of its relevance to the study.

The social dimension of learning relates to three forms ranging from "individual learning in a group, to learning as a group, to learning as social change" (p. 165). According to the author, individual learning in a group refers to the process of learning by the individual "within social interaction" and therefore the individual learns through collaborating with others and building relationships. Learning as a group relates to the learning that organisations derive from social interactions as a whole. Learning as social change, on the other hand, is "a trigger to system-wide change processes" within the entire society (ibid). This kind of learning is key for sustainability education because it offers a theoretical lens to climate change mitigation and adaptation within organisations and how this triggers social change.

3.2 Liisa Rohweder and Anne Virtanen's model of learning for sustainable development

This model by Liisa Rohweder and Anne Virtanen was based on the ideas by UNESCO as well as the work of Tilbury and Cooke (2005) and Tilbury and Ross (2006). At the launch of the UN decade of Education for Sustainable Development (DESD), UNESCO argued that, "education for sustainable development should be interdisciplinary and holistic, value driven and locally relevant, and it should promote critical thinking and problem solving"(Virtanen,

2010, p. 233). Tilbury and Cooke (2005) cited in Virtanen (2010) proposed critical factors of learning for sustainable development which included envisioning a better future, systemic thinking, critical (reflective) thinking, participation in decision making as well as networks and partnerships for change.

The other set of critical factors in learning for sustainability were proposed by Tilbury and Ross (2006) cited in Virtanen (2010, p. 233) and these included future orientation, value clarification, critical thinking, participation in planning and learning, relevance and capacity building. According to Rohweder and Virtanen (2009) this model contains agreed upon critical factors of education for sustainable development divided into "context, mental and activity related aspects" (p. 35). These are Illustrated below (See Figure 3.1).

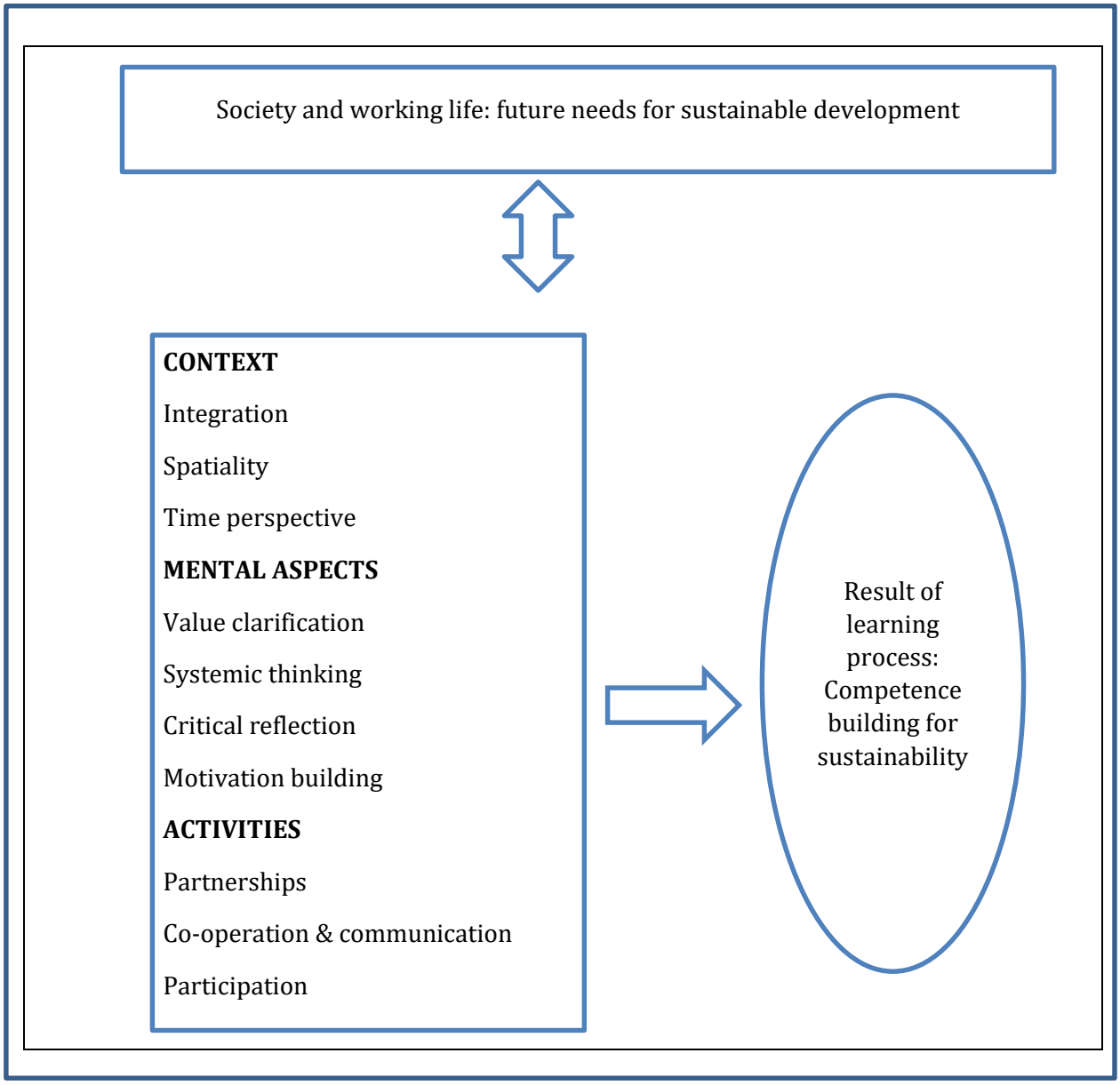

Figure 3.1. The model of learning for sustainable development. Adopted from Rohweder and Virtanen (2009)

The authors argued that, "the outcome of the learning process is competence building to promote activities for sustainability." Therefore, the main feature of this model of learning is that it enables interaction between universities and society (p. 35). First, the context-related factors in the model are the integrative approach, spatiality and time perspective. This integrative approach refers to the need for universities to mainstream issues of sustainable development into their curricula and courses across programmes and units within the university. The spatiality factor refers to the need to look "at sustainability issues from local to regional and global perspectives." Time perspective emphasises the importance of having "a clear vision of the sustainable future" and therefore work towards achieving it (Rohweder & Virtanen, 2009, p. 36).

The mental aspects of the model comprise "value clarification, systemic thinking, critical reflection and motivation building." The authors believe that values and attitudes are key in the process of sustainable development because they help to "explore the links between assumptions, biases, culture, decision making and actions" of individuals. They continue to argue that systemic thinking offers "a way to understand and manage complex processes as it emphasizes a holistic and integrative approach" to learning for sustainable development. Therefore, in their operations and programmes, universities need to base on "the principles of interconnectedness, holism and interdisciplinary, and cross-curricular approach" (Rohweder & Virtanen, 2009, p. 37).

Critical and reflective thinking refers to universities finding "new interpretation for activities, workplaces and the whole world" in order to "reconstruct our understanding of the world and its political, economic and social structure." This implies that universities need to engage learners and teachers in critical reflection "to question their pre-conceptions of issues and create a new or modified interpretation to understand and realise activities for sustainability" (p.37). Motivation as a critical mental factor refers to the need for universities to be inspired to search for knowledge and master skills (ibid).

The third category of critical factors include partnerships, cooperation, communication and participation. Partnerships refer to universities establishing collaborations among "educational communities, public organizations, Non-Governmental Organizations, local communities, entrepreneurs etc. for education for sustainable development programmes." The cooperation

and communication aspect means that universities should provide an education that responds to the needs of society and, therefore, develop skills for future needs (p. 38).

Participation as a critical factor implies that universities should involve students and all stakeholders in the learning process. They should build knowledge and skills and take responsibility for the sustainability of their activities. Competence building, on the other hand, implies that universities continuously develop capacity at different levels to foster sustainability (ibid).

According to the model, a combination of these critical factors represents the future needs for sustainable development and, if taken into consideration by the universities, they would translate into competences among learners.

3.3 Ostrom's Institutional Analysis and Development (IAD) Framework

The study adopted Elinor Ostrom's Institutional Analysis and Development (IAD) framework (2011) to analyse the case universities. The framework supported data collection and presentation of findings specifically analysing the context of the case universities, the state of climate change education, the key actors and their roles as well as patterns of interaction within climate change education interventions at the universities.

Elinor Ostrom developed the IAD framework for institutional analysis in 1991 and later modified it in 2005 and 2011. The author presented this framework as a "common set of variables that can be used to analyse all types of institutional arrangements" by analysts, policy makers and scholars (Ostrom, 1991, p. 13). According to Ostrom, the framework helps to diagnose and analyse any system and prescribe interventions (p.14). The author argued that when using the IAD framework the first step is "identification of a conceptual unit—called an action arena—that can be used to analyse, predict and explain behaviour within the institutional arrangements." According to her, "an action arena refers to the social space where individuals interact, exchange goods and services, solve problems, dominate one another, or fight (among the many things that individuals do in action arenas) each other." The author explains that the "*action arena*, include a model or models of *action situation* and a model or models of the *actors* in that situation." In other words, the action arena refers to "a complex unit containing one set of variable called an action situation and a second set of variable called an actor" (p.15).

The action situation contains several variables: a set of participants; the specific positions to be filled by participants; the state of the world which can be affected; a set of allowable actions and their linkage to outcomes; level of control each participant has over choice; the information

available to participants about the structure of the action situation; and the costs and benefits which serve as incentives and deterrents to actions and outcomes (Ostrom, 1991, p. 18). The actors, on the other hand, can be an individual or group. The analyst, according to Ostrom, makes "assumptions about what and how participants value, what resources and information they have, their information processing capabilities, and the internal mechanisms they use to decide upon strategies" (Ibid).

Based on the analysis of the action situation and actors in the action arena, the institutional analyst can predict results by "making inferences about results." The inferences could be weak or strong depending on the situation and model used. The analyst must take note of the rules in use within the institutions. The rules are "linguistic entities that refer to prescriptions about what actions (or states of the world) are required, prohibited or permitted" as a way to "achieve order and predictability" among actors (Ostrom, 1991, p. 19). Thus, in doing institutional analysis the analyst should understand the rules that actors are following in making decisions (ibid).

In her initial explanation of the IAD framework, Ostrom presented other variables affecting the action arena:

> Community attributes that affect the structure of an action arena may include; the norms of behavior generally accepted in the community, the level of common understanding potential participants share about the structure of particular types of action arenas, the extent of homogeneity in the preferences of those living in a community, and the distribution of resources among those affected (Ostrom (1991, p. 23).

The set of exogenous variables that affect the action arena in the initial version of the IAD framework was summarised by Imperial (1999) who argued that:

> The IAD framework suggests three basic categories of variables that influence the pattern of interactions among individuals and organizations in an action arena… These are the explicit and implicit assumptions about the rules used to order relationships between individuals or organizations, the underlying physical and biological setting that impose important constraints on the development of rules and, the influence of community attributes on inter-organizational relationships (p. 454).

Polski and Ostrom (1999, p. 6) explain that this framework helps analysts to "comprehend complex social situations and break them down into manageable sets of practical activities." They argue that, "the IAD framework is best viewed as a systematic method for organizing policy analysis activities that are compatible with a wide range of more specialized analytic techniques used in the physical and social sciences." They note that the framework "provides a means to synthesize the work of multiple participants, including those who are directly involved in the policy situation and have an interest in policy outcomes."

The authors presented a simplified way of applying the IAD framework in policy analysis and design, following 7 steps:

1. Define the policy analysis objectives and specify the analytical approach.
2. Analyse the physical and material conditions that influence the action situation and constrain the institutional arrangements like physical and human resources.
3. Analyse community attributes that affect the action situation like demographics, norms, beliefs, values, and preferences.
4. Analyse rules in use that explain policy related actions, interactions and outcomes.
5. Integrate the analysis of the action situation and actors in terms of participants, their positions, actions and their link to outcomes, the level of control over the action situation and possible outcomes in the action situation.
6. Analyse the patterns of interaction within the action arena.
7. Analyse the outcomes of the policy performance in terms of efficiency, welfare improvement, equity, accountability and sustainability (p. 28).

The 2005 version of the IAD framework

In 2005, Elinor Ostrom provided a detailed explanation of the IAD framework with some modifications. Initially her framework had the exogenous variables (physical/material conditions, attributes of the community and rules in use), the action arena (action situation and model of an individual), and the incentives that lead to patterns of interaction leading to outcomes. In her 2005 book, Ostrom modified the framework as illustrated below.

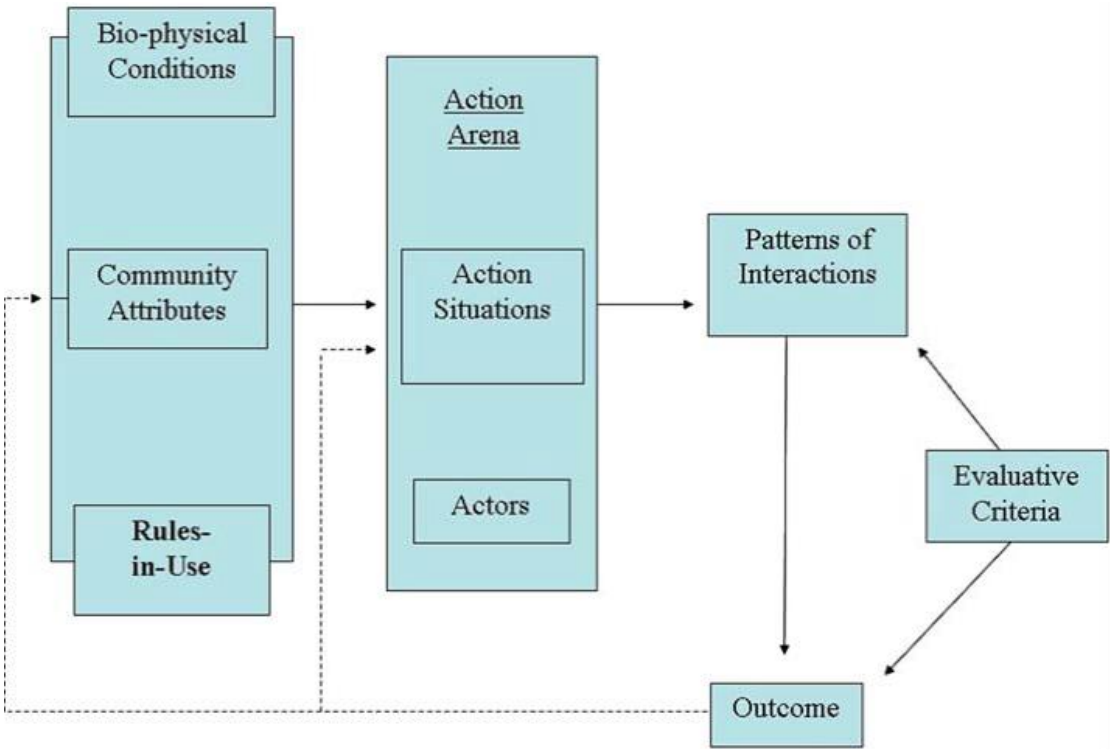

Figure 3.2. Ostrom's Institutional Analysis and Development (IAD) Framework. Source: Adapted from Ostrom (2005, p. 15)

According to Ostrom, the focal level of analysis in the framework is "the action arena in which participants and action situation interact as they are affected by exogenous variables and produce outcomes that in turn affect the participants and action situation" (Ostrom, 2005, p. 13). The author argues that, "the exogenous variables do affect the structure of an action arena, generating interactions that produce outcomes" while the evaluation criteria are used "to judge the performance of the system by examining the patterns of interactions and outcomes." However, she adds that, "the outcomes feed back into the participants and the situation and may transform both over time" (Ibid).

The exogenous variables

In explaining her modified framework, Ostrom suggests that the analyst needs to begin by focusing on "the exogenous variables that affect the action arena", then the action arena and then link the action arena to outcomes. The first part of the analysis necessitates inquiring into the exogenous variables "that affect the structure of an action arena." The factors in this category include the rules used by participants to order their relationships; the attributes of the biophysical world that are acted upon in these arenas; and the structure of the community within which any particular action arena is placed (Ostrom, 2005, p. 15).

The author maintains that rules in the context of IAD framework "are defined to be shared understandings by participants about enforced prescriptions concerning what actions (or outcomes) are required, prohibited or permitted" (Ostrom, 2005, p. 18). Institutional rules are often "self-consciously crafted by individuals to change the structure of repetitive situations that themselves face in an attempt to improve the outcomes that they achieve" (p. 18). The analyst, therefore, could explore deeper into "the working rules that individuals use in making decisions" because these are always used by participants to justify their actions to other participants (Ostrom, 2005, p. 19). Ostrom advises that the analyst will need "to classify rules according to their direct impact on the working of an action situation" (p. 22). Consequently, once the working rules are understood, the analyst should study the sources of these rules within the institution's legal framework, standard operating procedures, constitution, ethical codes and administrative guidelines. (p. 20).

Regarding other variables, the author suggests that the analyst should examine "the attributes of the biophysical and material conditions and their transformation" in terms of their effect on "the outcomes, action sets, action-outcome linkages and information sets in that situation" (Ostrom, 2005, p. 22). Attributes for analysis under this category include the resources used and their availability and adequacy, resource mobility, demographics as well as physical environmental aspects. However, Ostrom advises the analyst to tailor the analysis to particular situations (p. 26).

The last set of factors that affect the action arena relate to the community where it is located. Ostrom provides the following attributes to be considered when analysing this variable and they include:

(a) The values and acceptable behaviour in the community.

(b) The level of common understanding that potential participants share (or do not share) about the structure of particular types of action arenas.

(c) The extent of homogeneity in the preferences of those living in a community.

(d) The size and composition of the relevant community.

(e) The extent of inequality of basic assets owned by those affected (Ostrom, 2005, p. 27).

The analyst, therefore, will need to extensively examine these issues and how they affect the action arena within the institution being analysed.

The Action arena

The second part of the institutional analysis focuses on the action arena and its variables, that is, the action situation and actors. According to the author, the structure of the action arena includes the set of participants; positions to be filled by participants; the potential outcomes; a set of allowable actions and the function that maps actions into realised outcomes; the control that an individual has in regard to this function; information available to participants about actions and outcomes and their linkages; and the costs and benefits that motivate or deter actions and outcomes (Ostrom, 2005, p. 32). Ostrom illustrates the internal structure of the action arena as shown below:

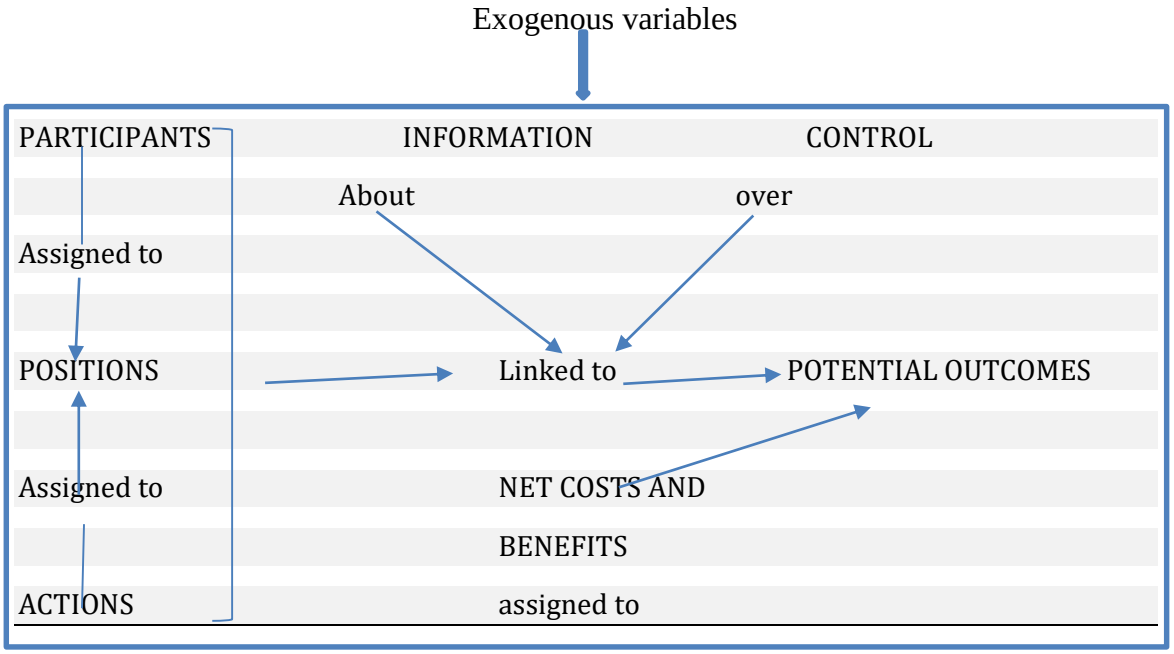

Figure 3.3 The internal structure of an action arena. Adapted from Ostrom (2005, p. 33)

Ostrom called the above parts the "givens of a situation" and hence the structure of the situation has to be assumed fixed if the analyst is to study the "likely human behaviour and outcomes within a particular structure" (p. 33). The analysis has to identify the number of participants, their potential actions that "represents the means that participants have to achieve particular outcomes in that situation" and the information participants need to access with respect to the situation. The analysis also has to focus on the costs and benefits that act as "incentives and deterrents in the situation" (Ostrom, 2005, p. 32).

Predicting outcomes and evaluation criteria

The last part of the analysis using the IAD framework is predicting and evaluating outcomes. In predicting outcomes, the analyst has to "make strong or weak inferences about results" depending on whether the action situation is "tightly constrained" or "less constrained." The author argues that, "under conditions of complete information among participants in selecting strategies that lead to stable equilibria, the analyst may make strong inferences and specific predictions about likely patterns of behavior and outcomes." Conversely, the analyst will make weak inferences in situations where participants are uncertain about the situation and therefore adopt expected strategies or "change their strategies over time as they learn about the results of past actions" (Ostrom, 2005, p. 64).

Ostrom provided a criterion that institutional analysts can use to evaluate "outcomes that are being achieved as well as the likely set of outcomes that can be achieved under alternative institutional arrangements." The criteria suggested includes:

(a) Economic efficiency to measure "the magnitude of change in the flow of benefits associated with an allocation of resources."

(b) Equity to assess the individuals' contribution, the benefits derived as well as their differential ability to pay.

(c) Accountability to measure the level of responsibility by officials or decision makers to their citizens or constituents.

(d) Adaptability, resilience and robustness of individuals within the action situation.

(e) Conformity to general morality and level of sensitivity to moral values within the institution.

(f) Sustainability to measure the ability of the institutional arrangement to respond to the ever-changing environment and the likely "trade-offs to achieve institutional performance" (Ostrom, 2005, p. 68).

The 2011 version of the IAD framework

In the 2011 version, Ostrom reviewed the structure of the framework in response to comments raised by several scholars who used the framework. Ostrom noted that the terms *action arena* and *action situation* had confused readers, who had not seen any difference between the two concepts as used in the framework. Therefore, the author modified the IAD framework as illustrated below:

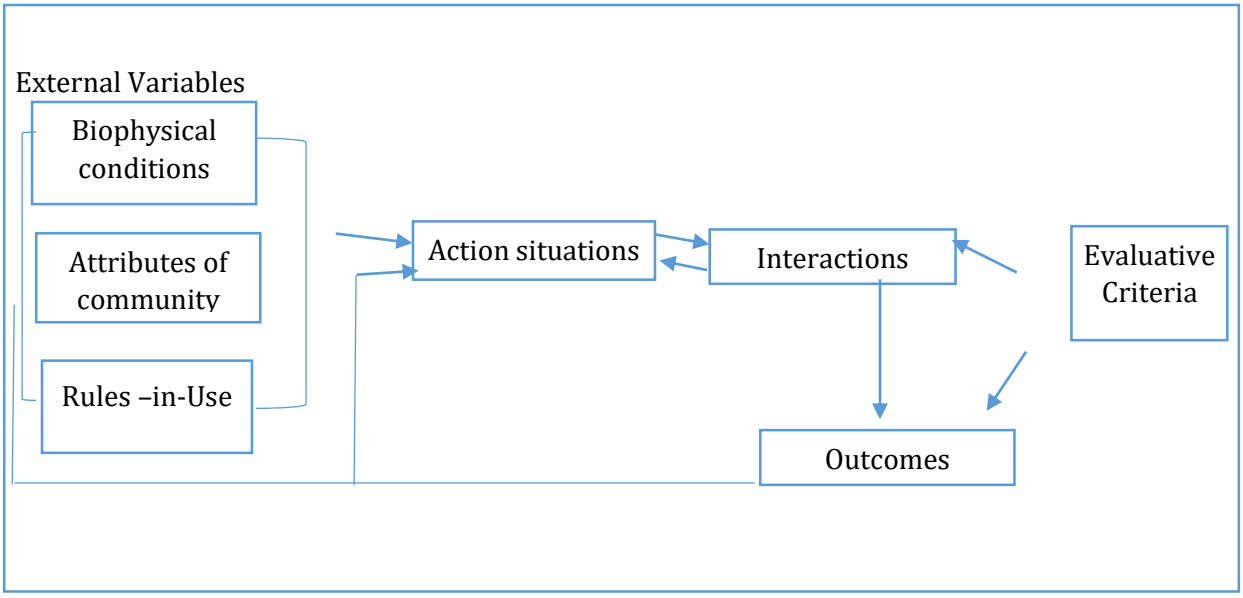

Figure 3.4. A Framework for Institutional Analysis: Adapted from (Ostrom, 2011, p. 10)

In this new version, Ostrom argues that the analyst has to first "identify a conceptual unit called an action situation" (rather than action arena in the previous version) "that can be utilized to describe, analyse, predict, and explain behaviour within institutional arrangements." According to her:

> the actor within an action situation (an individual or a firm) includes assumptions about; 1) the resources that actor brings to the situation, 2) the valuation actors assign to states of the world and to actions; 3) the way actors acquire, process, retain and use knowledge contingencies and information; and 4) the processes actors use for selection of particular courses of action. (Ostrom, 2011, p. 11).

Apart from this modification, the structure of the framework remained the same.

3.4 The contribution of the theory, model and framework to the study

The study combines a conceptual and theoretical framework that draws concepts and constructs from the Social Learning Theory (SLT), the model of learning for sustainable development and the Institutional Analysis and Development (IAD) frameworks. This combined framework is presented and explained below.

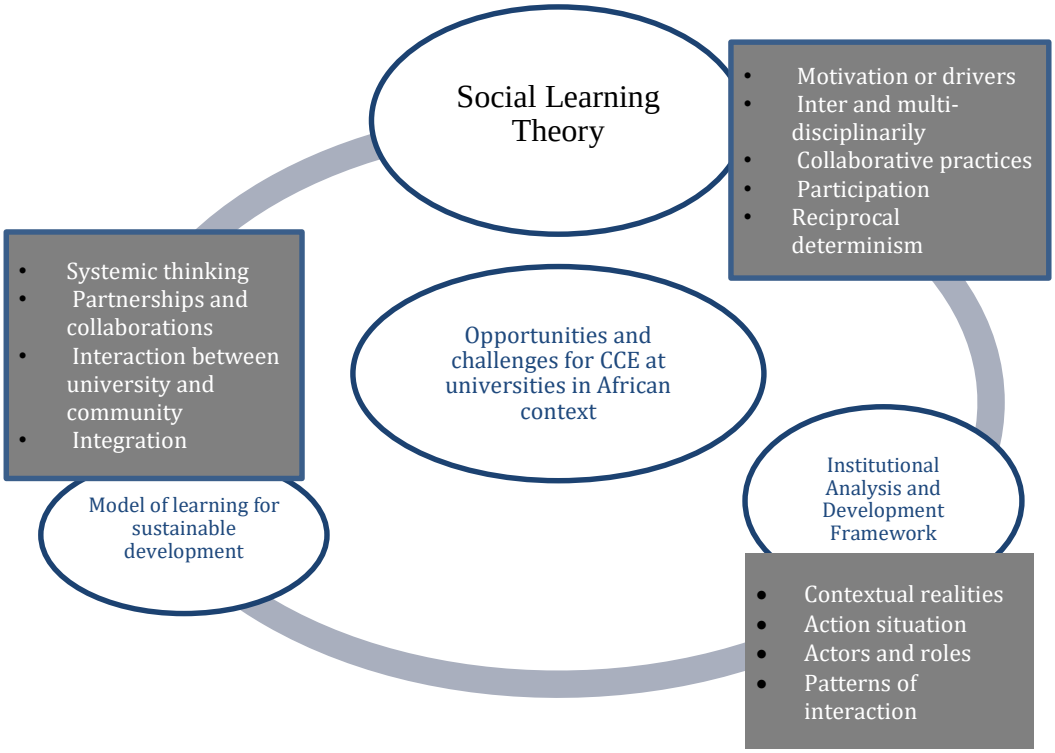

Fig. 3.5 Conceptual and theoretical framework on opportunities and challenges for climate change education at universities in the African context

The contribution of the social learning theory

The social learning theory, which was the main theory, was important for understanding climate change education interventions at the case universities. It explained the behaviour of actors within the case universities regarding climate change education as individuals and groups and how this knowledge moves from the individual to groups to entities and society as a whole. Understanding climate change education interventions, the challenges faced and opportunities available, required a theoretical framework that explains the behaviours of the actors and the social context they operate in. The theory enabled the researcher to understand the behaviour of the key actors in the context of climate change education at the case universities.

The theory explained the context in which case universities operate, and to determine the progress and implementation of climate change education interventions. The study analysed the context in terms of the institutional policies, the strategic and administrative structures, and

how they support climate change education interventions. It also helped in investigating the drivers of climate change education work at the case universities.

The study also appropriated other concepts from the theory such as inter-disciplinarity, multi-disciplinarity and collaborative practices. The concepts helped in investigating the level of integration of climate change issues in existing university programmes, and the ways in which different disciplines contribute to climate change education. The researcher also interrogated the existing partnerships for climate change education at the case universities and how various stakeholders are involved in them.

The contribution of the model of learning for sustainable development

The study employed the model of learning for sustainable development to investigate the various climate change education interventions and how they are integrated into academic units in the case universities. It also informed the analysis of the institutional support system for climate change education.

The researcher used the model to investigate various partnerships and collaborations, including community engagement programmes on climate change implemented by the universities. The model requires effective interaction between the university and the community in order to implement educational programmes for sustainable development.

The contribution of the IAD framework

The study used the Institutional Analysis and Development (IAD) framework to analyse the climate change situation in the respective countries, the country profiles and the organisational contexts for both universities. It deployed variables of this framework to analyse institutional actors, their roles, and how their interactions influence the implementation of climate change education interventions at the case universities. The model provided a better way of collecting relevant contextual information and understanding the interventions, the challenges, drivers and opportunities available for climate change education at the universities.

Chapter summary

This chapter discussed in detail the theoretical framework the study used to analyse climate change education initiatives at African universities. It outlined various models and frameworks used and how their key concepts apply to various themes in this research on climate change education. Chapter Four presents the research design and methodology used in the study.

CHAPTER FOUR: RESEARCH DESIGN AND METHODOLOGY

Introduction

As outlined in Chapter One, the study set out to examine the opportunities and challenges of climate change education at universities in the African context. In order to achieve this main research objective, the study posed the following questions: What are the current academic, research and community engagement programmes on climate change implemented by the case universities? What are the key challenges faced by the implementing units in carrying out academic, research and community engagement programmes on climate change within the case universities? What are the success factors that would support universities to adequately address climate change issues in their academic, research and community engagement programmes and what can be done to improve the situation? To answer these questions, the study adopted a case study research design guided by the interpretive philosophical perspective, which is elaborately discussed in this chapter. It also outlines the methodology used to select study participants, tools and techniques of data collection, and the procedures used to analyse data.

4.1 Research philosophy and approach

The research philosophy

The phenomena of climate change can be investigated from an educational and social science research perspective, which has been guided by several epistemological debates for several decades. This debate (also referred to as 'paradigm wars') stated in the 1960s especially with Thomas Kuhn's work. Bandyopadhyayi (2015, p. 129) defines a paradigm as "value judgements, norms, perspectives, standards, frames of references, theories, ideologies, and myths adopted by people that govern their actions and thinking." Neuman and Robson (2012, p. 41) define it as "an integrated set of assumptions, beliefs, models of doing good research, and techniques for gathering and analysing data."

The approaches used in social science research are positivism, Interpretivism and critical paradigms. According to Neuman and Robson (2012, p. 41) each of these approaches has "internal divisions, offshoots and extensions." Guba and Lincoln (2005, p. 193) describe positivism as an approach that uses experimental or deductive methodologies to arrive at objective truth. The ontological orientation of positivism assumes that there is only one objective truth and this reality is predictable. It can be controlled and the role of the researcher, therefore, is to look for this objective reality and provide explanation of how it works. The epistemological orientation assumes that reality is independent of the researcher. The researcher's values and views should not influence the study findings. The methodological

orientation, on the other hand, relates to the adoption of only those methods that ensure objectivity and the findings arising from their use can be generalised, verified and are value free.

According to Neuman and Robson (2012), positivism "assumes that social reality is made up of objective facts that value-free researchers can precisely measure and use statistics to test causal theories." According to them, this paradigm emphasises the ability to replicate or generalise an idea to a wider population (p. 42).

The Interpretivism paradigm, on the other hand, contrasts with the positivism epistemology, which is criticised for not being applicable to the study of the social world. Interpretivism hinges on the ontological view that reality is relative and subjective because people understand and interpret the social world differently (Iofrida, Luca, Strano, & Gulisano, 2016). This implies that there are multiple realities in the social world. Therefore, the researcher has to be actively involved and his or her values, viewpoints and subjective interpretation of the world will find their way into the findings of the study. According to Bryman (2008), Interpretivism calls for respecting the "the differences between people and the objects of the natural sciences and therefore requires the social scientists to grasp the subjective meaning of social action" (p. 16).

For Neuman and Robson (2012), the interpretive approach views "human social life as qualitatively different from other things studied by natural science." In their words, they argue that human social life "is based less on objective, hard, factual reality than on ideas, beliefs and perceptions that people hold about reality" (p. 43). They contend that based on this paradigm "social scientists will be able to understand social life only if they study how people go about constructing social reality" (p. 43). Peter and Medina (2013) argue that "the epistemology of this paradigm is inter-subjective knowledge construction" and, therefore, "interpretive knowledge of the other is produced through a prolonged process of interaction undertaken by ethnographers who immerse themselves within the culture they are studying" (p. 4). Social constructivism emerged out of this philosophical perspective.

The critical paradigm, on the other hand, focuses on empowering researchers to be "critical thinkers" that can address socio-political and economic injustices in societies they research on. According to Peter and Medina (2013), it "enables the researcher to identify and transform socially unjust social structures, policies, beliefs and practices"(p.6). The authors argue that this paradigm advances social justice in society:

> The primary purpose is to identify, contest and help resolve gross power imbalances in society which fuel ethically questionable profit making activities that contribute to systemic inequalities and injustices such as social exclusion of some sections of society, loss of cultural capital and cultural identity amongst ethnic minorities and anthropocentric climate change and loss of biodiversity (Peter & Medina, 2013, p. 6)

For Neuman and Robson (2012), "the key feature of the critical approach is a desire to put knowledge into action and a belief that research is not value-free" (p. 44). Therefore, it advances research that creates knowledge for political or moral struggles.

This study was informed by social constructivism from the interpretive research paradigm. Cresswell (2009, p. 8) notes that, "social constructivists hold the assumption that individuals seek understanding of the world in which they live and work." This view assumes that researchers construct meanings as they interact with phenomenon being interpreted; in other words, that they try to understand the world by developing "subjective meanings of their experiences—meanings directed towards certain objects or things." Creswell contends that because there are multiple interpretations, the researcher has to look for "the complexity of views rather than narrowing meanings into a few categories or ideas." Therefore, "the goal of research, then is to rely as much as possible on the participant views of the situation being studied" (p. 9).

Lincoln and Guba (1985), cited in Lodico, Spaulding, and Voegtle (2010, p. 14) agree that social constructivist inquiry is influenced by the researcher and the context in which the study is carried out. This implies that reality is constructed by the researcher through socialisation, which leads to multiple meanings depending on the participant's views and experiences of the phenomenon being studied.

Lodico et al. (2010, p. 14), however, believe that social constructivists also "challenge the scientific realist assumption that reality can be reduced to its component parts." Instead, they seek to understand the phenomena as "complex wholes that are inextricably bound up with the historical, socio-economic and cultural contexts in which they are embedded." In other words, the authors conclude that social constructivists link social realities to their specific contexts.

This study, therefore, found social constructivism an ideal approach in so far as the researcher sought to answer questions through interaction with various stakeholders in the case universities. This paradigm allowed the researcher to make meaning of the respondents'

perspectives and realities. The researcher analysed primary and secondary data in order to construct social reality in relation to the topic being investigated.

4.2 Research design and strategy

Research approach

This study adopted a qualitative research approach based on social constructivism. Qualitative research is associated with inductive reasoning. Lodico et al. (2010) claim that qualitative researchers adopt "inductive approaches to data collection because they formulate hypotheses only after they begin to make observations, interview people and analyse documents" (p. 11). According to Polkinghorne (2010, p. 425), "the focus of these approaches is on describing and understanding the meanings people attach to their encounters with other people, their cultural environment and material objects".

Silverman and Marvasti (2008), cited in Bandyopadhyayi (2015), outlined the following key characteristics of qualitative research including:

(a) The issues are "purposefully selected according to the condition" or context.

(b) The researcher is involved in the problem.

(c) It uses a wide range of data.

(d) Interpretations are "holistic and subjective" but they are rigorous and transparent.

(e) It is very useful in "understanding how and why certain outcomes were achieved" or not.

(f) It allows "diversity of responses" and adaptability to "new developments."

(g) It uses "different methods for data collection and data interpretation."

(h) It focuses on "knowing the why and how of social matters."

(i)It can work "with small numbers of cases," thus small sample size as well as "a few aspects are studied in depth" (p. 126).

The goal of qualitative research, therefore, is to understand and explain social phenomena from different perspectives. These include analysing individual and group experiences; analysing "interactions and communications in the making" and studying documents or other experiences (Flick, 2007b, p. x).

Other scholars such as Crowe, Inder, and Porter (2015) agree that qualitative research approaches are "oriented towards understanding meanings and experiences" and they help in collecting "a variety of empirical material that describe routine and problematic moments and meanings in individual's lives". Therefore, these scholars also emphasise that qualitative studies endeavour to understand the way people make sense of phenomena in their natural contexts (p. 416).

The study used this approach to examine the issues under study within the context of universities in Africa. The research questions required a research approach that would engage individuals within the institutions to share their views, opinions, experiences and ideas on how climate change issues are being addressed in their university programmes as well as the challenges and opportunities they face in their work. The approach was useful in finding answers to the research questions and consequently the main objective of the study as well.

Research design

The concept of research design in qualitative research is less commonly used compared to quantitative research. However, it is a very important aspect that guides any research, whether qualitative or quantitative. Ragin (1994), cited in Flick (2007a), defines it as:

> a plan for collecting and analysing evidence that will make it possible for the investigator to answer whatever questions he or she has posed. The design of an investigation touches almost all aspects of the research, from the minute details of data collection to the selection of the techniques of data analysis (p. 37).

A research design includes the sampling plan, the intended comparisons and level of generalisation, quality issues to be addressed, the audience and style of presenting findings, triangulation of data as well as the focus of the study (Flick, 2007a, p. 39). Denzin and Lincoln (2005) view a research design as one that "describes a flexible set of guidelines that connect theoretical paradigms first to strategies of inquiry and second to the methods for collecting empirical materials." It situates the researcher in "the empirical world and connects him or her to specific sites, persons, groups and bodies of relevant interpretive material, including documents and archives" (p. 25). For Robert Yin, a design logically links research questions to the data to be collected (Yin, 2009, p. 19).

The common designs scholars have cited include; narrative design (Clendenin and Connelly, 2000), phenomenology (Moustakas, 1994), grounded theory (Corbin and Strauss, 1990, 1998,

2007), ethnography (Fetterman, 2010 and Wolcott, 2008) and a case study design (Stake 1995 and Yin 2009, 2012). These have been commonly used in education and social sciences studies (Cresswell, 2014). This research adopted a case study design to link the interpretive theoretical paradigm, the methods of data collection and the research questions posed in order to understand the phenomenon under study at Makerere University and University of Dar es Salaam.

Case study research design

Scholars such as Robert Stake (1995), Sheran B. Merriam (1998) and Robert Yin (2003, 2006) have been key at explaining the application of case study methodology. For Stake, a case study is not "a methodological choice but a choice of what is to be studied" (Stake, 2005, p. 443). He emphasises that in designing the study, we should focus on what is to be studied rather than how it will be studied, while seeking to optimise our "understanding of the case rather than to generalize beyond it" (ibid). The author argues that the essence of doing a case study is to fully understand the specific case and its context rather than to generalise it to other cases.

He writes: "we do not study a case primarily to understand other cases. Our first obligation is to understand this one case" (Stake, 1995, p. 4). "The real business of case study," he says, "is particularization, not generalization":

> We take a particular case and come to know it well, not primarily as to how it is different from others but what it is, what it does. There is emphasis on uniqueness, and that implies knowledge of others that the case is different from, but the first emphasis is on understanding the case itself (Stake, 1995, p. 8)

He recommends that in selecting cases, we should seek to maximise what we can learn (Stake, 1995, p. 4). He identifies three types of case studies: intrinsic, instrumental and collective or multiple case studies. An intrinsic case study is one where the researcher wants to understand a particular issue better. In an instrumental case study, an investigator examines a particular case "to provide insight into an issue or redraw a generalization." The multiple or collective case study, on the other hand, is where the researcher analyses a number of cases jointly "in order to investigate a phenomenon, population or general condition" (Stake, 2005, p. 445). In all cases, Stake emphasises that contextual factors should be studied as well.

Yin, on the other hand, looks at a case study first as "an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between

the phenomenon and the context are not clearly evident" (Yin, 2003, p. 13). Secondly, it is an inquiry that studies a "technically distinctive situation" with multiple variables; it draws evidence from multiple sources; and it benefits from "the prior development of theoretical propositions to guide data collection and analysis." Yin's view sums up a case study research as an all-encompassing method which covers the logical design as well as techniques of data collection and analysis"(Yin, 2009, p. 14).

Unlike Stake, Yin identified four types of designs for case studies: single (holistic), single (embedded), multiple (holistic) and multiple (embedded) case study design. This typology groups them into single and multiple case designs and categorises each of these into holistic and embedded. According to Yin, the rationale for doing a single case study whether holistic or embedded is when it represents "the critical case in testing a well-formulated theory; represents an extreme case or a unique case; is a representative or typical case; [or] is revelatory" (Yin, 2009, p. 47).

The holistic or embedded nature of a single case study arises on account of the unit of analysis. According to the author, a unit of analysis is the specific aspect to be studied including the "specific time boundaries needed to define the beginning and the end of the case" (Yin, 2009, p. 26). The unit of analysis could be an individual, event or entity, decisions, programmes, implementation process or organisational change (p. 23). An embedded single case study is one where "the same single case study may involve more than one unit of analysis"; that is, if the case selected is an organisation, then there must be various units within the organisation to be studied. The holistic single case study, on the other hand, is where the "case study examines the global nature of an organization or of a program"; that is, the unit of analysis is only one for the case. The entire case is studied as one unit of analysis (Yin, 2009, p. 50).

The multiple case study design, on the other hand, is where "the same study may contain more than a single case" (Yin, 2009, p. 53). The author justifies the use of a multiple case study design on the account of "replication logic" rather than "sampling logic. In other words, the "case must be carefully selected so that it either (a) predicts similar results (a literal replication) or (b) predicts contrasting results but for anticipatable reasons (a theoretical replication)." The outcome of these replications is "the development of a rich, theoretical framework" which "later becomes the vehicle for generalizing to new cases" (Yin, 2009, p. 54).

According to Yin, a multiple case study design can also be holistic or embedded depending on "the type of phenomenon being studied and the research questions" (Yin, 2009, p. 59). Again

the holistic or embedded nature of each case study within a multiple case study design depends on unit of analysis to be considered in the study.

Based on Yin's typology of case study research designs, the researcher adopted a holistic, descriptive multiple case study design. Yin (2012) contends that descriptive case studies "can offer rich and revealing insights into the social world of a particular case" (p. 49). Therefore, the design was adopted because it would bring out rich and revealing insights into the phenomenon under investigation and also provide room for replication (lateral and theoretical) of findings among case universities and beyond. The researcher adapted Yin's approach as shown below:

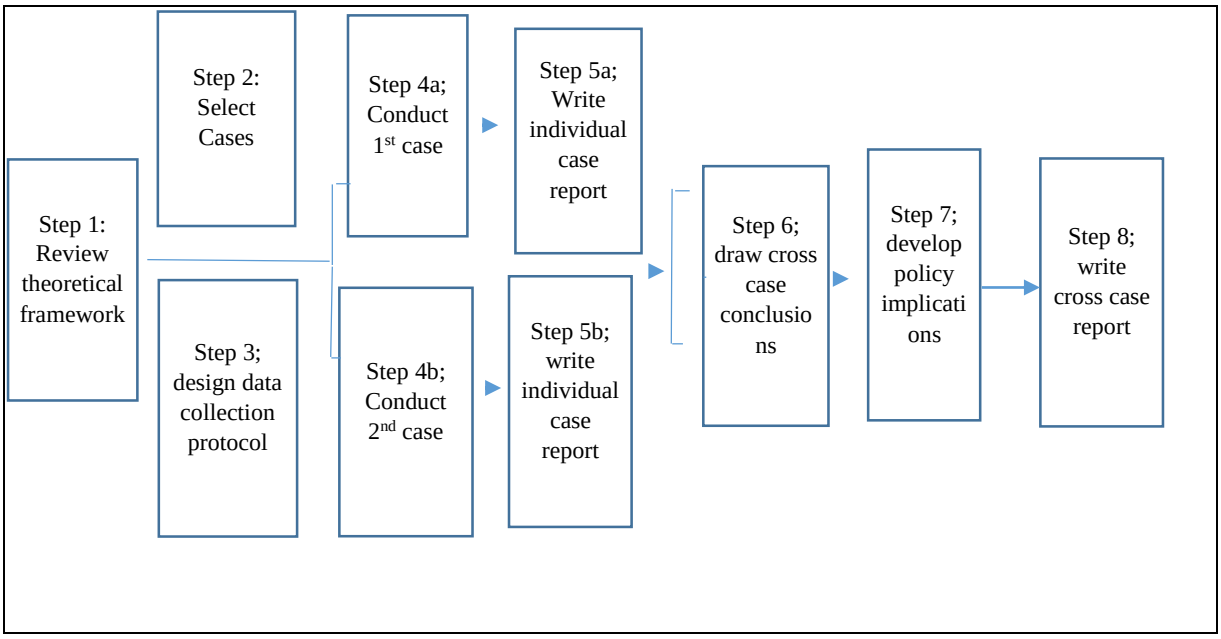

Figure 4.1. Case study design framework used. Adapted from Yin (2009 p. 57)

The above figure illustrates the stages that the researcher went through to design and conduct the multiple case study. The researcher adopted Bandura's social learning theory 1977, supported by Rohweder &Virtanen's model of learning for sustainable development 2009 and Elinor Ostrom's Institutional Analysis and Development (IAD) framework 2011. The researcher then used purposive sampling to select the cases, that is, Makerere University and University of Dar es Salaam. In supporting the use of multiple case study design, Yin (2012) explained that they produce more credible findings and conclusions compared to single case studies. This study focused on the two universities because they are the oldest in the region, have climate change centres, are the most influential, and they are capable of influencing other emerging universities in the region and the continent.

The researcher developed a data collection protocol which was approved by the university Doctoral Committee. It was ethically cleared at university and in Uganda and Tanzania where data was collected. Developing a study protocol helps a researcher to be clear about the scope, the theoretical framework and empirical debates around the issues under study, as well as the methodology to be followed. It ensures that the "values, expectations and perspectives" of the researcher are clearly integrated in the design of the study (Yin, 2016, p. 107).

The researcher then conducted fieldwork for each case in Tanzania and Uganda. Field work involved collecting data using interviews and focus group discussions with participants at the case universities and these provided the evidence on which the researcher relied to reach conclusions (Yin, 2016, p. 116). Cross case analysis and conclusions involved bringing together the common and divergent findings from the cases, and identifying patterns across them. The researcher later wrote a cross-case report and developed policy implications.

4.3 Sampling strategy and study participants

After ethical approvals and getting ready for field work, the researcher faced what Yin calls the "sampling challenge". According to Yin, "the sampling challenge arises from needing to know which specific units to select and why, as well as the number of the units that are to be in a study" (Yin, 2016, p. 86). For each case university selected, the researcher had to choose the specific units to analyse and the respondents. Yin argues that "the selection of these units should seek to obtain the broadest range of information and perspectives on the subject of study" (p. 88).

The researcher adopted purposive sampling in the selection of the two case universities as well as the units to be included in the institutional analysis. The administrators and lecturers/researchers on climate change related courses within the units were also selected purposively. Patton argues that the logic and power of purposive sampling (which he calls purposeful sampling) lies in "selecting information rich cases for study in depth." According to him, the "information rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the research"(Patton, 2015, p. 169).

Sampling procedure at University of Dar es Salaam

The researcher selected the Institute of Resource Assessment (IRA) at University of Dar es salaam and the Centre for Climate Change Studies as units to participate in the study because environment related programmes and courses (including climate change studies), are taught by these units. The researcher used purposive sampling to select three administrators of IRA and

the Centre for Climate Change Studies; two researchers on climate change and four lecturers teaching courses related to the climate change at IRA and the Centre for Climate Change Studies. These were interviewed using semi-structured in-depth interview guides. The researcher selected 24 students offering courses related to climate change at this case university using purposive random sampling and engaged them into 3 focus group discussions. The complete sample size at this case university is presented in the table below.

Method of data collection	**Participant group**	**Number**
Semi-structured in-depth interviews	Administrators	03
	Lecturers	04
	Researchers	02
Focus group discussions	Postgraduate students	08
	Undergraduate students	16
	Total	**33**

Table 4.1. Study sample at UDSM.

Sampling procedure at Makerere University

The researcher also purposively sampled participants at Makerere University in the College of Agriculture and Environmental Sciences and specifically, Makerere University Centre for Climate Change Research and Innovation (MUCCRI). These units do house environmental and climate change programmes and courses. The lecturers, administrators and researchers were purposively selected because they were knowledgeable and experienced in climate change research, teaching and programme management. They later participated in semi-structured in-depth interviews that lasted approximately one hour.

For this case, students offering courses related to climate change were selected for two focus group discussions using purposeful random sampling. According to Patton, purposeful random sampling is used to select participants randomly to achieve "credibility and not

representativeness." The author argues that a small purposeful random sample aims to reduce suspicion about why certain cases were selected for study, but such a sample still does not permit statistical generalizations" (Patton, 1990, p. 180). The entire sample size at this case university is presented in the table below.

Method of data collection	**Participant group**	**Number**
Semi-structured in-depth interviews	Administrators	03
	Lecturers	04
	Researchers	02
Focus group discussions	Postgraduate students	08
	Undergraduate students	08
	Total	**25**

Table 4.2. Study sample at MAK.

4.4 Data collection Methods and Instruments

The researcher collected data using multiple data collection methods including semi-structured in-depth interviews, focus group discussions and document review. Semi structured in-depth interviews and FDGs are qualitative methods that seek to understand and interpret more local meanings, recognise data as gathered in specific contexts and sometimes they produce knowledge that contributes to more general understanding (Braun & Clarke, 2013). The methods employed for data collection are presented in the figure below;

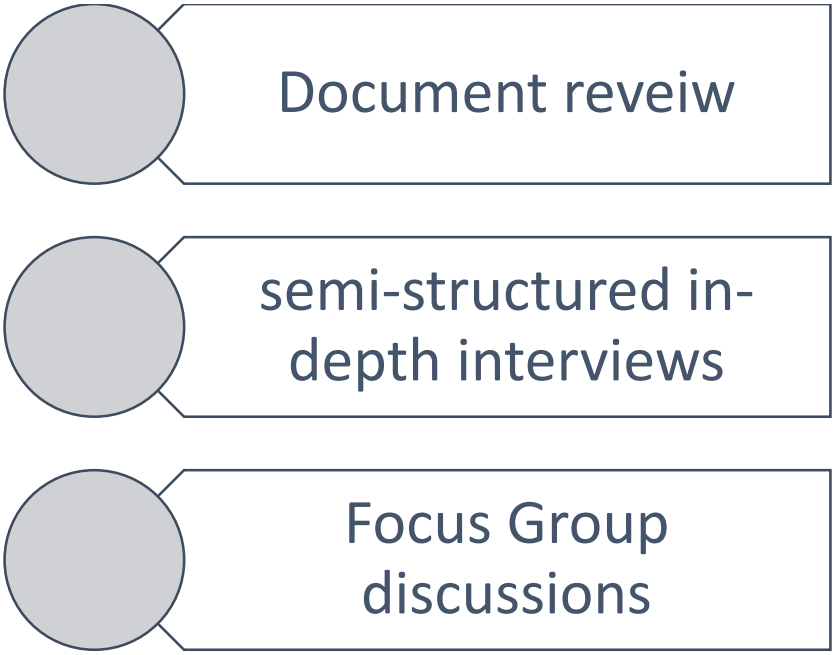

Figure 4.2: Data collection methods used

4.4.1 Document review

Data collection began with document review. Documents such as personal and official documents, mass media articles, virtual outputs and photographs provide a wide range of data. Others include; "annual reports, mission statements, press releases, newsletters, memos, minutes of meetings, internal and external correspondences, policy documents, strategic plan documents and program evaluation reports" (Bryman, 2008, p. 522). These documents often convey important and useful information that a researcher can effectively use as data (Bruce L. Berg, 2012).

Atkinson and Coffey recommend that, "documentary materials should be regarded as data in their own right" because "they often enshrine a distinctively documentary version of social reality." Therefore, researchers need to give documents "due weight and appropriate analytic attention" like any other source of data (Atkinson & Coffey, 2009, p. 59). Documents reviewed from the case universities are shown in the Figure 4.3 below:

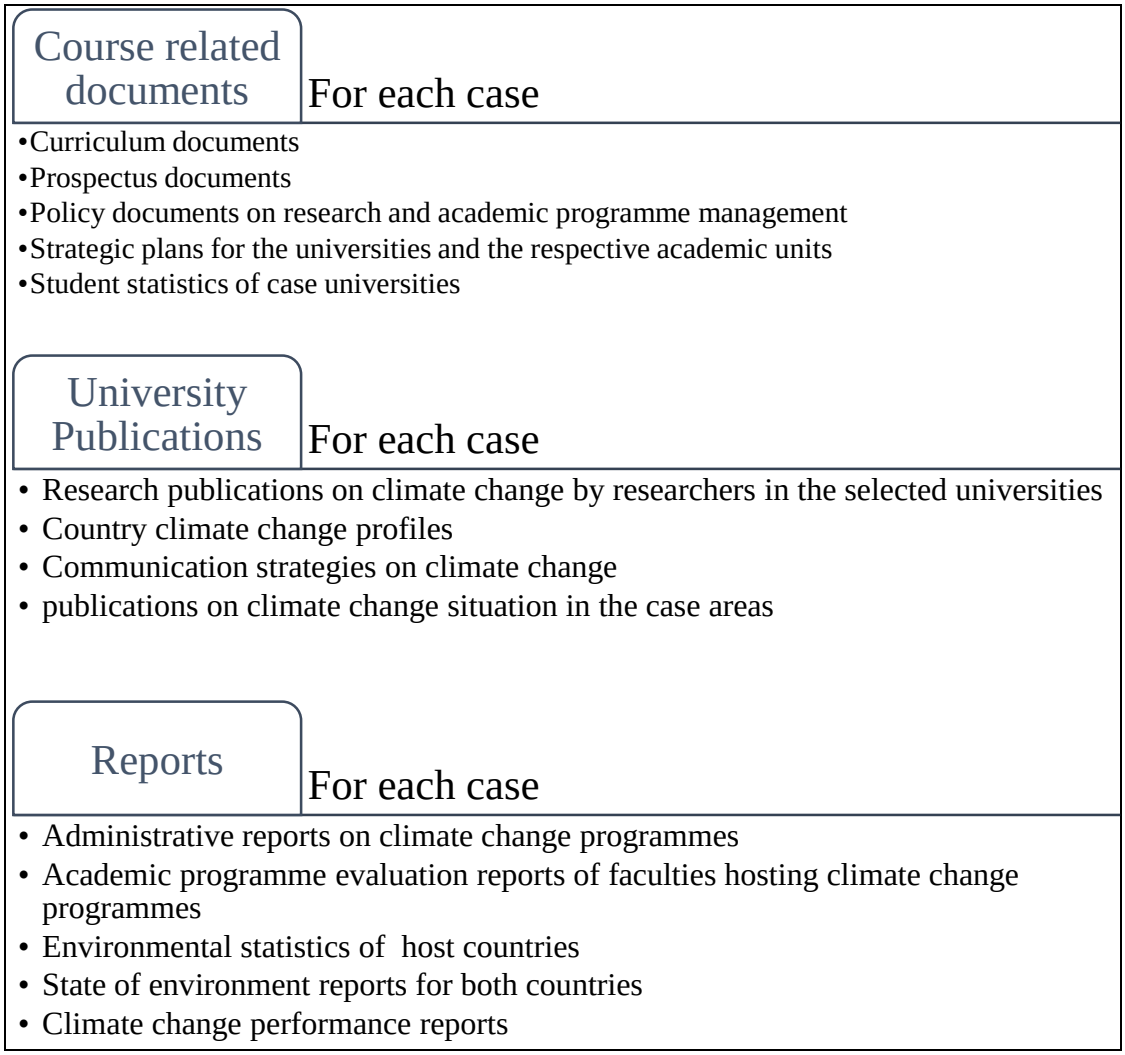

Figure 4.3. Documents reviewed at case universities

4.3.1.1 Document review checklist

The researcher used a document review checklist during data collection. The checklist was part of the research protocol outlining the key documents and information that was to be reviewed. The supervisors reviewed the checklist to ensure that its contents were consistent with the research questions and ethical considerations. It was useful in collecting the necessary contextual information that was needed for the study at the case universities.

4.4.2 Semi-structured in-depth interviews

The researcher collected data using semi-structured in-depth interviews. Steinar Kvale emphasises the importance of interviews in research:

> In an interview conversation, the researcher asks about, and listens to, what people themselves tell about their lived world, about their dreams, fears and hopes, hears their

> views and opinions in their own words, and learns about their school and work situations, their family and social life. The research interview is an interview where knowledge is constructed in the inter-action between the interviewer and the interviewee (Kvale, 2007, p. 1)

The author notes that an interview has a "structure and purpose" and involves a "careful questioning and listening approach with the purpose of obtaining thoroughly tested knowledge" (p. 7). In qualitative research, an interview provides "a key avenue for exploring the ways in which subjects experience and understand their world" and this "provides a unique access to the lived world of subjects, who in their own words describe their activities, experiences and opinions" (p. 9).

During field work, the researcher conducted semi-structured interviews in each university lasting between 45-60 minutes. The interviews covered issues such as the role of universities in addressing climate change; the academic, research and community engagement programmes on climate change; challenges the universities face as they implement climate change programmes, as well as success factors that made them succeed in these programmes.

The researcher adopted Steinar Kvale's seven steps in undertaking the in-depth interviews as shown below.

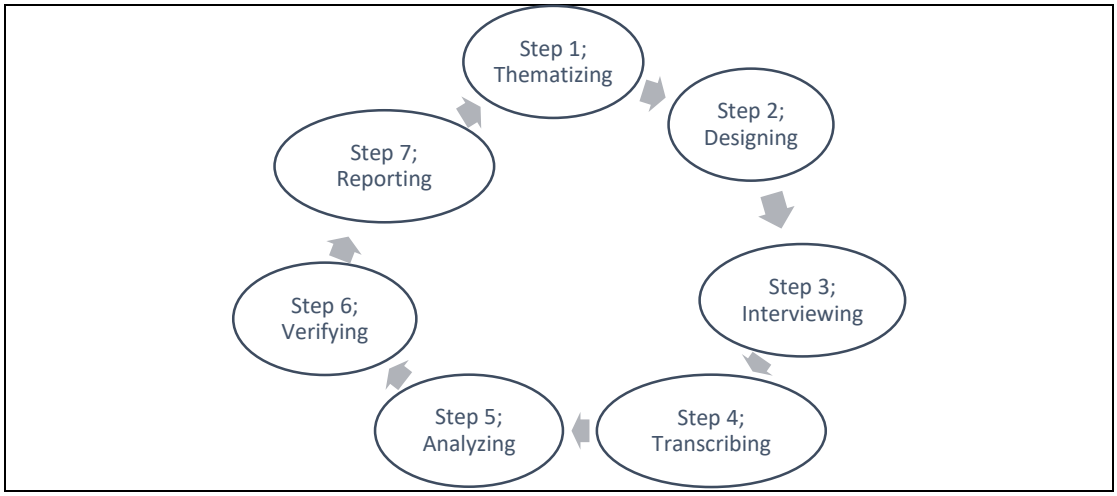

Figure 4.4. The stages of interview. Source: Adapted from (Kvale, 2007)

Step 1: Thematising

Kvale defines thematising as "the formulation of research questions and a theoretical clarification of the themes investigated" (Kvale, 2007, p. 37). Before going to the field, the

researcher and the supervisors reviewed the research proposal to identify the key research questions and the theoretical framework that would guide the themes in the interview guide. The researcher piloted the draft interview guides to test for validity and reliability and the comments of the pre-test helped the researcher to update the final version.

Step 2: Designing

Kvale, looks at the design stage in terms of "planning the procedures and techniques" to be followed in conducting the interviews (p. 41). The researcher worked with the supervisors to develop a schedule for the interviews at both universities and they wrote to the heads of research in both universities introducing the researcher. The researcher and supervisors contacted the participants to agree on the schedule for the interviews.

Step 3: Interviewing

Kvale advises researchers conducting interviews to focus mainly on the interview stage, scripting the interview, asking questions as well as probing for more information and the post-interview reaction (p. 65). Using this format, the researcher prepared the interview guides, information sheets and consent forms for participants. He also used an audio recorder for interviews, notebooks for taking field notes, information for briefing and debriefing participants as well as a plan for post interview reaction. This stage helped the researcher to adequately conduct semi-structured in-depth interviews at both case universities.

Well-developed interview guides were used to collect data from respondents. The researcher ensured that the interview guides were focused on collecting the required data to answer the research questions. These were piloted before they were administered on the participants to check their validity and reliability (Bryman, 2008).

Step 4: Transcribing

The recorded interviews were later transcribed. The details on transcription are in the analysis section.

Step 5: Analysing

The analysis of interview data started right from the field during data collection. Preliminary themes were generated and these helped to inform detailed analysis of the transcribed data. Details of analysis are in the analysis section.

Step 6: Verifying

After analysis, the findings and related themes were verified to ensure that they were consistent with raw data. This was to ensure validity and reliability of findings. Kvale argues that "reliability pertains to consistency and trustworthiness of research findings…also in connection with transcription and analysis of interviews, pertaining to whether different transcribers and analysers will come up with similar transcriptions and analyses" (Kvale, 2007, p. 122). For validity the author explained that it "rests on the quality of the researcher's craftsmanship throughout an investigation, continuously checking, questioning and theoretically interpreting the findings" (p. 123). The researcher did verification of findings by checking through the interview data and the meaning as well as extreme views of participants and how these would impact on final interpretations.

Step 7: Reporting

Case study findings were presented in a report with distinct sections per case study. Each case study findings were written down in a complete chapter and methodological aspects were well articulated to substantiate and report on validity of the findings. Kvale admitted that "working towards the final report from the start of an interview study may contribute to a readable report of methodologically well-substantiated, interesting findings" (Kvale, 2007, p. 131).

4.4.2.1 Interview guide

The researcher developed an interview guide that was used in conducting the semi-structured in-depth interviews at the case universities. Patton (2015) describes an interview guide as one that contains various questions or topics that the interviewer explores during the interview. According to him, the researcher has to prepare the interview guide to ensure consistency across participants interviewed but also to guide the interviewer in probing further to gain enough detail. The interview guide does structure the "course of the interview" and contains a "sequence of carefully worded questions" (Kvale, 2007). An interview guide helps the researcher to conduct what Yin (2016) called "guided conversation" (p. 147). Hugh-Jones (2010) argues that when a researcher takes adequate time to prepare an interview guide, it enhances the likelihood of producing data.

For this particular study, the researcher prepared three interview guides while putting together the research protocol. The interview guides were to solicit opinions, views and perspectives from the three groups of participants: lecturers, researchers and administrators. These guides,

together with other instruments, were reviewed by the supervisors to check consistency, relevance, adequacy and wording of the questions. The guide contained open-ended questions related to the issues explored in the study. The researcher ensured that a variety of question types were included; that is, open ended descriptive questions, meaning-making questions and probing questions. The researcher also considered proper sequencing of the questions ensuring that they logically flow (Braun & Clarke, 2013).

The interview guides were also checked for ethical considerations by ethics bodies at the University of Oldenburg, the National Council for Science and Technology in Uganda and the Council for Science and Technology in Tanzania. After approval of the protocol, the researcher piloted the tools at Makerere University in the School of Forestry, Environmental and Geographical Sciences to ensure their validity and reliability.

4.4.3 Focus Group Methodology

Originally used in marketing research, this methodology has been widely adopted in other research domains. Linhorst (2002) defines focus group research as "a qualitative research method in which a moderator interviews a small group of participants typically 6 to 10, and uses the group process to stimulate discussion and obtain information on the beliefs, attitudes or motivations of participants on a specific topic" (p. 209).

Wilkinson (2009, p. 177) looked at the focus group methodology as "a way of collecting qualitative data which—essentially—involves engaging a small number of people in an informal discussion (or discussions), focused around a particular topic or sets of issues." It is a method in which a group of participants discuss a number of topics run by a moderator or facilitator.

The essence of the focus group method was explained by Bryman (2008):

> The focus group practitioner is invariably interested in the ways in which individuals discuss a certain issue as members of a group, rather than simply as individuals. In other words, with a focus group the researcher will be interested in such things as how people respond to each other's views and build up a view out of the interaction that takes place within the group (p. 473).

Bryman's view is that focus group research "offers the researcher an opportunity to study the ways in which individuals collectively make sense of a phenomenon and constructs meanings around it" (p. 476). As members of the focus group discuss and interact amongst themselves

about the phenomenon, knowledge is constructed and shared. To support this argument, Tausch and Menold (2016, p. 1) point out that "the group functions as a promoter of synergy and spontaneity by encouraging the participants to comment, explain, disagree and share their views. Thus experiences are shared and opinions voiced that might not surface during individual interviews."

Using this method, the researcher collected data from postgraduate and undergraduate students on courses related to climate change in both case universities, with the help of the CERMESA Coordinator at University of Dar es Salaam and the Head of the Department of Geography and Climatic Sciences at Makerere university. Participants for the focus groups were randomly selected for the 5 focus groups in both case universities.

Focus group research in University of Dar es Salaam

In the University of Dar es Salaam, three programmes were purposively selected and they included Bachelor of Geography, Master of Climate Change and Sustainable Development and PhD in Climate Change and Sustainable Development. These programmes were selected because the students undertaking them cover a wide range of courses related to climate change. From these groups, the researcher got class lists and randomly sampled 16 participants from the Bachelor of Geography programme, who were assigned to two focus groups. For the Master's and PhD programmes, the researcher used class lists to randomly sample eight participants for the third focus group. Each focus group was composed of eight participants.

Barbour (2007, p. 60) recommends that although the ideal group should be 10-12 people, eight participants are generally adequate. The justification for this is that "in social science research we are generally more interested in exploring in depth participants' meanings and the ways in which perspectives are socially constructed" rather than generalisation that would require large numbers (ibid).

The conduct of the three focus groups at this particular case university went on smoothly as planned. The selected participants were invited to attend the focus group sessions and all invited participants attended the sessions. During the first few minutes of the meeting the researcher gave the selected participants information sheets and asked them to voluntarily fill a consent form. The two undergraduate focus groups took place on the same day, the first one in the morning and the second one in the afternoon.

The Research Assistant who was a member of staff at the university helped to organise interviews. The moderator of the focus groups ensured that participants were audible enough and that they did not talk over each other, which would make transcription very difficult. The participants in all focus group sessions were provided with refreshments. It is ethical to ensure that your participants are as comfortable and refreshed as possible during the data collection sessions (Barbour, 2007).

Focus group research at Makerere University

At Makerere University, only two groups participated in the focus group discussions. This was because of the administrative challenges of mobilising the students to participate since it was examination time. However, the proposed sample size for each case was two groups, and this made the researcher achieve 100% response rate. One group comprised postgraduate students (3 PhD students and 5 Master's students), while the other was for undergraduate students.

The researcher purposefully selected three programmes from which to identify participants for the focus groups. These included Bachelor of Science in Meteorology (for undergraduate students) as well as Master of Science in Geography and PhD in Geography for postgraduates. This was to ensure homogeneity in groups so that they could easily interact within the groups, as advised by Barbour (2007, p. 59).

With the help of the Head of Department, the researcher accessed lists of students in the three programmes and used simple random sampling to select eight participants for each focus group. The focus groups were conducted on the same day, one in the morning and another in the afternoon. Both took place in a lecture room provided by the department.

The researcher recorded the focus group sessions and also took field notes which helped to capture adequate data for the study. The researcher recorded the students' views on the role their university is playing in addressing climate change issues; its academic, research and community engagement programmes on climate change; the challenges it faces and the effective ways they think their university can address climate change issues. The method offered the researcher an opportunity to study the ways in which individuals collectively make sense of the phenomenon under study and construct meanings around it (Bryman, 2008).

4.3.3.1 Focus group discussion guide

The researcher developed a focus group discussion guide for data collection from the students of climate change related courses at the case universities. One tool was developed for both

undergraduate and postgraduate students on climate change related programmes at the case universities. Braun and Clarke (2013) recommends that one of the first things a researcher intending to conduct focus group discussions has to do is to design the focus group discussion questions carefully (p. 117). The focus group discussion guide contains a wide range of topics that the researcher wants participants to discuss. The guide is meant to stimulate and engage the participants to share their views and perspectives on the issues outlined. The focus group discussion guide was developed as part of the research protocol.

4.5 Data analysis and interpretation

This section presents in detail the procedures that were followed in analysing the collected data and their justification. The section covers an overview of the data analysis process, the data transcription process followed, the use of MAXQDA software for initial coding and the thematic analysis method adopted. The section also covers the interpretation and writing of findings.

4.5.1 Overview of data analysis process

The researcher had a challenge of deciding which data analysis method to use in analysing the collected data from semi-structured in-depth interviews, focus groups and document review. The method adopted was thematic analysis by Virginia Braun and Victoria Clarke (2006). The method will be explained in the next section.

Data analysis is at the heart of any research, whether qualitative or quantitative. Uwe Flick stresses that data analysis is "the central step in qualitative research. Whatever the data are, it is their analysis that in a decisive way, forms the outcomes of the research" (Uwe, 2014, p. 3). Cohen, Manion, and Morrison (2011, p. 537) acknowledge that "qualitative data analysis involves organizing, accounting for and explaining the data, in short, making sense of data in terms of the participant's definitions of the situation, noting patterns, themes, categories and regularities." This description highlights the processes through which qualitative data is conducted, which is the gist of this section. However, as Patton notes, doing qualitative data analysis is challenging:

> The challenge of qualitative analysis lies in making sense of massive amounts of data. This involves reducing the volume of raw information, sifting the trivial from the significant, identifying significant patterns, and constructing a framework for communicating the essence of what the data reveal (Patton, 2015, p. 65).

This implies that there are several methods that can be adopted in analysing qualitative data and they depend on the purpose of the study.

Dey (2005, p. 32) explains that qualitative data analysis is a circular process involving three phases namely: describing, connecting and classifying. According to the author, "the first step in qualitative analysis is to develop thorough and comprehensive descriptions of the phenomenon under study" and this "description encompasses the context of action, the intensions of the actor, and the process in which action is embedded". Classification, on the other hand, refers to the process of making "meaningful comparisons between different bits of data." This is not different from categorising data to enable the researcher make meaning. The author looks at classification as a "conceptual process" that involves assigning bits of data into categories and later forming "a conceptual framework" that depicts "logical relations of hierarchy and subordination between concepts" (Dey, 2005, p. 46). Making connections as the last phase of qualitative data analysis implies "identifying associations between different variables." This phase analyses "inherent capabilities and liabilities of social actors, and how these interact to produce particular effects" (Dey, 2005, p. 51).

Yin's approach to qualitative data analysis, on the other hand, involves five phases: compiling, dissembling, reassembling (and arraying), interpreting and concluding. Compiling field notes and data means putting them in some order, after which it is "dissembled" or broken down into smaller pieces. This procedure involves "assigning new levels or codes" to the smaller chunks of data. This dissembling procedure is iterative and can happen several times to arrive at realistic codes (Yin 2011, p. 178).

The third phase is "re-assembling" data or field notes, which involves "using substantive themes or reorganizing the dissembled fragments or pieces into different groupings and sequences that might have been in the original" (Yin, 2011, p. 179). "Interpreting" is the forth phase that involves "using the reassembled material to create a new narrative" that ends up into writing the manuscript. The phase of "concluding" involves drawing conclusions from the study.

4.5.2 Data transcription

During transcription, the researcher played the audio recordings several times to derive textual transcripts, which were then re-read to correct errors. Braun and Clarke (2013, p. 164) identify these errors as sentence structures, quotation marks, omissions and mistaken words or phrases. Specifically, for this study, transcription of five focus groups and the eighteen interviews in

both case universities took close to eight weeks to ensuring that verbal utterances and interactions were captured correctly.

The process of producing a quality transcript can be affected by several factors. Mero-Jaffe (2011, p. 232) identifies five factors: the researcher (influenced by his or her attitude towards the research topic); the interviewer (influenced by his or her knowledge level about the research study); the transcriber (influenced by limited professional competence in transcribing); the interviewee (influenced by his or her spoken intonation, the insecurity and language fluency as well as clarity during the interview); and the equipment and place of transcription (influenced by the quality of recording and conduciveness of location of the interview).

In this study, the researcher was also the interviewer and transcriber and thus the quality was enhanced by his positive attitude towards the research project, his understanding of the research, and his competencies in transcription. The researcher did all transcriptions of semi-structured in-depth interviews and focus group data for both cases in order to get "immersed in the data, an experience that usually generates important insights" in data analysis (Cohen et al., 2011, p. 525). The researcher also developed transcription notations, including participant identifiers that were used to ensure anonymity. These formed part of the transcription system for the study. Kowal and O'Connell (2014, p. 68) look at a transcription system as "the sum of all the notation signs plus the conventions for arranging the signs sequentially on paper or screen and the methods used to assess the various behavioural aspects" of the data collected.

4.5.3 Data coding with MAXQDA and thematic analysis

Thematic analysis, according to Braun & Clarke (2006, p. 2), offers "an accessible and theoretically flexible approach to analysing qualitative data" and is quite compatible with other analytical approaches such as grounded theory and discourse analysis. It offered flexibility to the researcher to generate findings based on themes.

In using thematic analysis, one needs to be clear about what counts as a theme, the type of analysis you want to do whether inductive or theoretical, and the level at which your themes will be identified; that is, the latent or semantic levels. All these decisions have to be made when considering to use thematic analysis (Braun & Clarke, 2006). In addition, the study's epistemological orientation and the type of research questions used have to be considered when using thematic analysis.

Thematic analysis process

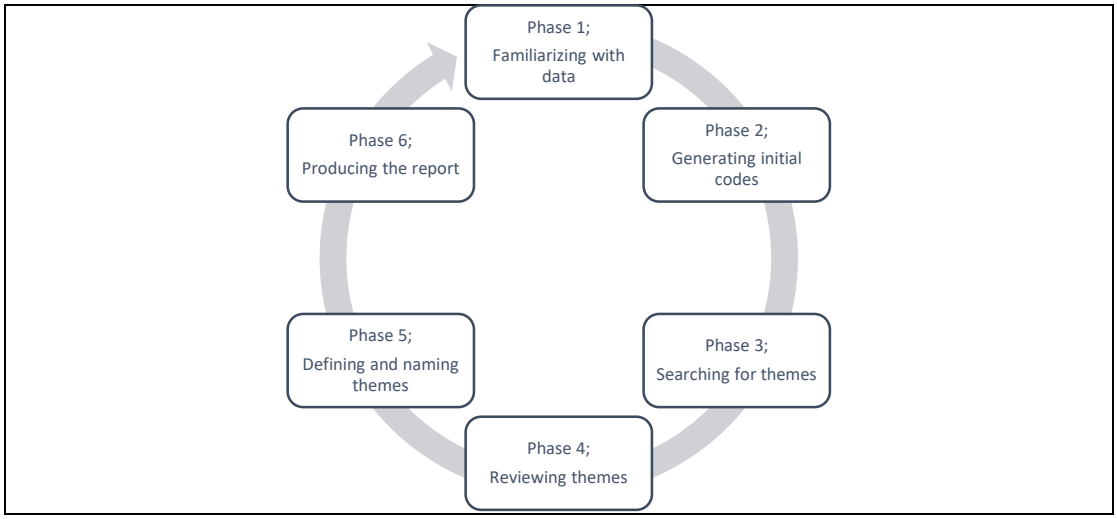

Figure 4.5. Thematic analysis process used. Source: Adapted from Braun & Clarke, 2006

According to Braun and Clarke (2006) the researcher goes through six phases as shown in the figure above. This study followed the above process as explained below.

Phase 1: Familiarising with data

This phase requires that the analyst gets familiar with the data. Braun and Clarke (2006) advise that one "immerse" oneself in the data so that one gets "familiar with the depth and breadth of the content" to be analysed (p. 16). The authors explain that "immersion usually involves repeated reading of data…in an active way, searching for meanings, patterns and so on" (Ibid). This implies that the analyst gets ample time to read through the entire data set at least once though it would be useful to do it many times before the coding process begins.

Dey (2005) advocates for active reading accompanied by annotating data. According to the author, these should go hand in hand because as the analyst reads, there is a "need to record observations and ideas about the data in order to prepare the ground for analysis" (p. 93). The analyst read through the entire data set and kept notes on key observations and ideas about the analysis before coding.

Familiarising with data would happen more if the analyst participated in data collection and transcription. Otherwise, one needs to read and re-read the entire data set to have a thorough understanding generally of what the participants are saying. Since the researcher was the transcriber and the analyst it provided a good ground for immersion into the data. Before transcription, the researcher listened several times to the audio recordings for both semi-structured in-depth interviews and focus group sessions for both cases. This helped a lot to make the researcher familiar with the data. The transcription process was yet another great

opportunity for the researcher to immerse in the data. This process helped the analyst to get familiar with the data. The analyst then edited the transcripts by cross-checking the original audio recordings. This provided an opportunity to read and read the data before coding.

Phase 2: Generating Initial codes

Coding refers to the process of reducing chunks of qualitative data into fewer concepts that answer the research questions. Johnny Saldana explains that "a code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language based or visual data" (Saldana, 2009, p. 3). Another explanation for the concept of codes was given by Braun and Clarke (2006). According to these authors, "codes identify a feature of the data (semantic content or latent) that appears interesting to the analyst, and refers to the most basic segment or element, of raw data or information that can be assessed in a meaningful way regarding the phenomenon" (p. 18).

Using MAXQDA software, the analyst imported the transcripts into the software for coding. Patton (2015) observes that:

> Software has eased significantly the old drudgery of manually locating a particular code paragraph. Analysis programs speed up the processes of searching for certain words, phrases and themes, labelling interview passages and field notes for easy retrieval and comparative analysis; locating coded themes; grouping data together in categories; and comparing passages in transcripts or incidents from field notes (p. 529).

However, using computer assisted data analysis software does not take away the responsibility of the analyst; rather, the analyst remains in charge of the actual coding and taking decisions on how to categorise these codes and later on formulation of themes.

Braun and Clarke (2013) provide two types of codes: data derived codes and researcher derived codes. The former provides "a succinct summary of the explicit content of the data"; in other words, the code captures the gist of what the participant is saying in the transcript. The latter are those that "invoke the researcher's conceptual and theoretical" understanding of the study to make meaning of the data (p. 207). Thus, they are created by the research based on his "deeper engagement" with the transcript or data. For this particular study, the analyst chose to generate data driven codes and later applied "an interpretive lens" to come up with a final list of codes (p. 210).

There are several coding methods or approaches from which an analyst can choose. Saldana (2009) categorizes coding methods into first cycle and second cycle coding. According to the author, the former category includes attribute coding, structural coding or holistic coding, descriptive coding, Nvivo coding, initial coding or values coding methods (p. 48). The latter category includes focused coding, axial coding and theoretical coding methods (p. 151). Merriam and Tisdell (2016), on the other hand, identify three approaches of coding: open coding, axial or analytical coding, and selective coding (p. 204), while Braun and Clarke (2013) cite selective and complete coding.

The analyst used open coding or complete coding by identifying "anything and everything of interest or relevance to answering" the research questions for the study (Braun & Clarke, 2013, p. 206). The analyst read and re-read the text and using a highlighter mechanism in MAXQDA, marked the text with codes that describe that portion of data. Open coding was done paragraph per paragraph within the segment of data for a particular question or topic (Cohen et al., 2011). The analyst then generated initial codes from the data by working through the entire data set. The initial codes were later interpreted with the research questions in mind as well as the theoretical framework, to produce a final codebook for analysis. The codebook supported the formulation of categories and themes.

Phase 3: Searching for themes

The analyst clustered the codes into related ideas and grouped these related ideas into categories (Crowe et al., 2015). Dey (2005) provides useful guidelines on creating categories:

> Creating categories is both a conceptual and empirical challenge; categories must be grounded conceptually and empirically. That means they must relate to an appropriate analytic context, and be rooted in relevant empirical material. Categories which seem fine in theory are not good if they do not fit the data. Categories which do fit the data are no good if they cannot relate to a wider conceptual context (p. 102)

In other words, one has to consider several resources in creating categories including inferences from the data, the research questions, the theoretical framework and the researcher's knowledge about the study and related literature (ibid). According to Merriam and Tisdell (2016), constructing categories is a "process of grouping your open codes" which other authors call axial coding (p. 206). The researcher did group the open codes into categories and later organised these into potential themes. The initial themes and their corresponding codes and data extracts were compiled to help in identifying candidate themes for review.

Phase 4: Reviewing themes

The candidate themes were reviewed to enable naming of the final themes that would support reporting of findings. Identifying final themes is a critical process in data analysis. The analyst had to consider the themes themselves, where candidate themes that were not coherent with the data extracts were reviewed to check their goodness, and discarded if they were problematic. Secondly, the review involved checking for the validity of individual themes in the data set. This ensured that the themes were valid and they reflected the gist of the data set. In considering themes at both levels, the analyst ensured that they were distinct and they made sense. The analyst did re-coding to review some themes that had not reflected the entire data set. Finally, good themes were identified to support naming and defining final themes for reporting.

Phase 5: Defining and naming themes

Once the themes have been reviewed and a final list of themes with their corresponding categories and data extracts is put in place in a thematic map, the next step is to refine the themes more to aid analysis. The analyst critically looked at the thematic map and did a detailed analysis of each theme in order to describe each to help in interpretation. The scope and content of each theme was defined and final names for each theme were given for purposes of reporting (Braun & Clarke, 2006). The analyst creatively and critically came up with names for each theme that would represent the content and the analytic lens of the researcher (Braun & Clarke, 2013). The analyst then prepared the final thematic map and clear definitions of each theme.

Phase 6: Producing the report

This is the last phase of thematic analysis. At this stage, the analyst has a complete and clear thematic map, with themes, their respective categories, and the data extracts for each category. Braun and Clarke (2006) claim that:

> The task of the write-up of a thematic analysis, whether it is for publication or for a research assignment or dissertation, is to tell the complicated story of your data in a way which convinces the reader of the merit and validity of your analysis (p. 23).

The authors call for conciseness, coherence, logical and non-repetitive flow as one writes down the narrative from various themes (ibid). The analyst ensured that evidence for each theme was extracted from the data and reported under the themes. Each theme and category was explained and extracts of data that captures the essence of the analyst's interpretation were considered in

the report. Each theme was linked to the specific research question during reporting and illustrative extracts were presented for each theme to answer the specific research questions (ibid).

4.5.4 Interpretation and writing of findings

After applying the thematic analysis approach to analyse data for both cases, the researcher interpreted the findings and embarked on writing of the report. The interpretation of themes was also guided by the social learning theory, the model of learning for sustainable development as well as the IAD framework. The researcher answered the three research questions while interpreting the findings for each case and also did comparisons of findings with those in the literature reviewed. Also important in interpretation was comparison of findings across the cases, which informed comparative analysis of the phenomenon under study across the case universities.

Reporting of study findings is one of the last stages in the research process, that sums up the plan, design, data collection and analysis processes that result in the key findings and conclusions. The researcher in consultation with the supervisors came up with a thesis structure that would guide the writing of the final thesis. The findings for each case study were presented separately in individual chapters providing background (contextual) information of the case and findings for each research question. For a multiple case study, Yin (2009) proposes that the report should "contain multiple narratives, covering each of the cases singly, usually presented as separate chapters or sections" (p. 170). Based on this understanding, each of the case narratives were presented as separate chapters, then a "cross case analysis" and discussion of results was done in a separate chapter.

4.6 Quality of the research

Qualitative research depends on the quality and credibility of the process and hence the final output in form of findings. While ensuring quality and credibility of the research, the researcher used the social construction and constructivist criteria (Lincoln and Guba, 1986). According to these authors, an inquiry based on constructivist perspective requires the researcher to follow a different quality criterion which focuses on credibility, transferability, dependability and confirmability. Credibility means ensuring that the researcher is able to separate his or her own views from those of the respondents while transferability relates to the ability to transfer findings from one case to the other. Dependability, on the other hand, relates to the use of logic,

traceability and how it was documented, while confirmability refers to the linkage between the data and interpretations of the researcher (ibid).

For this study, the research adopted Michael Quinn Patton's criteria (see 4.5.1) for judging quality as shown.

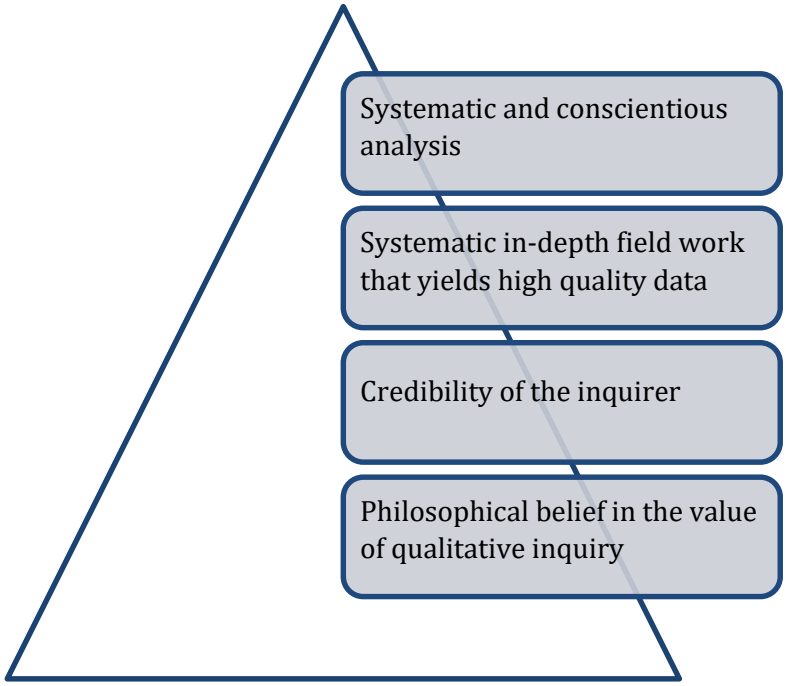

Figure 4.6. Research quality criteria. Source: Adopted from Michael Quinn Patton 2015 p.722

4.6.1 Philosophical belief in the value of qualitative inquiry

Patton (2015) argues that, "philosophical belief in the value of qualitative inquiry is a prime determinant of credibility." This dimension relates to the researcher's "appreciation of naturalistic inquiry, the qualitative methods, inductive analysis, purposeful sampling and holistic thinking" (p. 722). The researcher situated this study in the constructivism paradigm, which generally is known for its compatibility with the qualitative research approach. The entire design of the study was based on this foundation ensuring that the research questions, the research design, the methods of data collection, data analysis and interpretation, were aligned to the research paradigm and the qualitative research approach. This contributed to quality and credibility of the study.

4.6.2 Credibility of the inquirer

Patton (2015) argues that a researcher is "the instrument in qualitative inquiry" and his or her credibility is critical in ensuring quality of the inquiry (p. 700). The credibility of the inquirer

in this case is determined by his or her "relevant experience, training, perspective, competences and purpose" (p. 708). In this study, the research had adequate working experience in the education sector but also prior research experience and ably used this experience to enhance the credibility of the research. The researcher had adequate training acquired through a CERMESA-DAAD funded research methodology training in Port Elizabeth, South Africa, and Eldoret in Kenya. The researcher also attended several research methodology and scientific writing workshops organised by the graduate academy at the University of Oldenburg.

4.6.3 Systematic in-depth field work that yields high quality data

High quality research hinges a lot on the process of generating data as well as analysis and interpretation. The data collection process needs to be systematic if it is to yield high quality data. According to Patton (2015), "using a combination of data types-triangulation…increases validity as the strength of one approach can compensate for the weaknesses of another approach" (p. 390). This was the basis for the use of semi-structured in-depth interviews, focus group methodology and document review methods in the same study as explained above.

The researcher enhanced the quality of the study by using multiple methods from different sources of data. The researcher followed a systematic procedure for field work which involved ethical clearance before going to the field, pre-testing of the tools for data collection, recording the interviews and focus group data, taking detailed descriptive field notes to ensure everything is captured, and purposeful sampling to select knowledgeable participants for the study (p. 416). This systematic process ensured that high quality data was collected.

4.6.4 Systematic and conscientious analysis

The quality of research is also dependent on the nature and process of data analysis and interpretation done to arrive at findings. If case analysis is not done well and systematically, the interpretation will be faulty and, therefore, the findings and quality of research will be compromised. For this study, the analyst trained in qualitative analysis and read scholarly literature on the subject before going to the field to collect data. Based on the training and readings, the analyst prepared a data analysis strategy that was used for the study.

Data analysis started in the field. At the end of every data collection session, the analyst listened to the recordings and read through the field notes to identify key issues and reflect on what participants said and meant. The analyst also ensured that all data was properly protected with periodical backups of all recordings and field notes. The analyst dedicated time for transcription, interpretation and thematic analysis of the data.

Patton (2015) suggests a long checklist for qualitative data analysis, interpreting findings and reporting data. The checklist includes; keeping the analysis simple, presenting actual data for readers to experience first-hand, distinguishing description from interpretation and explanations, ensuring that the purpose of the study drives the analysis, being reflective and reflexive while analysing data, and documenting and reporting analytical decisions and procedures (p. 632). With this checklist, the analyst remained focused on the purpose and objectives of the study, and kept a record of all the analytical decisions and processes as already explained above.

4.7 Methodological Limitations and Delimitations

The main limitation of the proposed study relates to limited transferability of the themes emerging from the analysis, beyond the comparative cases (Makerere University and University of Dar es Salaam). The study was purely qualitative and it was limited to the African context; therefore, the findings cannot be generalised to other universities in other parts of the world. The conclusions are thus limited to the selected comparative cases, although universities within the same context and similar experiences might learn from the study findings and conclusions.

The study was limited to examining the university academic, research and community engagement programmes on climate change, the challenges faced in implementing these programmes, the success factors and ways of improving the university responses to climate change issues in their programmes. It excluded other issues of climate change education for sustainable development in higher education institutions.

4.8 Ethical considerations

Researchers have an ethical obligation to their colleagues, study populations, and the larger society since their work delves into the lives of other human beings (Bruce L. Berg, 2012). Researchers need to anticipate the ethical issues that may arise during their studies. They have to protect their research participants, develop the respondents' trust, promote integrity of research, and guard against misconduct and impropriety that might reflect on their institutions. Ethical issues arise in discussions about codes of professional conduct for researchers.

To ensure valid and reliable results, the researcher paid attention to ethical issues. Before going to the field for data collection, the researcher got ethical clearance from the Commission for Research Impact Assessment and Ethics of the Carl-Von-Ossietzky-University of Oldenburg, Germany. The study was also cleared by the Tanzania Commission for Science and

Technology (COSTECH) and the Uganda National Council for Science and Technology (UNCST). This ensured conformity with national and international legislations.

The researcher also adhered to issues such as; consent of participants and voluntary participation, autonomy of subjects and beneficence, so that the project acted in the best interest of participants, confidentiality and non-maleficence to avoid harm to subjects. These procedures were outlined in detail in earlier sections of this Chapter.

In general, the research was conducted based on ethical standards in research practice as outlined by Braun & Clarke (2013, p. 63). These included maintaining privacy and confidentiality; obtaining consent from participants; participants knowing their right to withdraw from research during or after; and awareness of professional ethics and standards in research.

Chapter summary

This chapter has outlined the research design and methodology followed in undertaking the study. The research objectives and questions, the philosophy that underpinned the study as well as the research design and strategy adopted have been clearly explained. The sampling strategy used to determine study participants, the data collection methods and instruments used, data analysis and interpretation processes, that enabled the researcher to arrive at the key findings has been exhaustively covered in this chapter. To ensure validity and reliability of findings, some measures were followed as explained above. However, the study had methodological limitations as well as ethical considerations, which affected its content and scope. The next chapter presents a description of the key findings for the Makerere university case.

CHAPTER FIVE: KEY FINDINGS FOR CASE 1; MAKERERE UNIVERSITY

Introduction

This chapter presents the key findings concerning Makerere University as a case study. It provides a contextual analysis of the case by highlighting the climate change situation in Uganda and the background information about the university. The action situation of the case that explains the key findings per theme is also discussed in detail.

5.1 Contextual analysis of the case

Uganda is a land locked country located in East Africa. It neighbours Kenya in the east, Tanzania and Rwanda in the south, Democratic Republic of Congo in the west and South Sudan in the north. The country lies between 10 29' south and 40 12' North latitude, 290 34 East and 350 0' East longitude (UBOS, 2016a). Uganda is characterised by beautiful landscapes, fresh rivers and lakes, wetlands, ever green grasslands and rich biodiversity in a favourable climate that supports rain fed agriculture (NEMA, 2016, p. 2). The country is endowed with various minerals such as oil and gas, gold, sand and uranium though the exploitation of these is yet to be fully realised. Uganda has a total surface area of 241,550.7 square kilometres with open water bodies covering 15.3% (36,527.4 square kilometres); wetlands covering 4,500 square kilometres while the land area is 200,523.2 square kilometres (UBOS, 2016b, p. vii).

The country is one of the few on the African continent with the highest levels of biodiversity with respect to "genetic, species and ecosystem levels" (p. 5). It is located in the tropics "with temperatures ranging between 21°C and 25°C in most parts other than the mountainous regions with lower temperatures." The annual rainfall ranges between 1,000mm and 2,000mm in most parts other than the north and north-eastern region (p. 4). It has rich cultural and tourism diversity including "more than 50 ethnic groups, languages, traditions, rainforests, national parks, wild life including mountain gorillas, fresh water lakes and rivers and diverse ecosystems" (ibid).

Uganda's demographics are characterised by an annual population growth rate of 3% with a total population of 34,634,650 according to the national population census of 2014 (UBOS, 2016a). The population density was 173 persons per square kilometre higher than Kenya (74), Tanzania (54) and South Sudan (18) in 2014. The largest population lives in the rural area with only 7,425,864 living in urban areas (p. 10). The overall sex ratio for Uganda was 94.6 in 2014 with majority of the citizens between 15 and 64 years at 49.2%. Uganda has one of the youngest populations in the world with 47.9% below 15 years of age. The overall dependency ratio in

2014 was 103, one of the highest in the region (ibid). The Total Fertility Rate (TFR) per Ugandan woman was 5.8 children in 2014 while the Infant Mortality Rate (IMR) was estimated at 53 deaths per 1,000 live births. The country's life expectancy was estimated at 63.3 years (p. 18).

In terms of economic outlook, Uganda's GDP was estimated to have grown at 5.2% in 2015/16 while GDP at basic prices was estimated at 77,780 billion Uganda Shillings and 398.3 million USD as reserves (UBOS, 2016b). The key economic sectors of the economy are agriculture, forestry and fishing contributing 23.6% to GDP; industry and manufacturing contributing 19.8% to GDP; services sector contributing 48.7% and trade in products contributing 7.9% to GDP (ibid). The headline inflation rate for the year 2015 was estimated at 5.5% mainly driven by food and beverage inflation. The trade balance for the country in 2015 was characterised by a deficit of $3,462.8 million with total export earnings of $2.666.1 million. The country's import bill was $5.592.4 million in 2015. Uganda's main foreign exchange earner was coffee followed by tobacco, tea and cotton while the major commodity imports were petroleum, vehicles, medical and pharmaceutical products, iron and steel, as well as cereals and cereal preparations (P. 100).

The climate change profile for the country

Uganda is one of the developing countries in Africa that are feeling the impacts of climate change given its dependency on rain-fed agriculture and natural resource based livelihoods. Niang et al. (2014) argue that "the equatorial and southern parts of eastern Africa have experienced a significant increase in temperature since the beginning of the early 1980s" while there has been "an increase in seasonal mean temperature in many areas of Ethiopia, Kenya, South Sudan and Uganda over the last 50 years" (p. 1206). The authors project that "maximum and minimum temperatures over equatorial eastern Africa show a significant increase in the number of days warmer than 2°C above the 1981-2000 average by the middle and end of 21st century." They anticipate an increase in temperature over the upper Nile region of between 2°C and 5°C at the end of the century (p. 1209). The authors pointed to "extreme precipitation changes" that have been observed across eastern Africa for some time. They report that "droughts and heavy rainfall have been experienced more than frequently during the last 30 to 60 years" and "projected increases in heavy precipitation over the region have been reported with high certainty" indicating "an increase in the number of extreme wet days by mid-21st century" (p. 1211).

GOU (2012) indicates that, "in East Africa, there is evidence of retreating glaciers, along with increased frequency and intensity of droughts, floods, heat waves and landslides" (p. 2). In Uganda, the ice cap on Mount Rwenzori has significantly melted (ibid). These have been key sources of water for communities around the slopes of the mountain. Rainfall is less, unreliable and unevenly distributed, while "floods and landslides are on the rise and are increasing in intensity" (P. 5). Also, droughts have increased especially in the western, northern and north-eastern regions of Uganda. The central region has equally experienced serious drought in 2016 (Ibid).

The Uganda National Climate Change Policy (2012) indicates that various factors make Uganda's economy vulnerable to climate change. These include reliance on exploitation of natural resources, particularly in the agricultural sector; heavy dependence on rain-fed agriculture; fluctuating agricultural sector performance; and a high annual population growth rate of 3.2%. Other factors include: high rate of poverty; low per capita income; low adaptive capacity; weak and inadequate infrastructure; inadequate supply of clean water and sanitation facilities; and inadequate availability of health and medical services (pp. 5,6).

Uganda ratified the UNFCCC on 8th September 1993 and the Kyoto Protocol on 25th March 2002. Due to these commitments, it has "benefited from funds and other support to facilitate mitigation and adaptation measures" (GOU, 2012, p. 2). The government approved the Uganda National Climate Change Policy (UNCCP) on 1st April 2015 to ensure that all actors have a "harmonious and coordinated approach towards a climate-resilient and low carbon development path for sustainable development in Uganda" (p. 10). The policy provides key priority areas to address climate change, including: climate change adaptation responses for each sector; climate change mitigation responses for each priority sector; the strategy for climate monitoring, detection, attribution and prediction; institutional arrangements as well as resource mobilisation for implementing climate change activities (ibid).

The Uganda Water and Environment Sector Performance Report 2015 indicates that for the FY 2014/2015 the country registered a number of achievements in climate change management. These include: development of institutional capacity for climate change management at ministry level; construction of the climate change resource centre and offices; development of the performance measurement framework for implementation of the policy; and establishment of knowledge base for climate change mitigation and adaptation in collaboration with MUCCRI. Others included: establishment of the Green House Gases (GHG) inventory office;

development of the climate change atlas landscape for Uganda; effective participation of Uganda in the COPs (COP 20, COP 21 and several ministerial meetings in Bonn and New York); and running of various projects on climate change. The projects include the Global Climate Change Alliance (GCCA) project, the Low Emission Capacity Building (LECB) project, and the Clean Development Mechanism (CDM) capacity development project. The sector also achieved a lot through conducting various assessments of the impact of climate change in Uganda with the support of development partners (GOU, 2015).

Background information about Makerere University

Makerere University is located in Uganda within the East African region. The university has several campuses in the country: the main campus located on Makerere Hill in Kampala City, the Mulago Hill campus for the College of Health Sciences; the Business School campus in Nakawa; Kabanyolo campus for the College of Agriculture and Environmental Sciences; and the Jinja campus located in Jinja town in eastern Uganda. The university has several establishments in various parts of the country including 45 acres on Mulago hill, 650 acres in Kabanyolo, 350 acres of farmland in Buyana, 250 acres of farm land in Nakyesesa and several health centres. It also owns several housing estates located in Kampala City (MAK, 2016, p. 1).

The university is affiliated to several training institutions in the country that run programmes certified by it. Among these include; Makerere University business school, National major seminary Kinyamasika, National Major Seminary Katigondo, National Major Seminary Ggaba, Mulago Paramedical School, Fort Portal School of Clinical Officers, and Masaka School of Comprehensive Nursing. Others are; Soroti School of Comprehensive Nursing, Jinja Ophthalmic Clinical Officers Training School, School of Psychiatric Clinical Officers, Health Tutors College Mulago, and Uganda Institute of Bankers. The university affiliates with; Nsamizi Training Institute of Social Development, Senior Military Staff College Kimaka, Sheikh Technical Veterinary School Somalia and Public Health Nurses College Kyambogo among others.

Makerere University is one of the oldest in East and Central Africa, having been established by the colonial government in 1922. The college initially offered programmes in medicine, agriculture, veterinary medicine, engineering and teacher training as an affiliate of the University of London until 1963. In 1962 Uganda and many East African countries got independence. Makerere College became a constituent college of the University of East Africa

in 1963. In 1970, the University of East Africa was dissolved giving birth to three independent universities: Makerere University in Uganda, University of Dar es Salaam in Tanzania and University of Nairobi in Kenya. Makerere University became an independent university established by an Act of Parliament in Uganda the same year (MAK, 2016, p. 1).

The university is organised into Colleges and Schools operating at the three campuses. Currently it has ten Colleges and several Schools in each College (MAK, 2016a, p. 2). The university's vision is "to be the leading institution for academic excellence and innovation in Africa." Its mission is to "to provide innovative teaching, learning, and research and services responsive to national and global needs" (Ibid). The current Strategic Plan 2008/09 - 2018/19 identifies several strategic goals that the university seeks to achieve. These are outlined below:

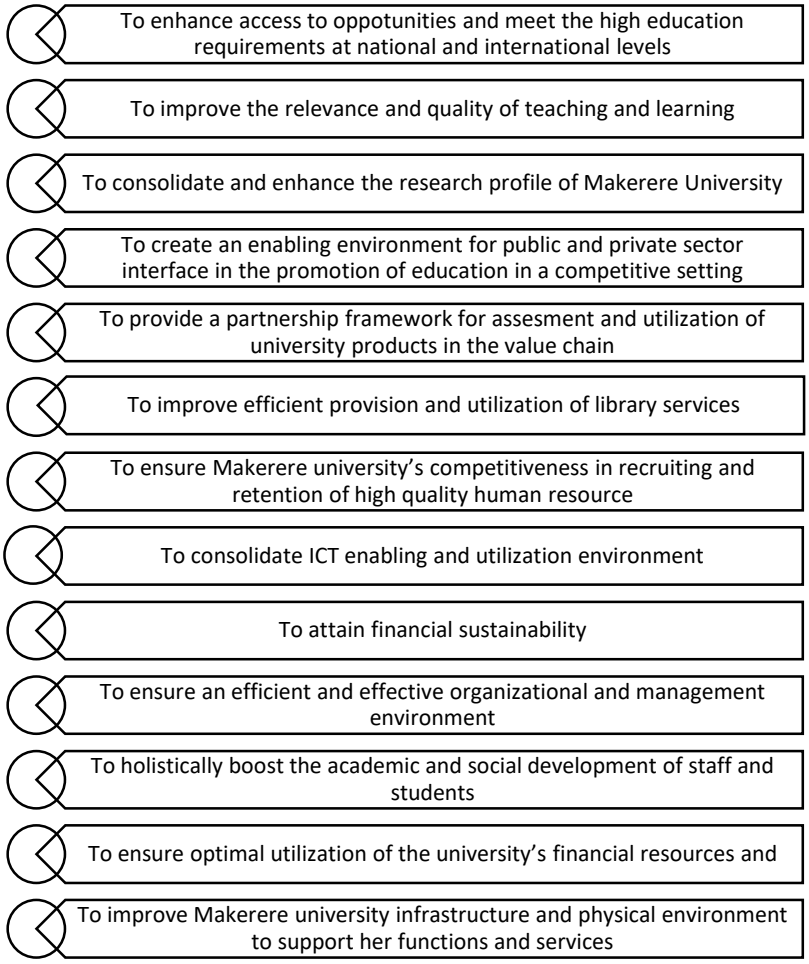

Figure 5.1: Strategic objectives of Makerere University; Source (MAK, 2008, p. 15)

Makerere University had a total of 275 academic programmes in the year 2016. Records indicate that the university had 16 ordinary diploma programmes, 134 Bachelor's degree programmes, 14 postgraduate diploma programmes, 103 Master's degree programmes and 8

PhD degree programmes (MAK, 2016, p. 8). By January 2016, the university enrolment was 39,546. Of these, 36,947 were undergraduate students while 2,599 were postgraduate students. For the academic year 2015/2016, 164 were admitted for PhDs, while 2,130 were admitted for Master's degree programmes. There were 160 admitted on postgraduate diplomas across Colleges. Of those admitted on postgraduate programmes in 2015/2016, international students were 267 (p. 10). The enrolment at Makerere University Business School totalled to 10,494 students both at undergraduate and postgraduate levels (MAK, 2015, p. 3). This puts the total enrolment for the entire institution for the academic year 2015/2016 at 48,102 students (ibid).

The university runs several programmes in collaboration with other universities. Records show that the university has been running the following since 2015:

Table 5.1; Joint collaborative programmes offered at Makerere University

S/No.	Programme	Partner universities
01	Chinese and Spanish language	Kenyatta university (Kenya), University of Dar es Salaam (Tanzania)
02	MSc. Natural production technology and value chain	Sokoine University of Agriculture (Tanzania), University of Nairobi (Kenya)
03	Masters of wildlife, tourism and recreation	University of Manitoba, Canada
04	MSc. Animal product, processing, and entrepreneurship safety	University of Rwanda (Rwanda)
05	MSc. International infectious diseases management	University of North Dakota (US)
06	BSc. Engineering	Belgorod Shukhov State Technological University (Russia)
07	One health residency programme	University of Minnesota (US)

Source (MAK, 2017, p. 18).

The university had 1,632 academic staff, 347 administrative staff and 1,554 support staff as of February 2016. The academic staff are ranked from Assistant Lecturer to Professor. Of the total number of academic staff, 26.7% are females while 73.3% are males. The institution had 96 full Professors, 149 Associate Professors, 200 Senior Lecturers and 472 Lecturers. The Assistant Lecturers were 515, while Teaching Assistants and Part-Time academic staff were 200. Analysis per qualification of academic staff shows that in 2016, 790 staff had PhDs, while 666 had Master's degrees with many of these enrolled on PhDs. The rest of the academic staff have Bachelor's and postgraduate Diplomas but working with the support of those with PhDs and Master's degree qualifications (MAK, 2016, p. 36).

In terms of research, the university agenda for the period 2013-2018 include;

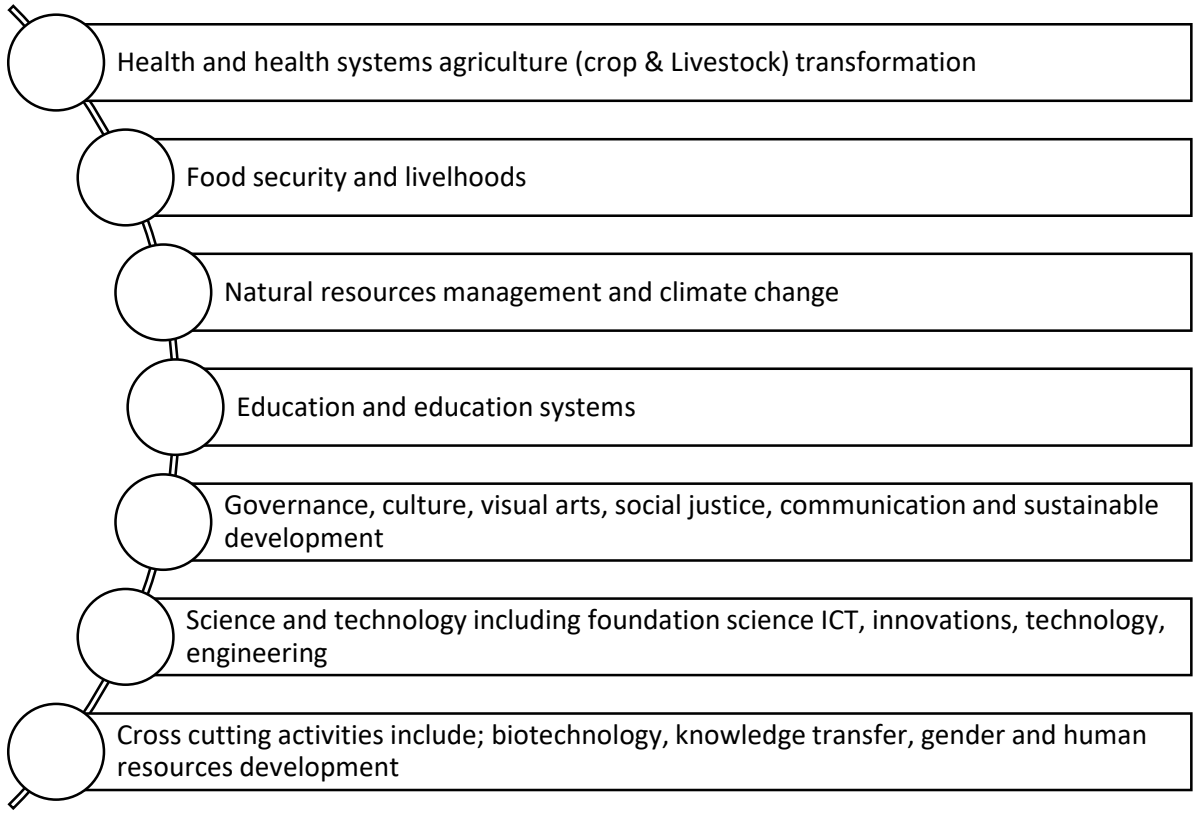

Figure 5.2: Makerere University Research Agenda 2013-2018; Source : (MAK, 2017, p. 20)

The research agenda above is supported by several policies and systems. These include the Research and Innovations Policy, the Intellectual Property Management Policy, the documented peer review systems, and the research management databases for monitoring progress of staff and graduate students' research work (p. 21). The university has increased its research capacity in terms of "volume and quality research output (ibid). It has had a

"significant increase in the volume of research evident from the rankings and number of publications in international research databases like the Elsevier/Scopus and Thompson Reuters/Web of science" (ibid). The university has been ranked by the Times Higher Education and Webometrics among the top 10 universities in Africa between 2011 and 2016. In 2013 it was ranked the 4th in Africa (p. 22).

Makerere University has enjoyed several research grants from the Bill and Melinda Gates Foundation, Welcome Trust grants, National Institute of Health US, the Centre for Disease Control (CDC) and Carnage Corporation of New York (p. 23). It has established several research networks including the following:

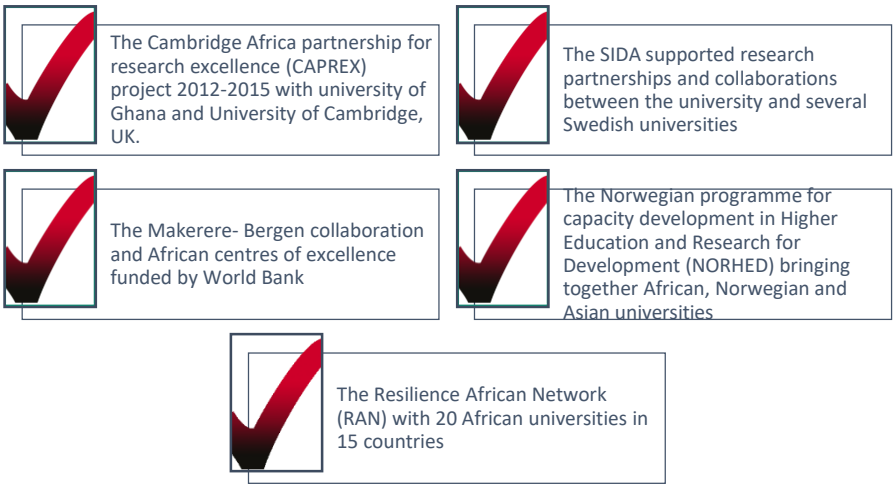

Figure 5.3 ; Makerere University Research networks; Source MAK (2017, p. 27)

The university has also been involved in various research and innovation projects over the years and there are notable research and innovations that have been achieved as shown below:

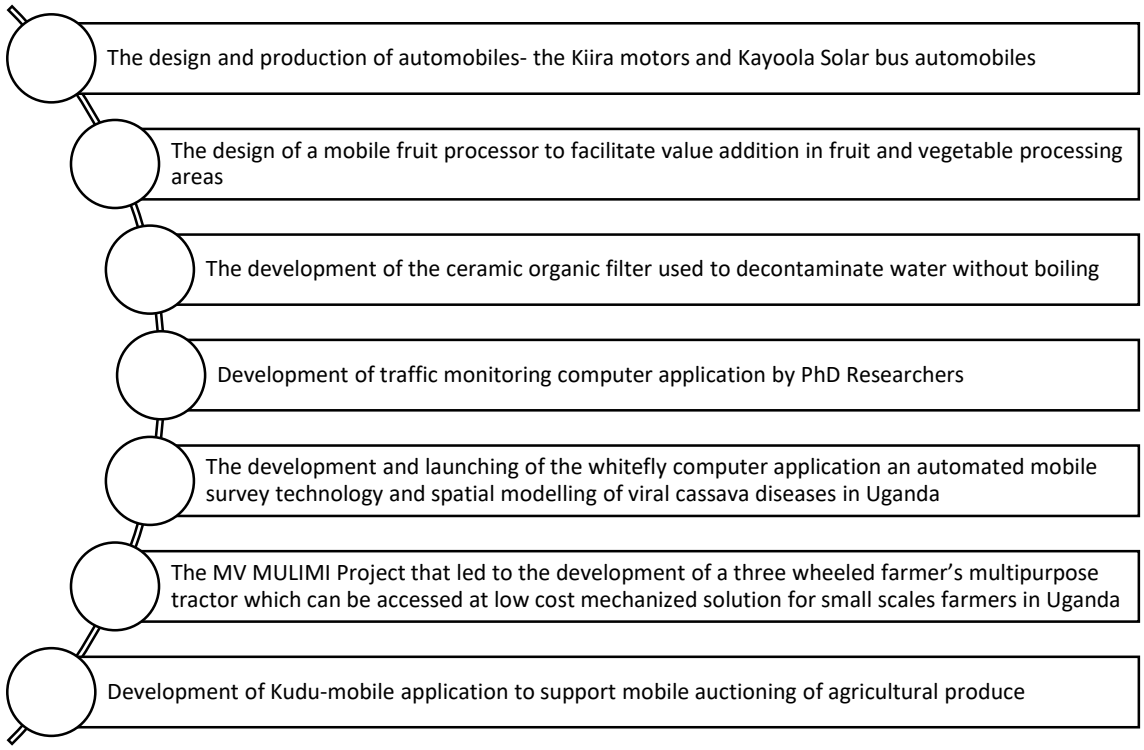

Figure 5.4: Makerere University notable research and innovations: Source MUK, 2017 (p. 13)

5.2 The action situation for case 1; Makerere University

This section presents the findings from the semi-structured in-depth interviews and focus groups conducted at Makerere University in Uganda. The findings are presented in themes and sub-themes answering each of the research questions. Each theme or sub-theme is explained in detail including excerpts from participants' views.

Table 5.2; Code structure for Case 1: Makerere University

Research question	**Themes and sub themes**
What are the current academic, research and community engagement programmes on climate change implemented by	**Theme 1**: **The role of the university and institutional support for climate change interventions** **Sub theme 1.1: The university in action** • A hub of knowledge generation on climate change • A home for training and capacity building on climate change • A house of innovation and technological solutions to climate change

the universities in selected cases?	• An epicentre of sensitizations and guidance on climate change phenomenon • A centre of action on climate change in communities **Sub theme 1.2: Institutional support for climate change interventions** • Strategic support • Administrative support
	Theme 2: University programmes on climate change **Sub theme 2.1 University training menu** • Short courses on climate change • Long courses on climate change • Undergraduate programmes on climate change • Postgraduate programmes on climate change **Sub theme 2.2: University research menu** • Climate change science research • Climate change mitigation research • Climate change adaptation research • Climate change policy research **Sub theme 2.3: The University goes out** • Mobilizing communities to deal with climate change • Providing onsite solutions • Introducing new products
What are the key challenges faced by the implementing units in carrying out programmes on climate change within the	**Theme 3: Enemies of progress to university climate change interventions** • Institutional barriers • Resource related impediments • Organizational environment related obstacles

universities in selected cases?	
What are the success factors that would support universities to adequately address climate change issues in their programmes on climate change and what can be done to improve the situation?	**Theme 4: Key drivers and current openings for our work** **Sub theme 4.1: Key drivers for our climate change work** • Internal influences • External stimuli **Sub theme 4.2: The current openings for our climate change work** • Legislation backup • The nature of the phenomenon • The conducive environment around us **Theme 5: Ways to do things better** • Training and capacity development improvement strategy • Research capacity improvement strategy • Community outreach improvement strategy • Institutional management improvement strategy

Theme 1: The role of the university and institutional support for CCE interventions

Box 5.1: Participant's views on the role of the university and institutional support for climate change education interventions

Sub theme 1.1: The university in action

- A hub of knowledge generation on climate change
- A home for training and capacity building on climate change
- A house of innovation and technological solutions to climate change
- An epicentre of sensitizations and guidance on climate change phenomenon
- A centre of action on climate change in communities

Sub theme 1.2: Institutional support for climate change interventions

- Strategic support
- Administrative support

The researcher asked participants to give their views on the role that Makerere University can play to address climate change issues and the institutional support it offers to climate change education programmes. This theme explores their views on these aspects. The findings on its role are presented in sub-theme 1.1 while those on institutional support are covered in sub-theme 1.2.

Sub theme 1.1: The University in action

The participants identified several roles of the university including generating knowledge on climate change, training and capacity building on climate change, advancing innovations and technological solutions to effects of climate change, conducting sensitisation and taking the lead in local adaption and mitigation initiatives at community level. These roles are explained in detail below.

a) A hub of knowledge generation on climate change

The participants viewed Makerere University as a centre for producing the much-needed knowledge on climate change through research. One of them argued:

> "We all know that universities being higher institutions of learning, they are centres with expertize to do research and bring out the real picture of what is happening because of climate change in the villages" [MUK GD22 PGD; Position: 18-18]

As the participant noted, the university has 'expertise' in terms of well-trained and competent researchers who can ably conduct research on various aspects of climate change. These experts can investigate its effects and propose mitigation and adaptation measures across various sectors of society. The university has the ability to "bring out the real picture of what is happening" regarding climate change issues, through research. It can make society aware of the situation including proposing measures to deal with the climate change effects in communities. Therefore, Makerere University can ably position itself as a knowledge hub on climate change in Uganda and Africa.

b) A home for training and capacity building on climate change

The participants identified training and capacity building as a key role that Makerere can play in addressing climate change issues. They called for integration of climate change in all programmes of the university to produce graduates who are knowledgeable in these issues. They recommended developing new programmes as a way of developing a pool of knowledgeable and competent human resource on climate change. One of the participants in a semi-structured interview said:

> "[A] university is the one producing the human resource for the country. So, a university by integrating climate change in its curriculum teaching and learning, would be able to produce the human resource that is responsive to the changes in climate change, and of course that would have a multiplier effect in the various sectors. So having or producing products or graduates who have some knowledge, some training on climate change, is…very important." *[MAK PA21; Position: 19-19].*

The participant argues that the university can train various climate change professionals by "integrating climate change in its curriculum teaching and learning" across programmes. Dealing with climate change requires a number of skilled and knowledgeable professionals in meteorology, geography, sustainable development, environmental science, disaster and risk management, policy analysis and sociology. These are specialised professionals that are needed by various sectors of the society and can only be produced by the university like Makerere University. The graduates would then support in mitigation and adaptation efforts. They can also support policy formulation and design localised solutions to problems associated with climate change effects in the areas they work in. Therefore, Makerere University can be a home for training on climate change but also developing its own capacity to deliver quality training.

c) A house of innovation and technological solutions to climate change

The university can advance innovations and technological solutions for climate change mitigation and adaptation in the society. One of the participants supported this notion when he said:

> "[W]e come up with new products and these can be used, for example, if there are new technologies for crops…as part of my PhD. We developed the first sweet potato crop model to test how sweet potatoes are likely to be impacted by climate change in East Africa. This is a process-based model. So, some of those tools are very relevant to addressing the impacts of climate change. So, education has a huge role to play. Without it you really have no base to use to make any progress". *[MAK PL21; Position: 23-23]*

The participant stresses that the university can support in introducing new products through its research and innovation programmes. The university can invest in technologies that help in mitigating climate change induced hazards and dealing with its disastrous effects. Such technologies can be useful in sectors such as housing, transport and communication. Innovations and technological solutions tailored to local conditions would go an extra mile in supporting mitigation and adaptation to climate change in communities around the university.

d) An epicentre of sensitizations and guidance on climate change phenomenon

The participants recommended sensitisation on climate change as a key role for the university. The university is well placed to supply communities with the much needed information which is generated through research. One of them argued:

> "The first one [is] sensitisation, because these are centres of learning where people come from various regions of [the] country, different places, different countries. And therefore when all these people come to universities they can go with this knowledge, and become agents, therefore spreading this information when they go back to their places of origin. So universities can be centres of sensitisation. This is one key role. To solve a problem, you must first identify it and this has already been done by scientists but its currently the literate who know about it. The communities need to get to know about it and universities can play the sensitisation role". *[MAK GD22 PGD MAK; Position: 16-16]*

The participant underscores the importance of making citizens knowledgeable on climate change so that they can go back to their communities and spread the message. Most of the students who come to the university are youths and therefore targeting them is an important strategy for the sustainability of climate change interventions. The same participant argued that universities could provide guidance to government on climate change:

> "I see universities acting as centres of guidance to national programmes, where they can come up and advocate for appropriate means of mitigation and adaptation to climate change. Here we see them suggesting various options and alternatives to reduce on the impacts of climate change and also to suggest options that may lead to invention of new technology, that can assist and removal of what is existing and causing danger to the environment". *[MAK GD22 PGD MAK; Position: 17-17]*

The participant talks about the university being well placed to guide various stakeholders at different levels on policies, interventions, technology and other available options in dealing with climate change phenomenon.

Universities collect empirical evidence on climate change through research and they have expertise in several disciplines related to climate change. Therefore, they are key sources of reliable information to individuals, institutions and governments. Through policy dialogues and sensitisation workshops, the university can ably engage actors and stakeholders in climate

change interventions to enable them make informed decisions and take actions based on evidence.

e) A centre of action on climate change in communities

African universities can intervene by practically providing solutions to communities through community-based initiatives. One of the participants reported that the university had been engaged in activities on climate change within the local communities:

> "There was this programme of collecting plastic bottles, it was I think by environment or geography students who were working on that programme. It was collecting bottles around Kampala city, I think they even they even made a festival on that in the Kampala city. So it was like collecting bottles and then using them to make other things and not making them to remain on ground to cause other problems. Like there were some houses built using plastic bottles, and then used in filtering water and all that. So I got to know about that project, and due to shortage of time, I got, I tried to participate in it but I didn't reach the end point of it". *[MAK GD21 UG MAK; Position: 48-48]*

The participant emphasises that universities should leave their comfort zones and go to communities to carry out community projects focusing on climate change issues. She reported that the students participated in a programme on recycling plastic bottles collected from Kampala City and that some were being used to build houses. The other participant talked about the university engaging in dealing with "adaptation and resilience" in Karamoja region:

> "We provided a lot of technical backstopping to the GIS team in Karamoja sub region in order to deal with the drought systems, in order to deal with adaptation and resilience programming in that area. So we are looking at some of the livestock species, like camels and so forth. These are livestock species that are resilient to climate change and am more adaptive to drier conditions. All these, we facilitate the processes". *[MAK PR21; Position: 31-31]*

The university can take the lead in promoting such community initiatives on climate change. It could engage in local initiatives on renewable energy, monitoring resource depletion of essential ecosystem resources, production of climate friendly fuels and encouraging sustainable production techniques in the communities. By doing this, the university will become a centre of action on climate change issues.

Sub theme 1.2: Institutional support for climate change interventions

The researcher did ask participants to report on the kind of institutional support that Makerere University provide to support implementation of climate change education programmes. This sub theme explores participant's multiple realities and views regarding the nature of support offered. Based on the researcher's analysis of the data, institutional support for climate change education has been categorised into; strategic support and administrative support. These are explained as follows;

a) Strategic support

This category of institutional support relates to climate change interventions as well as actions by the institution's top management. At strategic level, participants identified inclusion of climate change interventions as one of the strategic intentions; the institutional arrangements to support climate change programmes; and the deliberate efforts to create strategic partnerships and collaborations for climate change interventions. A participant noted:

> "I would say they are fully supportive. When you look at the research priorities of the university, then climate change is among them. Meaning, it is already captured at a strategic level of the university." *[MAK PL22; Position: 29-29].*

As mentioned by the participant above, the university has climate change as one of the research priorities. This is a strategic move to show stakeholders that research on climate change is key and needs to be given maximum attention in terms of funding, management and administrative support. It also indicates that climate change research is an area for reporting and ensuring related performance indicators are delivered.

Another participant argued that the establishment of the Makerere University Centre for Climate Change Research and Innovation (MUCCRI) was a strategic action for climate change education. The Centre was established to coordinate climate change research, support teaching and training as well as community outreaches. In his own words he said;

> "I think I had partly mentioned that, ahmm there are quite a lot of reflections on, one is institutional arrangement. This Centre (MUCCRI) is one of the efforts and is one of the institutional arrangements to make sure that the university serves as one gateway to link to the communities that need knowledge, skills and research projects that can support people who are involved in dealing with the change in climate. So to that end, there is

an institutional arrangement making an effort that is in place." *[MUK PA22; Position: 29-29]*

This is a strategic support mechanism too for climate change interventions at the university.

b) Administrative support

Administrative support refers to all actions of the university management to implement climate change interventions. The researcher was interested in finding out participants' views on the provision of infrastructure and facilities, equipment and funding for these activities. Participants were asked about the effectiveness of administrative processes and systems to ease the implementation of climate change interventions at the university. Some participants reported about this kind of support when they said;

"I have no reservations, the management is supportive of the training as well as the research." *[MUK PL22; Position: 31-31]*

"ahmm the university has a centralized system of managing these projects. So it helps us on the financial bit, managing the finances, making sure that the finances are available when we need them. We could have a few challenges, and fail to get them in time, but the university manages the finances. But also providing the office space, and other facilities, so ahmm." *[MUK PL21; Position: 45-45]*

As shown above, the university management 'is supportive of the training as well as research on climate change'. The support is through efficient management of finances, providing office space and other facilities. The other participant added that;

"At least the university provides the facilities, like you know the office space, labs, the time and at least supervision time and the students are our students here in the college, so I don't know whether that is the contribution." *[MUK PL24; Position: 27-27]*

One of the participants, however, reported that there are challenges such as late disbursement of funds for the programmes, which affects implementation. This could be improved by the university management providing funds on time for the programmes to be implemented as scheduled. Administrative support makes it easy for implementers to do their work smoothly without delays and to achieve the objectives of the interventions.

Theme 2: University programmes on climate change

This theme covers findings relating to current university interventions on climate change at Makerere University. Participants were asked to report on the existing academic, research and

community engagement interventions on climate change implemented by the university. The theme has been categorised into three sub-themes as shown in the table box below;

Box 5.2; Participants views on the university programmes on climate change education

Sub theme 2.1 University training menu

- Short courses on climate change
- Long courses on climate change
- Undergraduate programmes on climate change
- Postgraduate programmes on climate change

Sub theme 2.2: University research menu

- Climate change science research
- Climate change mitigation research
- Climate change adaptation research
- Climate change policy research

Sub theme 2.3: The University goes out

- Mobilizing communities to deal with climate change
- Providing onsite solutions
- Introducing new products

These are explained as follows;

Sub theme 2.1; University training menu

One of the functions of a university is teaching and training. Participants were asked to report on training or academic programmes on climate change offered at Makerere University. Through document review, the researcher analysed the university training structure and the findings indicate that training is at a level of short courses and degree programmes on various aspects of climate change. This sub-theme presents findings from interview and focus group data regarding training on short courses, undergraduate and postgraduate programmes on climate change offered at the University.

a) Short courses on climate change

The Makerere University Centre for Climate Change Research and Innovation (MUCCRI) and different departments have developed short courses on climate change for specific groups of

students, professionals and actors. Findings indicate that some short courses are organised by the departments for a week or two targeting students of various courses specifically to create awareness about climate change. These have been developed linking climate change to specific sectors such as agriculture, mining, transport and industry. Other short courses are run on ad hoc basis depending on demand and in response to participant needs. These have been majorly run by MUCCRI in collaboration with other partners and have attracted policy makers and professionals in different fields. One study participant noted:

> "Well, in terms of short courses, these are demand driven, and so we have some which are much more like fixed orientation, but they are designed in a way that they must be responsive and dynamic. The intension for short courses is to really be very responsive in terms of what is available information and what are the needs that stakeholders for instance would want to have. Yes, but those are some of the examples. We also have those that are targeting policy, ahmm targeting farmer focused trainings, and so on and so forth." *[MUK PA22; Position: 43-43]*

The participant reports that short courses on climate change at Makerere University are demand driven — they depend on the knowledge needs of the target group. As one respondent said, the short courses are offered to external participants ranging from "government workers at central and local government, they can be practitioners of NGOs, development partners, with academia [and] researchers." *[MAK PA21; Position: 15-15]*

b) Long courses on climate change

Other than short courses on climate change, the university has many long term courses on climate change that are taught in certain programmes within the College of Agriculture and Environmental Sciences (CAES). Document review revealed that these courses are integrated within programmes such as BSc. Geography, BSc. Forestry, BSc. Agriculture, MA, Geography and MSc. Environmental Management. These courses run for a semester within a certain undergraduate or postgraduate programme on areas related to climate change. One of the study participants explained:

> "[W]e have courses integrated within university programmes. So we have courses…focusing on climate change science, courses dealing with climate weather and atmospheric processes, we have energy, environment and climate change, climate change and forestry. So all the various programmes have those courses integrated, but we have one specific one which we have proposed, it is a university wide course, and the course is weather atmospheric processes, and that course, the intension is that it can

have some minor modifications for those who want to modify a bit but we think that the whole university should do similar to course like Gender and development communication that are taught across all programmes". *[MAK PA22; Position: 45-45]*

As indicated in the excerpt, the university has developed a university wide course on climate change that will run across all programmes in the university. This is a good idea because it will ensure that all students studying various programmes get a dose of climate change knowledge, skills and attitudes. Such a course will empower students to take responsible actions on climate change wherever they will be.

Another participant talked about mainstreaming climate change in all programmes at the university:

> "We had a project that was looking at mainstreaming climate change in all college programmes. So we did that, we looked at the different college programmes, and we developed 2 course units which are common, which are taught across the college, addressing basic issues of climate change, climate and weather, and all those things." *[MUK PL23; Position: 27-27]*

The participant indicate that a lot has happened in the university focusing on integrating aspects of climate change in various programmes. He, therefore, recommends curriculum review and retooling of academic staff on those programmes in order to enhance the teaching and learning on climate change in the university.

c) Undergraduate programmes on climate change

The researcher was interested in participants' views and perspectives regarding undergraduate programmes on climate change offered at the university. Based on document review, undergraduate programmes are to introduce professional training to fresh secondary school graduates. These often have a component of field work and research which introduces students to the world of work and practice. One participant explained:

> "Where you are, is the meteorological unit of the department of geography, informatics and climate science, where we run two programmes, the BSc in meteorology and the postgraduate diploma in meteorology. In those 2 programmes, the climate change component is a thread, that runs through."

The excerpt above points to the existence of a BSc in meteorology and a postgraduate diploma in meteorology that have a significant amount of knowledge on climate change. This is a good step by university towards addressing climate change issues. The participant notes that the

climate change component is a thread that runs through the two programmes in meteorology offered at the university. It is expected that the graduates from these programmes are professionals who will entirely work on weather stations, supporting predictions and forecasting as well as producing climate information at various levels.

d) Postgraduate programmes on climate change

Participants highlighted several programmes ranging from the Postgraduate Diploma in Meteorology, MA in Geography, MSc. in Land use and Regional Development to the PhD in Geographical Sciences. These are currently running. They also mentioned several postgraduate programmes that have been developed and are going through the approval process. These include MSc. in Disaster Risk Management, MSc. in Climate Change and Sustainability, and MSc. Meteorology, as one participant explained:

> "We have also proposed some new programmes, a programme in climate change and sustainability, it has not yet been approved by the university but, it was passed by the department, school and college. So we are waiting. And when its approved, it will be a standing programme on that." *[MUK PL22; Position: 39-39]*

The participant reports that one of the proposed postgraduate programme is a Msc climate change and sustainability, which is yet to be finally approved by the university. According to him, the preliminary approval at the department, school and college level was already done and the programe awaits approval by senate. Another participant reported that a new Master's programme in Disaster Risk Management has been proposed and was meant to have been advertised in 2017. However, he noted that the Senate had not yet approved it, which has caused the delay in rolling it out. In his own words he said;

> "The other is, that we have also structured a masters in disaster risk and management that we hoped would be approved by this year, so that it could be advertised. But unfortunately senate has not done its role. Hopefully again, next year we will have that programme approved. Disaster risk management and climate change are just like brother and sister. So there are several climate change elements in the disaster risk management programme. We have funding from SIDA and the project which runs up to 2019." *[MUK PR22; Position: 19-19]*

The proposed new masters in disaster risk management programme according to the participant contains 'several climate change elements' and therefore it is expected to empower students on these elements making them more knowledgeable on climate change. The participant reported

that this programme is funded by the Swedish International Development Agency (SIDA) till 2019. The other participant mentioned that;

> "there is a PhD programme being worked on in climate risk management, and in the department of geography there are several course on climate change" *[MUK PR21; Position: 33-33]*

This is a very good step towards addressing climate change in their academic programmes and enhancing research on the subject. The proposed PhD programme will develop a pool of academics in the area of climate change and risk management at the university.

Sub theme 2.2: University research menu

Research is a core activity of a university. Universities are usually rated based mainly on their research visibility in high impact journals and citation indices. Both students and faculty engage in research on various disciplines. The research undertaken often is published in academic journals, although most student theses and dissertations end up in the university library.

This sub-theme attempts to present findings on the research programmes undertaken by Makerere University on climate change and related aspects. The theme has been split into four categories as shown below;

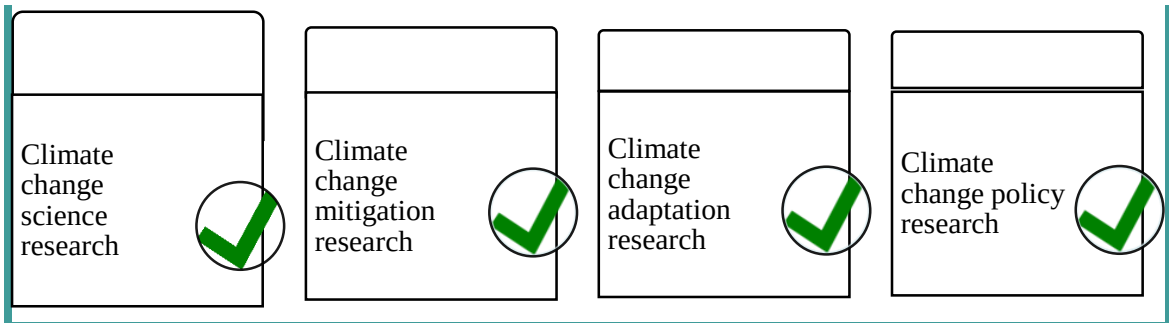

Figure 5.5; Categories of research on climate change undertaken at Makerere University

a) Climate change science research

The researcher was interested in finding out which climate change science aspects are being researched on at Makerere university. One participant explained:

> "[A] big chunk of what we have to do and science means we have to conduct research in these fields to understand the processes, to down scale or understand climate change at the lowest level possible. We have to look at impact across different sectors, but also

> look at may be innovations. … [W]e have been doing weather-related prediction studies across Uganda ". *[MUK PL22; Position: 25-45]*

The participant reports that the researchers at the university are engaged in conducting research on climate change to understand processes, the scale and impact across different sectors. They conduct research on the various innovations that have been advanced to deal with effects of climate change. She reported that they have been doing weather related prediction studies across the country. This kind of research enables academics to provide scientific evidence on the reality of climate change and its effects on the ground. Another participant supported this when she reported:

> "The other is for Karamoja region, we are contributing monthly weather bulletins for the sub region. But the argument is that local government in the sub region are saying that these may not be useful. Because we have our own indigenous knowledge system, around which we can forecast weather. And we are saying how then can we develop or draft a policy around indigenous knowledge to drive weather forecasting practices for the sub region." *[MUK PR22; Position: 59-59]*

As seen above, the university has been conducting weather forecasts and producing monthly weather bulletins for Karamoja sub-region. This is useful especially for the local farmers in that region that require weather information to make decisions related to their farm work. However, the participant notes that local governments in the sub-region do not see these bulletins as very useful because they are not related to their indigenous knowledge systems around which they have always done weather forecasts. This has made university researchers find ways of integrating indigenous knowledge into the weather forecasting at the regional level. Based on this experience, they are thinking about developing a policy around indigenous knowledge to drive weather forecasting practices for the sub-region.

Based on document review, the researcher discovered that the university has a weather station and a meteorological unit with equipment and facilities to do climate change science research and generate predictions and forecasting. However, they do not have government permission to disseminate weather forecasts and predictions. Therefore, the unit is working with the Uganda National Meteorological Authority (UNMA) which produces and disseminates such information. This is a good step in supporting adaptation to climate change.

b) Climate change mitigation research

This category relates to research programmes and projects that are solely focused on climate

change mitigation. The researcher was interested in finding out the current research programmes and projects on climate change mitigation and the specific aspects covered by such research. One of the participants noted;

> "hmm, mitigation is always a challenge and it is not just on our own, I think it is also related to the global setting that in Africa here, even the funding for mitigation is quite less compared to the funding for adaptation." *[MUK PL22; Position: 53-53]*

In the excerpt above, the participant reports that mitigation interventions have always been a challenge because funding for mitigation has not been adequate especially for African countries. Indeed, mitigation interventions have always been a challenge in African countries because of funding. In developing countries, mitigation seems to be non-existent. The respondent noted that even globally, funding for mitigation is minimal.

c) Climate change adaptation research

The category relates to research programmes and activities on climate change adaptation. The researcher wanted to find out the specific areas of adaptation research that is undertaken at the university. One of the participants explained;

> "[T]here is reasonably a lot of work that has much been focused on [the] cattle corridor of Uganda. I think…for obvious reasons. [F]or the mountainous ecosystems, it is the most sensitive ecosystem. So there is quite a lot of work that has been done with specifically to agriculture, where people are looking at the interfaces between the predominantly livestock dependent and ecosystem dependent livelihoods. Quite a lot of work has been done " *[MUK PA22; Position: 63-63]*

According to him, research has focused on the interface between livestock farming and climate change as well as livelihoods in the cattle corridor. In support of the above, another participant noted that there are many research projects such as the climate change and resilience project in Karamoja; perceptions and adaptations in highlands; landslides and climate change in mountainous areas; and climate change and adaptive crop species. She noted that;

> "There are so many research projects. We have projects all over. We have climate change and resilience project in Karamoja, we have perceptions and adaptation related project in the high land parts of Uganda." *[MUK PL22; Position: 45-45]*

According to this participant, all these are focused on promoting adaptation especially in relation to agriculture, livelihoods and safety of the communities in various parts of Uganda.

d) Climate change policy research

The researcher was interested in finding out the various climate change policy related research activities and programmes undertaken at Makerere university. Responding to questions on this category, one participant said:

> "[W]hat I know is that there are hundreds of policy briefs. This is one of the common things that people are doing from their research pieces. All the research pieces I have mentioned; …one research project comes out with more than one policy brief. So there are quite a number of policy briefs that have been written targeting different sectors, ranging from road sector, those linked to Kampala [Capital] City Council especially linked to climate change policy, strategy, all these have been informed by our research." *[MUK PA22; Position: 67-67]*

The participant indicated that the faculty has conducted several research projects on climate change policy related issues and produced 'several policy briefs' to inform policy makers on these issues. The policy briefs were compiled specifically to engage the decision makers on climate change policy and strategies that could be developed for the respective sectors. The policy briefs produced periodically would be very useful in informing policy makers and actors to make decisions.

Sub theme 2.3: The University goes out

This sub-theme explores the various ways in which Makerere University has been engaged in community interventions on climate change. The sub-theme covers mainly three categories of community programmes as outlined below;

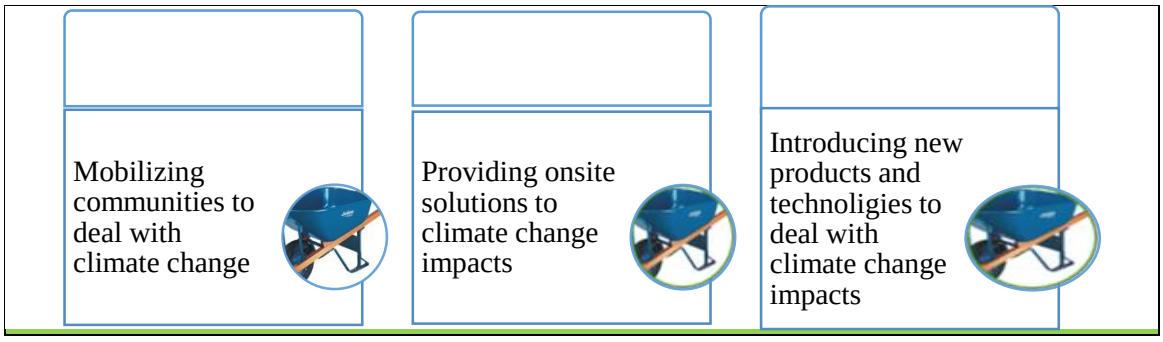

Figure 5.6; Categories of community engagement programmes on climate change at Makerere University

a) Mobilizing communities to deal with climate change

This category relates to activities and programmes the university has undertaken in mobilising communities to deal with climate change effects. One of the participants explained:

> "[L]ast year…I managed to participate in the festival, plus some students from forestry and it was about climate change. We presented about climate change at the festival and it was one of the ways of creating awareness about climate change to the general public, because that was the only place that people had gathered " *[GD21 UG MUK; Position: 50-50]*

The participant who is a student reports that the univesity organised a festival where students from the the school of forestry participated and made various presentations about climate change. According to her, the festival was "one of the ways of creating awareness about climate change to the general public" since it attracted many people to attend. According to the participant, through such festivals community members get to know about climate change and how it affects them. They also learn about the available mitigation and adaptation measures. The festival can be handy in opening up opportunities for university researchers to interact with the communities.

Another participant reported about the outcomes of the university community outreach programmes:

> "Others have started centres where they offer trainings, others have been able to initiate tree planting practices that integrate both adaptation and mitigation practices, just out of that knowledge. Others have become media champions where they have been able to host local language focused programmes and yeah. Those are some examples of outcomes of our community outreach programmes. But there are many examples." *[MUK PA22; Position: 85-85]*

The participants contends that the members of the community who participated in the university community outreach programmes like the festival, have gone back to their communities and came up with various initiatives. According to him, some of them "started community centres where they offer trainings" on climate change. This is a very interesting outcome of the university interventions since it promotes sustainability of the programmes. Initiating tree planting practices that integrate adaptation and mitigation practices is also a good outcome because it shows the change in behaviour and practices of the communities as a result of acquiring information on climate change during the festival.

Another form of reaching out to the community is identification of climate change champions within the communities. One participant reported that;

"….we identified champions who are linked with communities, influential members in the communities, especially those ones linked to agricultural sector. When we identify these people, we invite them to equip them with relevant knowledge around climate change, we want to raise their interest but also try to see how the general picture of climate change can be linked to what they are grappling with in terms of impacts. So that one we can identify areas in which we can investigate to support their areas, but also for them to know what they expect from us in terms of information, skills, innovations, things like that." *[MUK PA22; Position: 77-77]*

The act of identifying and empowering individuals dubbed 'climate change champions' in the community is a very interesting intervention by the university. The champions can ensure sustainability of climate change activities in the communities since they are part of the communities.

Available data points to several activities being done and many of these are part of research projects undertaken in those communities. The university organised festivals, established climate change champions across the country and it has been engaged in other activities with the communities all tailored towards mitigation and adaptation. The key challenge mentioned by the participants, however, is that these engagements are not fully developed and well planned. As one participant observed;

"….The trouble is that, our community engagement programme, is not fully well developed. It is not coordinated by one single unit. So each research has a component here and there. So in that way, we kind of tend to lose out the totality of the community engagement. But certainly, it is one of the things that need to be worked on." *[MUK PR21; Position: 63-63]*

The university needs to address this challenge by adopting a comprehensive community engagement programme, which is well planned and funded.

b) Providing onsite solutions

This category relates to programmes implemented by the university specifically to provide onsite solutions to effects of climate change for communities. The researcher was interested in finding out what implementing units at Makerere University are doing in this regard. One participant cited several examples of such programmes:

"Like we have worked in the landscape of mountains, mountain landscapes in Kapchorwa, to address issues of degraded landscapes, to restore them. There are

colleagues who have worked in Karamoja to understand the dynamics of grazing, forage availability, and things like that. In all these, we have been working with communities. We have worked on some water management measures, to try and understand the losses from different management practices, and you advise accordingly showing farmers how much they are losing with an idea that can make a difference." *[MUK PL22; Position: 57-57]*

The participant highlighted that the university has been working on water management practices, landscapes in Kapchorwa and supporting pastoral communities on how to manage forage for their animals in the face of climate change. All these activities are solutions to serious problems in communities which are related to climate change.

c) Introducing new products

This category relates to the new products that the university has introduced to the communities to help deal with climate change effects. These include introducing drought escaping technologies and early maturing crops in communities. One of the participants reported;

"On mitigation and adaptation, ahmm, I know for example for programmes where am directly involved, ahmm, for adaptations we always come up with especially in agriculture, we have done several where we introduce like drought escaping, technologies, early maturing kind of crops. So varieties which are really drought tolerant for example sweet potato, cassava." *[MUK PL21; Position: 61-61]*

Such products come out of research and advancement in technology by the university faculty. The communities that receive these products are able to use them and mitigate the effects of climate change.

Theme 3: Challenges faced by the university in implementing CCE interventions

Box 5.3: Participant's views on challenges faced by implementing units of climate change education interventions at Makerere university

Theme 3: Enemies of progress to university climate change interventions

- Institutional barriers
- Resource related impediments
- Organizational environment related obstacles

Makerere University face challenges as it implements its programmes on climate change. The researcher was interested in exploring experiences, perceptions and views of participants on

the key challenges that affect the university in addressing issues of climate change in its programmes. This theme covers the critical challenges that were identified by participants and these have been categorised into three:

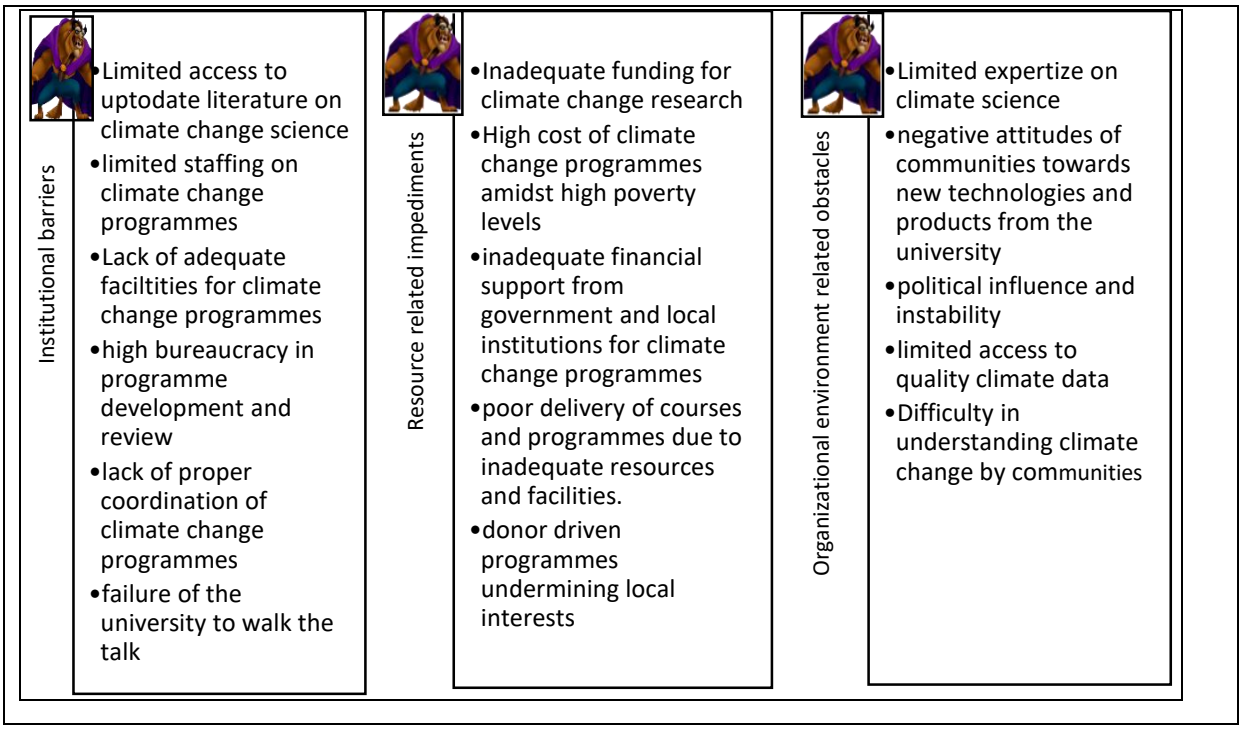

Figure 5.7; Key challenges affecting climate change education programmes at Makerere University

a) Institutional barriers to climate change interventions

This category of challenges arises from institutional failures and weaknesses that hamper the success of climate change interventions in the university. These are constraints to climate change programmes that are within the control of the institution as a whole although they are often difficult to deal with since the institution is larger than the programmes it offers. Some of these may be related to external factors like funding, political interference, government policies and culture, general society culture as well as mindset. The participants reported various challenges including limited access to literature and reference books; limited staffing on climate change programmes; lack of adequate facilities; and busy lecturers who are not accessible to students.

Participants argue that limited access to literature and reference books on climate change science is an institutional issue. This is because the university is responsible for purchasing learning materials and ensuring access to adequate and relevant scientific literature for training and research on climate change. However, often due to limited funding, the university is constrained and may not be able to play this role. A participant noted:

> "The problems I see with research, may be the availability of research books in the university. As we said our course is new and books are not very many at the moment, so we resort to using internet, but there are other things that really require using hard copies for references. Because these things you need them each and every day. The second thing I would see is the data access. Data access like satellite data, there are some programmes for satellite data which are not available and you have to really go, it is bureaucratic to get them, yeah" *[MUK GD21 UG MUK; Position: 44-44]*

The student participant illustrates the challenge of accessing reference books on climate change as a key one hampering the courses and programmes like Meteorology as well as research. This greatly affects students' research. She reports that even when they are referred to the internet for additional information, the source is not satisfactory in terms of the knowledge they need to undertake their courses or research. This is a serious challenge especially to the students and faculty involved.

The other serious challenge that was pointed out by the participant is limited access to climate change data. According to her, accessing satellite climate change data is difficult for students since the university has no such programmes to make it accessible. The participant reports that one way of accessing such data is to go to government agencies like Uganda National Meteorological Authority (UNMA) where the bureaucracy restricts students' access to information. These are serious challenges that affect climate change interventions especially training and research at the case university.

Limited staffing and busy lecturers who are not accessible to students are somehow related. The participants argue that most of the lecturers on the climate change programmes are too busy for students to have one-on-one interaction. One participant said:

> "Among the challenges we face is busy lecturers. They fail to give us ample time to effectively fulfil the course requirements. For instance, our department has a weather station. But at undergraduate as we were studying climatology either at introduction or an advanced level, we were never introduced into weather station and when you keep on reminding the person in charge, he or she tells you she has no time for that. What is taught in class many times is not related to what happens outside. Practical access to various equipment used in studying the phenomenon can be helpful in building our

capability and advance our knowledge. But most of such equipment is not accessible to us." *[MUK GD22 PGD MUK; Position: 28-28]*

The busy lecturers could be due to heavy workload since they are few and they have to engage in teaching, research and community outreaches. However, another participant mentioned that the remuneration for academic staff is still low and they have to do additional private work to make ends meet. This state of affairs compromises the quality of teaching and research since the volume of work to be done is constrained. Regarding the challenge of limited staffing a participant commented:

> "[T]here are some cases, you come to school you know, they are going to teach you for the first three weeks and the next weeks they are not there. But we understand that because the course is new. So we at times adhere to the situation, but there are times we get fed up… But apparently our lecturers really teach [well] if they get the time to teach us. They do it so perfectly. They give you everything in blue print." *[MUK GD21 UG MUK; Position: 31-31]*

The student participant reported that sometimes they miss classes due to limited number of academic staff. The challenge seems to step from meagre resources in the university that impede recruitment. To justify the challenge, another participant noted that:

> "Now there is this issue I talked about, that we get staff from the different units, so you sometimes may need staff and they are occupied elsewhere. And sometimes the funding organizations may not be willing to give funds to already existing staff, they say but these are already staff of the university. We have had a few challenges with some of the donors who want to give us consultants, and we have told them we do not accept consultants in the university because the university is made up of consultants and they say but we can't give you money. And many times we have said, remain with your money. So we have those challenges." *[MUK PA21; Position: 57-57]*

The other challenges identified under this category include high bureaucracy in programme development and review, lack of proper coordination of efforts of various stakeholders, conflict over who to host climate change programmes and courses, scepticism among staff about climate change and negative mind-set among staff. These challenges are institutional in nature and greatly affect the work and activities of climate change education initiatives at the university.

The participants reported that a lot of effort has been put in to develop new programmes on

climate change ranging from masters to PhDs but the process of approval is too long stretching to over two years. This is a bureaucratic challenge that is within the control of the institution but by its nature as a public institution, it is not easy to deal with. One of the participants said:

> "In terms of developing curricular and reviewing curricular, you know that universities are so bureaucratic. For you to be able to develop new curricular and have it accredited, it takes a number of years and some of these programmes have taken three to four years without being accredited. But for the new universities that don't have a lot of bureaucracy do it in months and have their new programmes accredited." *[MUK PA21; Position: 55-55]*

The participant notes that high bureaucracy hampers progress and timely implementation of programmes. It also demotivates staff who are putting in a lot to cause a serious positive change on society. According to him, it takes 3 to 4 years to have a new programme accredited. This delay affects the review of existing programmes to integrate and mainstream climate change courses.

Lack of proper coordination and conflict over who should host climate change programmes are the other key challenges that hamper climate change interventions in the university. It was reported that a lot of fragmented programmes and efforts on climate change mitigation and adaptation are visible at the university but not consolidated due to lack of a credible and well established command post for all these activities. Participants mentioned that the university has several colleges and a lot of teaching, research and community initiatives on climate change are being held in those units. However, coordination of all these efforts among various units is not streamlined. One of the participants supported this when she said:

> "The biggest challenge is much more of the scattered nature of these projects, ahmm lack of programmatic arrangement, in that you have a holistic arrangement on how you coordinate the knowledge generation and also the gaps that are being bridged in a way that can consistently develop research questions that can be addressed in a programmatic arrangement." *[MUK PA22; Position: 33-33]*

The university has established the Makerere University Centre for Climate Change Research and Innovation (MUCCRI) that will be responsible for coordinating climate change research and innovations. This is moving in the positive direction and will help a lot in consolidating efforts of various units. However, with the decentralised system in the university, MUCCRI may not provide oversight over the units especially if it continues to be housed by one of the

Colleges. The other Colleges will continue to question its mandate over them and, therefore, the challenge of conflict over who hosts climate change programmes is not about to be resolved by MUCCRI.

Another institutional challenge which participants highlighted in focus groups was that while the university conducts research on climate change, there are activities that emit carbon dioxide to the atmosphere within its own boundaries. One of them observed:

> "Makerere being no.1 university in Uganda, there is this thing that is making me sad, when you go in the halls of residence, because Makerere itself is a community, has more than 1000 people in the borders of the university, but it hurts me so much going around the university halls of residence, the kitchens and restaurants of the university are still using wood fuel. I don't know whether that is helping the communities in any way, because the more you use the wood, it's like encouraging people to cut down trees. You buying more, so if I analyze Makerere as a community, which is first of all governed and a centre of knowledge, I think we are not faring well in that aspect." *[MUK GD22 PGD MUK; Position: 50-50]*

The participant cited the wood fuel being used in the halls of residence by the private service providers and the university administration has not put in place policies and climate friendly regulations to be followed by the service providers. The university's climate change mitigation and adaptation messages become irrelevant when it is not enforcing climate friendly practices within the university environment. There is no effort to adopt renewable energy sources for use within the university.

The other challenges are having limited time for student research especially on postgraduate programmes, limited time for practical training and lack of feedback loop for climate change research. These challenges are also institutional because the university is responsible for structuring programmes and courses, and ensuring feedback loops for research programmes. Regarding the challenge of limited time for student research, one of the participants noted;

> "As a student I will also start with my own challenges. I am also doing research. Usually I realize that we get to this time, final year, research is one of the course units we do along others. It needs a lot of time, sometimes, the mindset for research contradicts with the mindset for reading these other things. Here you doing a lot of cramming, you know theory. Sometimes you have to cram to understand and the time limit makes you cram.

> We are advised never to cram but you just can't understand things and sit a paper. It may take you a year to understand certain things. So research comes in and it is a big burden, the mindset now begins, like splitting your brains into two parts and we have challenges sometimes." *[MUK GD21 UG MUK; Position: 42-42]*

Another participant noted that often the time allocated for the entire programme or course is inadequate. This affects what they are meant to cover in a particular course or programme: In his own words he reports that;

> "[W]e are given little time on the courses and we are not able to get what is enough. We get the basics but not able to cover all we should cover. There is a need to add on period on these courses. Like some of us missed out course units on climate change at undergraduate, now when you come for postgraduate studies and only have it for a semester, its not sufficient." *[MUK GD22 PGD MUK; Position: 20-20]*

The university can possibly think about restructuring the programmes to give adequate time to students to work on their research projects.

The issues of feedback relate to the failure to link the research findings to other climate change activities and outputs such as policy briefs. The participants reported that the university lacks a mechanism of linking research to other climate change activities like policy formulation, training, outreaches and other aspects of interventions. One of them reported:

> "[T]he key challenge I think is the lack of feedback loop and I think that could partly be due to lack of programmatic design of research programmes. So I consider this to be a challenge and probably a problem whereby there is a need to design research programmes in a such a way that they are intentionally designed to have back and forth feedback mechanism, so that essentially you have evolving research programmes. The policies will also evolve around research that has been done over time and also even interventions at various levels of whether they are farmers. I think this is a challenge that needs to be addressed in such a way that you have programmatic design arrangements that are well designed in a way that you get feedback loops so that actually research is evolving around back and forth linkages." *[MUK PA22; Position: 71-71]*

According to the participant such feedback loops would only happen when the research programmes are designed in such a way that the findings feed into policy, training and other

aspects of the interventions. He calls for a mechanism of ensuring a holistic impact of the research done on climate change at the case university.

b) Resource related impediments to climate change interventions

This category deals with resource challenges affecting climate change interventions in the university. The participants cited inadequate funding for research, high cost of training amidst high levels of poverty and poor delivery of training due to inadequate resources and facilities. These are very serious challenges because research, training and community engagement programmes require adequate funds. Participants indicated that government and local institutions do not provide adequate resources for climate change programmes. To illustrate this challenge, a participant noted:

> "Funding has always been an issue ahmm, all over. But it also depends on how creative people are. So if you look into this university which is very big, there has been several projects on climate change from different donors, development agencies and things like that. What comes from the university itself is quite small, but it is also understandable that the subvention may be from government is small. And so they grapple with issues of re-allocating it, like most of the funds are going to salaries." *[MUK PL22; Position: 33-33]*

The participant contends that donors fund most climate change programmes. The university provides limited funds for climate change research due to limited support from government. Most of the funding from government is allocated to salaries. Conducting donor driven rather than locally initiated programmes always has its limitations as some participants observed:

> "definitely, in Africa, most universities, not only in Makerere, the research is mainly supported by donors. You are writing proposals, submitting everywhere, who can fund this. Sometimes you doing it on an individual basis. So the university, government, have not reached that level of investing or putting money in research. So much of the research that is done now is donor funded." *[MUK PL23; Position: 31-31]*

> "Yes, the first one is of course, the funding. This can be quite challenging. As I said, many times you don't drive your own programmes, the donors drive the programmes. So sometimes you propose you want to do this and they say that they don't see the use of this, simply because they have their own interests. So one of the issues is funding." *[MUK PA21; Position: 73-73]*

This implies that the research agenda and all the other programmes are not designed based on

local needs and interests. Rather, they depend on the interest of donors who usually provide funding for specific aspects based on their political and national interests of their home countries. Once a report is compiled basing on donor requirements, the local researchers are not bothered whether it has any relevance for local leaders or government. This has greatly affected African local content on climate change since such research projects never take African context into account. Donor driven research ignores indigenous research methodologies, knowledge systems and local conditions. Many of such projects end up using the donor prescribed research methodologies that leave out indigenous knowledge and local contexts.

As previously shown in the contextual analysis of the case, there are low numbers of students on postgraduate programmes and courses. This is due to the high cost of climate change courses and programmes amidst high poverty levels. One participant observed:

> "The other thing I want to bring out is money issues, poverty in Uganda and Africa is killing every one. University education is very expensive and how does this affect the student? The student is already in university, and the hustles that the student goes through to raise the fees makes it tough. So whoever is teaching climate change courses may assure all is well when actually, students are either absent minded thinking of how to get fees and also cover other costs or are physically not present to attend classes. That's one of the biggest challenge we face on these courses." *[MUK GD22 PGD MUK; Position: 31-31]*

In the quotation above, the participant laments of high poverty levels in the community that makes the situation worse for poor families to afford postgraduate training. Most students from poor families struggle to raise tuition. They are ever stressed and rarely concentrate on learning. The other challenge identified was the high cost for poor students to undertake research. One student commented:

> "About research, yes the university is doing a lot, encouraging people to do research, but this research is expensive. I am suggesting that the different departments, should assist their students when they come back for research. Yes, many departments have done it, people are doing projects and some are funded. But what delays students on certain projects is this money, especially at master's level. I think every department, am suggesting should be able to admit students to their courses, but be able to assist.

> Because these things of studying are not easy and delaying on a course is not good especially because of poverty issues." *[MUK GD22 PGD MUK; Position: 38-38]*

Many students cannot afford postgraduate programmes and courses. This is a resource related constraint that significantly affects training and in the long run research and outreach. With limited numbers of students enrolled on postgraduate programmes on climate change, few are trained and the prospects of increasing the volume of research done on climate change are hampered. Postgraduate training offers opportunities of increasing the research potential in a certain field.

The participants highlighted the challenge of poor delivery of courses on climate change due to inadequate resources and facilities. They report that although the programmes and courses are well designed, their delivery is challenging due to lack of adequate resources and facilities to deliver them. In her own words one said;

> "The other ones are really pro-institutional programming, around the teaching process. Because there is a difference between designing the curriculum content and delivery. A curriculum is not a curriculum until there is direct investment into delivery. So if I don't have the adequate resources and facilities to deliver it, I can teach only what is possible and feasible within the given context that I am. Yeah, so. Those are a few things around there but pretty much these can be sorted depending on the programming." *[MUK PR21; Position: 41-41]*

She reports that lecturers only teach what is possible and feasible given the context. For example, meteorological equipment, modern training facilities, computers for simulations and field weather data are not adequately provided to students and researchers. This compromises the quality of teaching but also research since both students and faculty will not have all they need to learn or do research.

The other challenge under this category was the inadequate support from government and local institutions. Through interaction with participants, many of them indicated that governments have not seriously provided funding for research to the universities. In her own words one explained that;

> "On top of that, though I will bring out the challenging bit of it, ahmm as you know, Africa predominantly involves developing countries that have limited access to finances. Little is invested in research, yet research is the driver of economies. Most research done in these institutions is funded by western world. So the west benefits from

> the research curried out here where as our governments put in little. I am calling upon governments to begin funding research projects. It would be nice to hear that a country like Uganda has come up with an innovation funded by the government, without or with limited external funding. That we will be proud of it and it will encourage young practitioners to do more research." *[MUK GD22 PGD MUK; Position: 36-36]*

The participant talked about the limited investment in research by governments and local sources moreover research is the driver of economies. She reports that most of the research is funded by the developed world and therefore for their own benefit compared to the host countries. This explains the few publications produced by academics in the country since they have limited financing available for research. Despite the fact that most of the scholars and faculty have the ability to carry out state of art research on climate change, many of them can't do it due to lack of resources.

c) Environmental related challenges to the university climate change interventions

This category relates to challenges within the environment that affects university interventions on climate change. Many of these challenges are outside university control. Participants cited limited expertise in climate change science, and negative attitudes of communities towards new technologies and products introduced by the university through research.

The challenge of limited expertise in climate change science was highlighted as a key one affecting climate change interventions at the university. One participant noted:

> "The the human resource, this has been a problem, but I think we are trying to come up. Because initially everyone was trying to be an expert in climate change, and you don't have people who have that expertize on climate change. But at the moment, I think they are trying to come up" *[MUK PL23; Position: 67-67]*

The participant reports that competent and qualified human resource on climate change are not readily available in the environment. The university depends on the local and international community to supply it with human resources to work on sophisticated and specialised issues like climate science. Often the university will advertise positions to get such staff, but very few experts in climate science are available for the positions. This limits the ability of the university to do more research, more specialised teaching and innovations in this field.

The community's negative attitudes towards new technologies and products introduced by the

university significantly affects further research and innovation. One participant explained:

> "But also for some of the programmes, its not really easy, because you are trying to introduce improved varieties or high yielding varieties for example, and then there is the story of GMOs (Genetically Modified Organs), people are not so receptive to the new improved varieties. So one of the issues is, if there was any technology that was implemented, it really requires a lot of buy in from the population to be able to be accepted in communities. This is one of the huge challenges." *[MUK PL21; Position: 71-71]*

According to her, introducing improved or high yielding varieties is meant to support communities in the face of drought and harsh weather conditions. Due to cultural and religious beliefs and political ideologies and inclinations, communities are not so receptive to these new varieties. They may not appreciate and adopt such products, which demotivates scientists and experts to undertake more research and innovations on other climate related solutions.

The participants identified other key challenges; lack of career guidance for students at earlier levels of education, political interference and instability as well as financial expectations by the communities whenever the university engages them on climate change programmes. Lack of career guidance for students at earlier levels of education affects comprehension of concepts and motivation of students to enrol on climate change programmes. A participant noted:

> "For me one of the challenges I see, in the university teaching courses related to climate change begins from primary and secondary school levels. There is no good career guidance in secondary level. For example, many students who do geography in secondary level are students of humanities. Geography is taken as a humanity, not a science. But when it comes to university level, these students who have done geography, have not done mathematics, physics and are the students who are supposed to learn issues of climate change. yet in the curriculum of climate change for example at master's degree level, we expect things like climate modeling, modelling future climate scenarios to be undertaken. But for a student who didn't do mathematics at secondary school level to do climate modelling, it is really very impossible" *[MUK GD22 PGD MUK; Position: 30-30]*

The participant contends that when students enrolled at the university, it is assumed that they have acquired the basic knowledge, skills and attitudes at lower levels. It is also assumed that they got career guidance on various programmes in which they enrol. However, this is not often

the case as many of these students especially at postgraduate level lack the necessary background knowledge to undertake climate science related aspects.

Participants also mentioned political interference and instability that greatly affect the activities of the university. Makerere being a public institution will always be affected by the political swings in the country. Sometimes politicians may require that the university administration subscribe to their political ideologies and if this is not the case, they work hard to frustrate the university leadership. Participants also noted political instability as a key challenge to the activities of the university on climate change especially during community outreaches and field research.

The other challenges in this category were limited access to quality data on climate change, theft and vandalisation of equipment in the field and the communities' failure to understand climate change issues. The participants also cite limited access to quality data as a key challenge to climate change research:

> "the other problem, which I find very crucial. The challenge of data. Data, you could have all resources you need to collect data, but the data is a challenge. Getting good quality data say on agriculture, getting good data that span say 40-50 years of climate data, rainfall, temperatures and solar radiation is a huge challenge. And so ahmm data issues, is a challenge and this of course compromises the quality of the research and the results." *[MUK PL21; Position: 53-53]*

The participant reports that even when one has all the resources to collect quality data, accessing it is a challenge. Due to Uganda's turbulent political history, it is difficult to get good quality climate data spanning 40 to 50 years. The participant notes that this compromises the quality of research and therefore the findings. In addition, respondents observed that many of the institutions such as Uganda Bureau of Statistics (UBOS) and Uganda National Meteorological Authority (UNMA) that have climate data make it very difficult for student researchers to access it, or sometimes they ask them to pay in order to access it. One student reported that;

> "My issue is on data. When I look at research, especially in our university, there is a mismatch or a disjoint between the university and other private and public institutions out there. These institutions go out there to do research while the university also does research as well. But the data is owned by particular institutions as if it is only useful to

> that institution. Students of the university have no access to this data moreover they need it for their research. I can give an example of UBOS (Uganda Bureau of Statistics) and UNMA (Uganda National Meteorological Authority), these are data banks of the country but to get data is very difficult. It may even require you to pay money to access this data. For UNMA its worse, because the officers really brag a lot with their data. But data has value to each and every person and there is no need for me to keep data I have yet someone else needs it to generate some other information." *[MUK GD22 PGD MUK; Position: 40-40]*

The disjoint between the university and private as well as public institutions that are custodians of climate data has been highlighted as a key challenge affecting access to quality data by students. The participant argues that most of these institutions that collect the data like the UNMA and UBOS make it very difficult for students to access the data they collect. Moreover, the university has no effective arrangements with these institutions to support students to access data. This limits students' research on climate change.

Additionally, the participants reported that in an effort to collect short term data on weather, water or land related matters, the university often installs equipment in the communities but the equipment is vandalised or even stolen. One participant reported:

> "On earlier projects, [there] was theft of equipment. We were doing erosion studies, high up in the hills of Bududa and when you establish erosion plots, you use iron sheets so that you can tap the sediment. We had remote rain gauges, where we would connect on the computer and read data which is being generated. But that equipment was vandalised and the rain gauge was very expensive, but it just disappeared. … It was running around a particular water stream, we had a rain gauge, erosion plot, and another point where we had put a larger machine to understand water levels." *[MUK PR22; Position: 79-79]*

This challenge largely happens in communities where literacy levels are very low, where members may not understand the importance of such equipment. Climate related equipment is expensive, so vandalising or stealing it is detrimental to climate change education interventions.

Participants also noted that understanding of climate change among community members especially those with low levels of literacy is quite difficult. People rarely differentiate between

climate change and climate variability. One participant noted that;

> "climate change is a problem, except that the scientists or people who have gone to school, they know it, they know the causes. But when you come to the communities, what they call climate change is not actually climate change. There are certain indicators somehow but they think the cause is you know, their own, when in actual fact it is bigger than they think. It is a problem. We have had big events, we had you know, the drought, major drought. I think they are becoming more frequent than it used to be." *[MUK PL24; Position: 17-17]*

The participant noted that people do not appreciate the need for mitigation and adaptation because they do not look at long term effects of climate change. They think about climate variability, expecting things to get better in the short run. Many of them never take the effects of climate change seriously and therefore would not intervene in mitigation and adaptation efforts.

Theme 4: Key drivers and current openings for our work

Box 5.4: participant's views on key drivers and opportunities for climate change education at Makerere University

Sub theme 4.1: Key drivers for our climate change work

- Internal influences
- External stimuli

Sub theme 4.2: The current openings for our climate change work

- Legislation backup
- The nature of the phenomenon
- The conducive environment around us

This theme presents findings on participants' multiple realities and perceptions as well as views regarding the key drivers and current opportunities for climate change education work at the case university. The theme has been categorised into two sub-themes. The findings on key drivers are covered in sub-theme 4.1 while those on the current opportunities for climate change work are provided in sub-theme 4.2.

Sub theme 4.1: Key drivers for our climate change education work

The researcher established the success factors that have enabled the university to register the achievements so far. Participants gave various opinions on these during the semi-structured in-depth interviews and focus groups. The findings from data analysis are presented in two categories: internal and external influences.

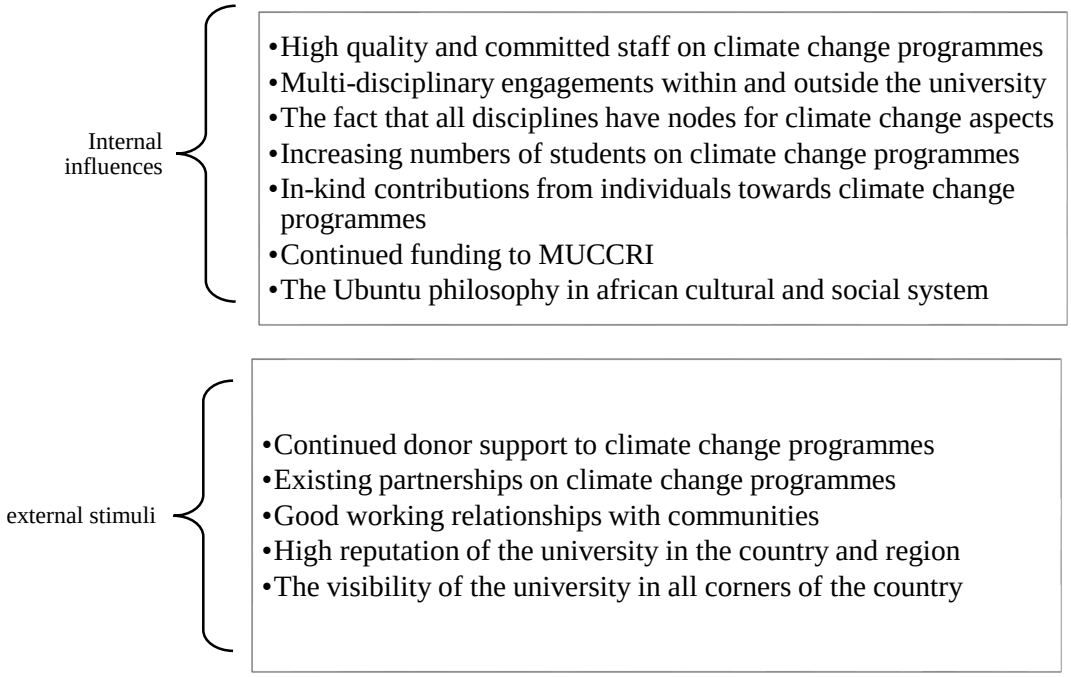

Figure 5.8; key drivers for climate change education interventions at Makerere University

a) Internal influences

The internal factors are those within the university system that facilitate successful implementation of climate change programmes. Participants mentioned high quality and committed staff on climate change programmes, multi-disciplinary engagements established by the university, and inclusion of climate change aspects in disciplines or subjects taught at the university.

Participants acknowledged that Makerere University has quality and committed staff and these have been very instrumental in pushing climate change programmes to higher levels in the university. One participant said:

> "[F]irst of all the human resources as I said, initially there were no people training in this area, but we got some people trained in this area. … We have some five PhD holders in meteorology and climate related aspects. So having those, from nothing, I think it is a strong point " *[MUK PL23; Position: 73-73]*

The participant reports that one of the key internal drivers to climate change work has been the competent human resource. Initially there were no experts in the field but later the university got some academics who went for training in areas like meteorology and climate related aspects. Currently, the university has five PhD holders in this field which makes it able to comfortably implement climate change education programmes. One student participant added:

> "On top of that is human resources. Makerere though has few professors and lecturers, but they do good work. This includes writing proposals, for instance an award of a grant doesn't come on a silver plate, there is a lot of input and for this credit is given to our department, because when I was at the world mountain forum, they told us in Makerere our department is the best in writing proposals. And it wasn't only from international organizations but also from the communities which implies that the name of Makerere is held high internationally world over." *[MUK GD22 PGD MUK; Position: 55-55]*

High quality and committed academic and administrative staff members are key to success of any intervention. Academic staff bring on board expertise and innovativeness, new ideas and projects, written proposals for funding and other technical aspects of climate change within the university. Administrative staff ensure that all support services required for programmes to be implemented successfully are in place.

The participants talked about multi-disciplinary engagements within and outside the university as a key factor. According to them, climate change cuts across various disciplines and sectors and therefore engaging various teams or professionals from different disciplines is necessary. This is because such engagements lead to wider coverage on various aspects of climate change across disciplines and sectors. In his own words one argued that;

> "The university also does a lot of multi-disciplinary, interdisciplinary and transdisciplinary kind of engagements within and outside the university. I think we are becoming more and more connected than before. So that's really a good thing" *[MUK PL21; Position: 73-73]*

They also noted that such engagements facilitate generation of new and varied ideas, multiple

responses and approaches to the phenomenon. The participants noted that this kind of engagement is visible in the university and has contributed to the success of climate change interventions implemented by various units of the university.

They also observed that every discipline or subject has nodes for climate change. Whether it is engineering, technology, agriculture, social sciences, education or health sciences, there are nodes for climate change education. One participant observed that:

> "there is no discipline or teaching…or research subject matter that doesn't have nodes [linked] climate change." *[MAK PA22; Position: 27-27].*

Participants indicated that various Colleges have started initiatives for integrating aspects of climate change in their respective programmes and courses. This is a key success factor that continues to push climate change agenda to higher levels within the university.

The other internal factors highlighted by participants include the increasing numbers of students on the programmes, the contributions from individuals towards the programmes, the continued funding to Makerere University Centre for Climate Change Research and Innovation (MUCCRI) and the African social and cultural system. The increasing number of students on climate change programmes is an indication that people are beginning to understand the climate change phenomena and how to deal with it. One participant said:

> "The achievements I have seen, I will start with my course, meteorology. At least we are seeing numbers increasing, because the 3rd years, who were here were around 17, and then the current 3rd years are 13 and then we the 2nd years are 15 and now the 1st years are 20 something. So the number is increasing each year and we are optimistic that even this year and next year numbers will increase. So that is an achievement." *[MUK GD21 UG MUK; Position: 54-54]*

The participants noted increasing student numbers on programmes such as BSc. Meteorology, Postgraduate Diploma in Meteorology and other programmes on climate change. This is a key motivating success factor for climate change programmes at Makerere University.

The continued funding of MUCCRI is a serious boost for the climate change programmes because without funding, the Centre would not run effectively. One participant indicated that;

> "But then of course a direct way in terms of financing, direct money, we are having funding from various institutions like FAO, USAID" *[MUK PA22; Position: 93-93]*

One participant argues that funding from organisations such as USAID, FAO is a key factor behind the success of the programmes at the university.

The most interesting and unique success factor which participants identified was the African social and cultural system. One of them argued:

> "The other factor I think is attached to our culture, that we are social, we love to help each other as a society. There is no way I can call myself to be developing when my neighbor is not developing. So Makerere university, because most of these projects am engaged in are around the vicinity of Makerere i.e. Katanga, Bwayise, Kyebando, Acholi quotas e.t.c because we want to help people in these communities. As a student I have a heart for the people." *[MUK GD22 PGD MUK; Position: 54-54]*

The participant noted that culturally, Africans are sociable and will always help each other amidst calamities. This is similar to the Ubuntu philosophy of Archbishop Desmond Tutu of South Africa. Therefore, many of the staff and students are involved in climate change work as a way of helping each other. They have a heart for each other as the participant indicated. Amidst challenges, those involved keep the fire burning since they are doing it for their fellow Africans and themselves.

Participants also mentioned contributions from individuals who offer themselves to support climate change work at the university. One participant said:

> "[W]e have been able to mobilise contributions in kind. This is one of the assets that is very critical. In-kind contributions from various institutions that are much interested and focused on climate change issues. So you know someone works somewhere and you have a training, and therefore you invite them to be a guest speaker. He or she is passing on knowledge, skills and experience and indirectly he is paying money. For us we consider these to be key funders or indirect funders. In this case we are not having direct cash but supporting in areas with indirect cost." *[MUK PA22; Position: 93-93]*

Mobilising such support from institutions and individuals locally is a very good and sustainable strategy for climate change interventions and therefore a key success factor.

b) External stimuli

The choice of the category “external stimuli” stems from the fact that these are external

inducements that keeps the team going as they implement climate change education programmes in the university. Participants identified continued donor support, existing partnerships and good working relationships with communities as key factors responsible for the success of climate change programmes of the university. The participants reported that the university has got funding from various donors such as SIDA to support climate change education programmes. Continued donor support was seen as very key success factor for the university.

Like indicated before, most of the resources for climate change programmes are from donors and very little if any comes from local sources and government. This means that without donor support, many of the climate change programmes would dwindle or collapse and fail to register any success. One participant was quoted saying that;

> "But the other is funding. We had SIDA one and it got finished, the Swedish government said they can give more money and therefore there was SIDA 2 and it also got finished. They again said they can give more and therefore SIDA 3, it got finished and they added more money, which is SIDA 4 currently. They give huge amounts of money, but they must see outputs and as university I think, any research project will have problems here and there, but as a university, I think we are making progress. They realize we have made serious progress." *[MUK PR22; Position: 91-91]*

The participant reported that the university has got funding continuously from various donors to support climate change education programmes. Donors like SIDA have been funding the university continuously and that they give huge amounts of money towards the interventions. Continued donor support was seen as very key success factor for climate change interventions in the university.

Relatedly is existing partnerships that the university has built over time. Partnerships with local and foreign agencies and funding bodies has been very useful in supporting the implementation of climate change programmes in the university. Nationally participants did cite partnerships with; national environment agencies, local governments, water development agencies and NGOs. At regional level, they talked of universities in East Africa, and regional agencies on agriculture and environment. International partnerships mentioned included; working with UN Habitat, DFID, GIZ and various foreign universities. To illustrate this, a participant reported that;

> "we have partners around communities mentioned above, at national level we partner with various ministries and institutions, for example we have the water development department, NEMA, KCCA etc. At international level we have various organizations for example GIZ, various international universities and organizations like UN Habitat, the DfID. All these brings the bond and sourcing of various equipment and resources needed to implement the various climate change programmes." *[MUK GD22 PGD MUK; Position: 55-55]*

The partipant reported that the university has partnerships with various government ministities and institutions to support the climate change education work. According to him, they include; the water development department under ministry of water and environment, the National Environmental Management Authority (NEMA), Kampala capital City Authority (KCCA) etc. To support the same, another participant reported that the university has partnerhsips with local governments, agencies and NGOs. In her own words, she noted that;

> "It's the university partnering with government institutions at all levels. Ahmm at national and local governments, but anyway we have institutions, for example if a farmer is asking for some kind of innovation or technology, we just link them to an institution for example NARO, we link them to other people who have come up with success stories. But also if necessary we organize them to have farm visits where they can go to learn. So we have partners who range from farmers to government institutions, local governments, students and NGOs and so on. So quite wide ranging category of stakeholders, both horizontally and vertically." *[MUK PA22; Position: 87-87]*

These existing partnerships have been useful in terms of funding activities and programmes, technical support to the implementing units and supporting in mobilizing communities and policy makers to engage in climate change activities.

The other factors include the high reputation of Makerere University, the visibility of the university in all corners of the country and technical personnel supporting the climate change work. The participants argue that Makerere university has a high reputation in Uganda and globally and therefore whatever activities it initiatives are supported by various players. One of them argued:

> "[The] number one thing is legacy. We have a very big name to protect. They say Makerere is number one university in East and Central Africa. That alone drives the

students, the lecturers and the governance body of the university to do a lot of research so that we can keep our name." *[MUK GD22 PGD MUK; Position: 54-54]*

Therefore, because of the high reputation of the university, the staff and students are motivated to work hard to maintain the name of their university. This leads to the success of the programmes.

The university is also known and visible in all corners of the country where it has established centres, research sites and collaboration projects. This enables the university to ably reach out to any area in the country. A participant observed:

> "Makerere can ably be visible in all parts of the country. This is a serious factor. That means anything that Makerere wants to implement, it can reach out in the entire country. The university is able to reach out to all corners of the country. To me that is a success factor."*[MUK GD22 PGD MUK; Position: 57-57]*

Participants also pointed to the fact that the university often works with people in the communities who are technical on most of these aspects. One observed that:

> "But the other is the technical personnel we worked with, the ideas is that our entry point, we identify the persons at the initial stages. So the project and activities grew up with those people, and they now know what we are doing. Any new project, that's the entry point, there is this new thing, how do we enter the community? We are to enter the communities, and they will help us understand the processes. Either we work with the original communities, but if we are to upscale, then they know where next we must go. These have been very supportive." *[MUK PR22; Position: 87-89]*.

Therefore, whatever activity will be implemented, will often succeed since those technical people know what to do even in the absence of university staff in the field. The university has over the years identified technical personnel within the communities that support its programmes. These have adequate experience in implementing programmes. This was seen as a key factor behind the success of climate change interventions in the communities

Sub theme 4.2: The current openings for our work

This sub-theme presents findings of participants' views on various opportunities that exist for Makerere to address climate change issues in its programmes. The findings on these opportunities are summarised below;

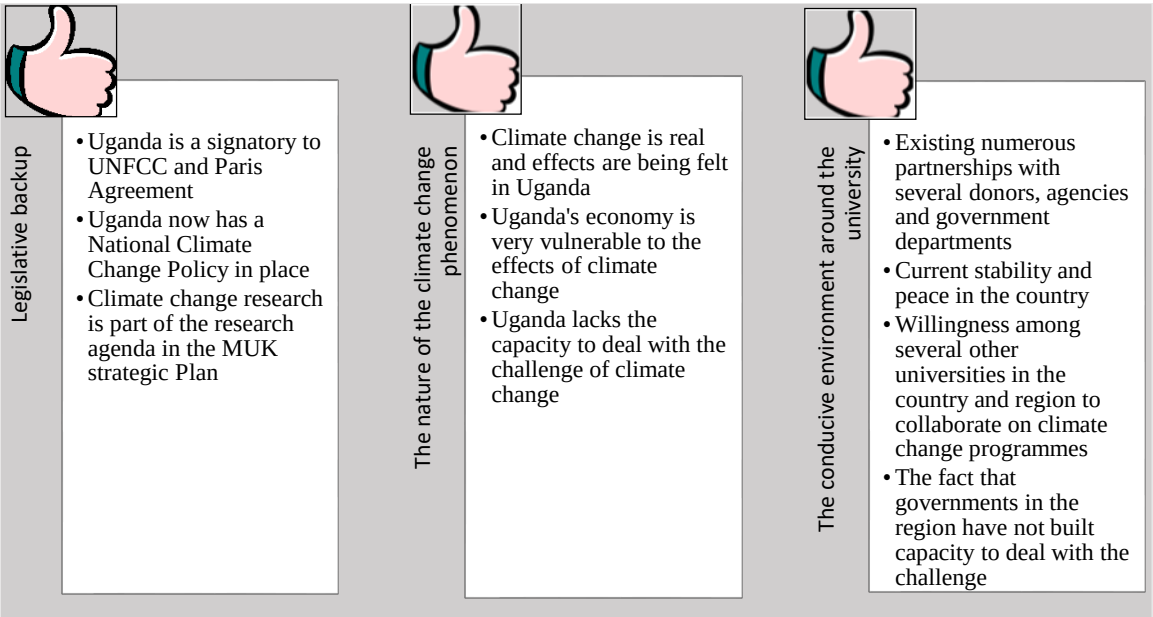

Figure 5.9: Current opportunities for climate change education at Makerere University

a) Legislation backup

This category relates to the opportunities that exist for the university to exploit arising from legislative back up on climate change. Participants noted that Uganda is a signatory to UNFCC which means that it committed itself to address the issues of climate change as a country. One participant said;

> "….Uganda is a party to UNFCC, and it participates in the COPs. Uganda government is leading as far as addressing climate change is concerned. So with all these, and Makerere university is a premier university in Uganda." *[MUK PA21; Position: 47-47]*

This implies that because Uganda ratified the convention, there are several national legislations and policies that support the university's climate change work. This acts as a basis for soliciting further support for the interventions from internal and international sources. Makerere University being a premier university in the country makes it one of the key centres for policy debates, scientific discussions and information to address climate change in the country. This platform gives the university opportunities to push the climate change mitigation and adaptation agenda.

b) The nature of the phenomenon

This category relates to opportunities that exist for the university based on the nature of the climate change phenomenon. Participants acknowledged that the effects of climate change are being felt through variations in the rainfall patterns and rising temperatures. A participant

explained:

> "Definitely climate change is a problem or a challenge to the development of Africa, because even prior to the spread of climate change phenomenon, Africa was already challenged with so many other problems and so having this added on to the so many we already have. I think it is stressing the people, many are dying of starvation, people are separating in their families, government budgets have been constrained, governments are confused and people do not really understand the impacts of climate change. Yes, it is a reality but its something that has not been explained thoroughly and for instance people in government have not been equipped on how to deal with this challenge at national level and when it fails at national level, definitely it will fail at the local level. So I see it as a great challenge." *[MUK GD22 PGD MUK; Position: 11-11]*

According to this participant, climate change has created stress among people, many have died of starvation, and it has constrained government budgets since more resources have to be spent to support mitigation and adaptation. From the African context, many countries such as Uganda, Malawi and Ethiopia have suffered drought, affecting agricultural yields and caused food shortage in these countries. The capacity to adapt in African countries is low and therefore the effects are felt more compared to developed nations. This implies that the university has an opportunity to support communities and governments to address this problem.

Participants reported that a number of sectors in Africa have been affected by climate change especially the rain fed agricultural sector. One respondent noted:

> "….climate change is really a big challenge. It is adding on the other challenges that Africa was already facing. A number of sectors in Africa are being affected by climate change. Africa being one of the regions that forms part of the developing world, already in many countries of the continent, sectors like agriculture is rain fed. And since climate change is causing a lot of seasonal variations, for example when farmers are expecting rains, they don't see the rains and because they can't use irrigation because of the low levels of technology, they are really affected. So given the fact that even after being affected, they have low incomes, they can't really cope up very fast with the challenge, which climate change is impacting on the agriculture." *[MUK GD22 PGD MUK; Position: 12-12]*

The participant argues that climate change has led to seasonal variations in rainfall patterns,

which makes developing nations that depend on rain-fed agriculture more vulnerable. These countries lack adaptation capacity, which has made life very difficult for their populations. The countries have low incomes and therefore cannot cope with the challenge. Dealing with effects of climate change in many of these countries has led to high debts and depending on donor or foreign financing. The nature of this problem and the complexities in addressing it, presents an opportunity for a university like Makerere to invest more efforts in research and other climate change interventions to support communities and government in addressing this very challenging phenomenon.

c) The conducive environment around us

The local and international environment in which the university operates presents enormous opportunities for addressing climate change issues in its programmes. Participants identified several opportunities that need to be exploited. These included the existing partnerships with several donors, agencies and government departments; the current stability and peace in the country; and the fact that governments around the region are not yet prepared to deal with the climate change phenomenon. The university has established several partnerships with various local, regional and international agencies that could be engaged strategically to further support climate change initiatives. The partnerships could also be used in disseminating climate change research findings and information to a wider community. One participant argued that several universities in the region such as the University of Nairobi, and University of Dar es Salaam are already implementing climate change programmes *[MAK PR22; Position: 99-99]*. This offers Makerere an opportunity to partner with them on a number of programmes. There are many universities that have realised the need to intervene but haven't done anything yet. These could be potential partners for Makerere to reach out to and collaborate with on some programmes

Theme 5: Ways to do things better

Box 5.5 Participants views on strategies for improvement in implementation of climate change education interventions at Makerere University

Theme 5: Ways to do things better

- Training and capacity development improvement strategy
- Research capacity improvement strategy
- Community outreach improvement strategy
- Institutional management improvement strategy

This theme presents findings on strategies for improvement in the implementation of climate change programmes at Makerere University. The findings are presented in four categories outlined below:

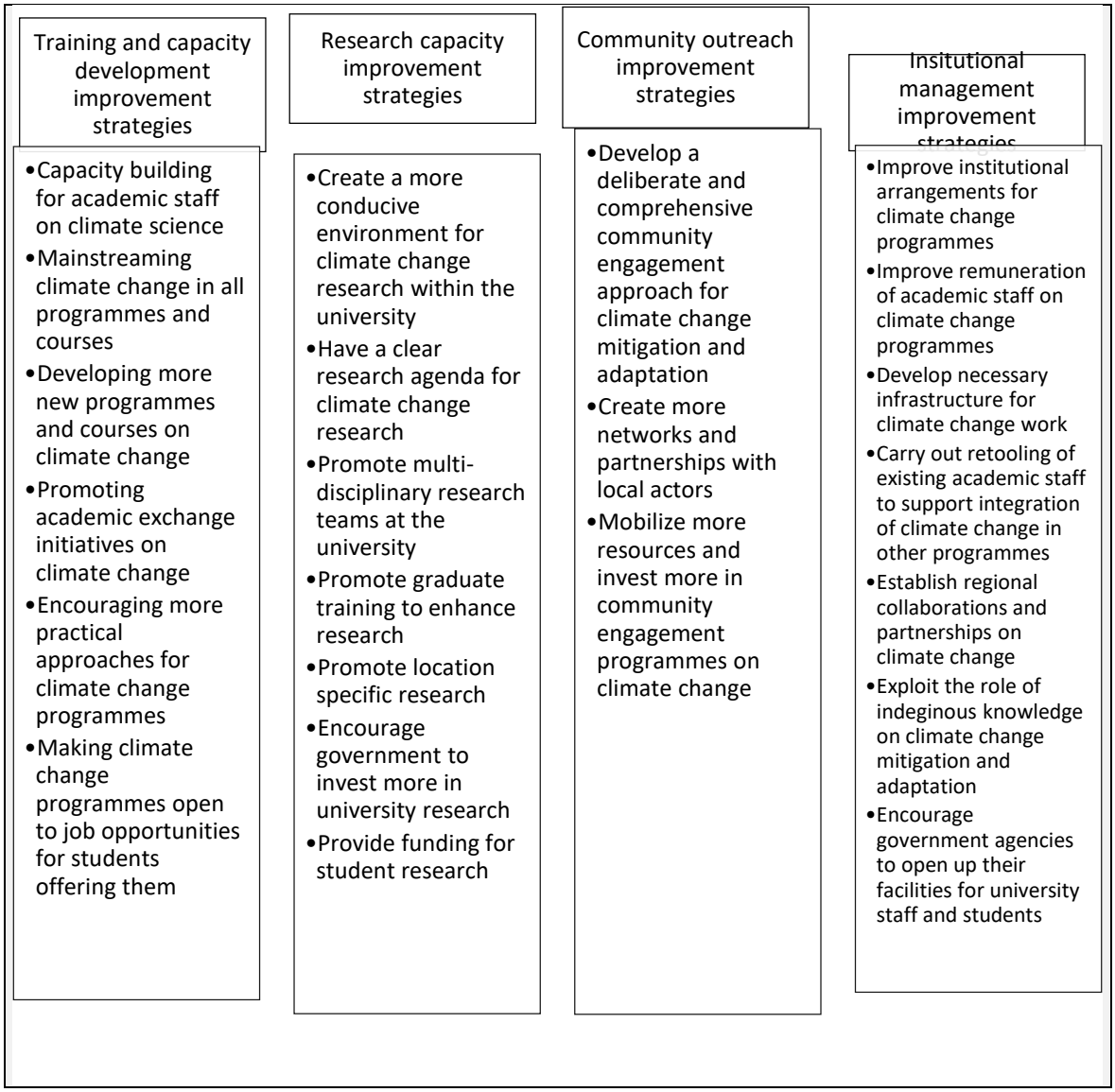

Figure 5.10; Suggested strategies for improvement in climate change education interventions at Makerere University

a) Training and capacity development improvement strategies

This section analyses strategies that can be adopted to improve training and capacity building interventions on climate change by the university. The strategies suggested include capacity

building for academic staff, mainstreaming climate change issues in all programmes, developing new programmes and promoting academic exchange initiatives on climate change.

The participants argue that the university has been supporting its staff to further their education at PhD levels as a form of capacity building. This should be encouraged to enhance staff capacity to teach and carry out research. One of the participants observed:

> "[T]he training that any person can receive, can always improve the quality of research. And the university has been very supportive. If there is a research opportunity or you looking for study leave to do a PhD, the university will always give you the opportunity. This is under the broad framework of capacity building, because there is a staff development agenda on the part of the university, largely to improve the quality of research, but also the quality of teaching. But this department is fortunate that all persons that are doing climate change work now have a PhD." *[MUK PR22; Position: 67-67]*

The achievements so far registered from the previous capacity building initiatives for staff will increase when more are given the opportunity for professional growth. This will increase expertise on climate change research.

The respondents also suggested that climate change issues be mainstreamed in all programmes offered at the university. Various units of the university should find a way of integrating aspects of climate change in their disciplines since almost all courses offered across units have nodes for climate change. One respondent said:

> "Makerere university is a big university. As you may know we have almost 40,000 students and about 10,000 or more are graduate students, spread over 9 colleges. ….. If you look at the wide spectrum, all issues of climate change cut across, all these areas." *[MUK PA21; Position: 23-23]*

Climate change cuts across all sectors and can be easily integrated in various courses and programmes. The participants recognised the effort by some academics and MUCCRI to develop university wide courses. All students who enrol on various degree programmes across the university units will offer such courses. Dealing with climate change requires that more people be sensitised on how best they can contribute to mitigation and adaptation.

The other strategy suggested was developing more programmes and courses. One did say that;

> "Then may be we need more courses in that field. Some of us have done bachelors and we don't know if we will ever do a masters in the same field, since it is not run here. We don't even know whether we can afford a visa to go out for it. So I would actually wish to at least see chances of us to do masters or even PhD around. Some people are willing to study this thing and then spread the knowledge." *[MUK GD21 UG MUK; Position: 60-60]*

The participant recognised the progress so far in developing Master's and PhD programmes that are underway for approval. This is a very positive trend towards increasing the number of programmes and courses on climate change. It will lead to increase in the number of experts in the country and region as a whole.

They also called for promotion of academic exchange programmes on climate change to provide opportunities for students and faculty to learn from other universities. This would enable these to explore new ways of doing research and approaching climate change. One of them was quoted saying;

> "My message to universities, is to improve on the programme exchanges. Here we are able to learn from what is happening in different locations, such that we learn from that and also see what we can implement here. I believe that most of the projects going on is out of our professors going out there for conferences where they get friends and institutions such that they bring ideas and get funds that will enable implementation of programmes. Secondly is that many universities are too traditional." *[MUK GD22 PGD MUK; Position: 63-63]*

She argued that climate change is a global phenomenon and various institutions across the globe are engaged in addressing it. Academic exchange programmes would offer opportunities to faculty and students to learn a great deal from other institutions. This would enhance their innovativeness as well as research capacity based on the new experiences got from such an exchange.

The other strategies suggested were encouraging more practical training approaches for climate change programmes and courses and making climate change programmes open to job opportunities for graduates. The participants were of the view that the university should encourage more practical training so that graduates can engage in practical work related to climate change in communities. One of the participants noted:

" In Africa, I think…we need to encourage more practical than doing theoretical stuff, so that…our students and staff come up with things that are really tangible and could be more useful to communities and universities." *[MUK PL21; Position: 85-85]*

The participant argue that practical training approaches would equip students with the needed skills so that they are more useful to communities and the world.

Respondents also proposed that the university deliberately develops climate change programmes that are related to job opportunities for the students. This is because many of the students would want to enrol on programmes that will offer them opportunities for employment. One was quoted saying;

"…… Yeah, the university should find a way of convincing us that we can also make money out of this, ahmm, preparing us to make money out of the knowledge that we have. Most cases students have completed and they feel like, they are being thrown away like trash. You don't know where to go, you don't even know how your knowledge will work for you. And if people don't connect that with the education alone, it could be that the university does want more numbers, but people can't connect the outcomes of that knowledge with reality. Yet we are going to help the nation and the entire globe, starting with ourselves. …" *[MUK GD21 UG MUK; Position: 60-60]*

Courses and programmes that offer more job opportunities are on high demand in the job market. These would attract more students and make graduates more relevant to the employment needs of the sector.

b) Research capacity improvement strategies

This category analyses strategies that need to be adopted by the university to enhance research on climate change. Participants made several suggestions, which included creating a more conducive environment for climate change research within the university; having a clear agenda for climate change research; promoting multi-disciplinary research teams at the university and promoting postgraduate training to enhance research.

Participants maintain that a good research environment would push forward the climate change research efforts by the university. This environment includes providing facilities to conduct quality research, giving adequate time for research to faculty and students and adequate funding. One of the respondents said:

> "Universities also need to continue creating a conducive environment for quality research. Making sure that they emphasize the challenges like denounce plagiarism for example, and that business of recycling material, such that the research is original and useful and usable." *[MUK PL21; Position: 83-83].*

The participants also called for a clear research agenda for climate change, where a deliberate list of research priorities are agreed upon for all units to follow in developing their research projects. This would be more effective compared to doing small bits of uncoordinated research as a result of following available donor funding. Currently, individual faculty members and units are doing a lot of uncoordinated research projects. The participants argue that with a clear research agenda, all those involved in climate change research would align their projects so that the university is able to consolidate the research efforts and outputs.

Since climate change issues cut across disciplines, the participants also proposed that the university promotes research teams among faculty and students from different disciplines to work on joint projects. One of them argued:

> "I think, we need to build interdisciplinary call it interdisciplinary, cross disciplinary research teams. Because some things…tend to be repeated. It is just getting a research agenda, a research scheme for climate change sciences in the university. If that is really worked on and you get a clear funding mechanism, and have it set, then you can consistently have a long term research agenda around climate change." *[MAK PR21; Position: 59-59]*

Such teams would enhance the quality of research since members bring on board various skills and perspectives as they work on a specific research project.

Another way to strengthen research capacity, participants argued, is to have a deliberate strategy to promote postgraduate training on climate change. When more people are trained at postgraduate level, they improve their research skills and get more experience in conducting academic research. One of the respondents explained:

> "On the quality of research, the largest part, the way we can improve the quality of research, is graduate training. I must say we started the climate change programme or climate change agenda, when most of us were, a larger number were just having a master's degree. I must say that in the department of geography, we are 19 members of staff, but we only have 2 people who don't have a PhD. But they are doing their PhDs,

may be in the next 2 years they will complete their PhDs." *[MUK PR22; Position: 65-65]*

Participants noted that increasing the number of PhDs on climate change related studies is a good way of enhancing the quality of research.

They also cited other strategies to promote research, such as providing funding for graduate students, promoting location specific studies and encouraging government to invest in university research. The participants argue that many graduate students are not doing quality research because of the costs involved. One of them said;

> "Funding….I think if funding could be identified to cover more than the masters, one goes into also the PhDs. Because I think the findings are there but not as conclusive as you would have wished. So you then get another student who is a PhD but is not continuing with this other one, he stopped somewhere." *[MUK PL24; Position: 41-41]*

The cost of doing research is privately incurred by students in most universities in Africa. Many of those that are able to complete their research at Master's level have no means to extend their studies to PhD level due to funding constraints.

The participants also suggested that the university should promote location specific research. By promoting location specific research, participants argue that research on climate change needs to consider location specificity for it to be relevant to the needs of that specific geographical location. In his own words one argued that;

> "…. I see a very important need to have the focus of climate change, different from the business as usual the way the universities do the things. The universities are much more seated there to be tanks of all sorts of knowledge and be able to be tapped from. I think for climate change especially when it comes to adaptation, whether it is research or education, there is a lot of location specificity to be considered. So I think the research and education should move from research problem oriented to problem solving orientation with specific locations." *[MUK PA22; Position: 99-99]*

Different communities have different climate-related problems given their socio-economic situation, cultural orientation, political situation, and geographical outlook. This is because climate change affects different locations and sectors variably though it cuts across sectors. These differences mean that communities experience climate change effects differently and, therefore, research must be carried out within the context of these differences across locations.

Participants also called upon government to seriously invest in university research on climate change because donor driven research rarely serves national and local interests and needs. One of them said;

> "definitely if you depending on someone, you cannot get adequate funds. He will give you what he has. But government, it is high time they prioritize and begin investing in research. If we have a call, this is money for research, come and apply, write proposals and you know that is money in the ministry of finance, it would really help a lot. And people will solve key problems that are of national nature." *[MUK PL23; Position: 33-33]*

A lot of climate change research is done but funded by donors who have their own interests and dictate on the specific aspects that the research must focus on. This implies that outputs of such donor funded research rarely feed into national policies and interventions. This make it difficult for such research outputs to create an impact on national economies and societies. Therefore, government must pick interest and deliberately invest in university research on climate change. This will lead to the increase in relevant research projects that are developed based on national and local needs and interests with respect to climate change.

c) Community outreach improvement strategies

This category relates to those strategies for improvement in the community engagement component of climate change programmes of the university. One of the key challenges highlighted was lack of a deliberate and comprehensive approach to community engagement on climate change by the university. In his own words one of them noted that;

> "we need to develop a comprehensive community engagement and outreach approach and that will help to consolidate community engagement efforts." *[MUK PR21; Position: 65-65]*

Most of the community engagement programmes on climate change so far implemented by the university are part of research projects and therefore not well structured and on a large scale as expected. Therefore, the participant recommended that there is a need to deliberately develop a comprehensive approach to community engagement in order to consolidate these efforts. Once a comprehensive approach is developed, he argues for more investment by the university in innovative ways of engaging communities in climate change mitigation and adaptation activities.

The other strategy to enhance the community component was creating more networks and partnerships with local actors. One reported:

> "It involves multi-stake; you know that sort of thing. Ministries, NGOs of course community based organizations, all those. The university just going and coming, I think it can't do a useful thing as is needed, and climate change is not only agriculture, it impacts livelihoods, everywhere, whether you are growing maize, bananas or keeping cattle or goats. So that is it." *[MUK PL24; Position: 55-55]*

The participant proposed that the university needs to create more networks and partnerships with local actors like individuals, groups and organisations within the communities where climate change programmes are implemented. Networking with local governments, NGOs, local community groups and other institutions in various sectors would help a lot to support the climate change work. It would also make it easy for the university to reach out to more people with climate change information.

d) Institutional management improvement strategies

This category relates to the ways the university can adopt to improve its institutional management for climate change programmes. The participants suggested several ways to improve institutional management. These included improving institutional arrangements for climate change activities; improving remuneration of academic staff on climate change programmes; developing necessary infrastructure for climate change work; and training more academic staff in climate science.

The participants argue that institutional arrangements for climate change must be improved to support proper coordination of climate change activities. As one participant commented:

> "The first thing is to do institutional arrangements. I think the institutional arrangements are missing in such a way that in almost all universities in Africa, have climate change programmes. But have no institutional arrangements to really coordinate and track progress in terms of doing research, develop an agenda for training and research in a very consistent and progress way. That is number one. Institutional arrangements, that should be very critical." *[MUK PA22; Position: 97-97]*

There should be clear and well-coordinated programmes, a system of tracking progress and developing the research and training agenda in a systematic way. According to the participants

this is still lacking at Makerere as far as climate change interventions are concerned. However, the establishment of MUCCRI has been a very good step in improving institutional arrangements for climate change.

The other suggestion was to improve the remuneration of academic staff on climate change programmes at the university. One was quoted saying;

> "Makerere University is working on that but moving slowly, because of the meager resources. I think the rest, the university is trying. Another it would do is to increase on the remuneration of academic staff, we need more money so that we can concentrate on our roles at the university, rather than doing so many things to survive. So we end up dividing the time so that we survive. In other universities, the staff are just concentrating on the job, because they are paid reasonably well, compared to what Makerere University pays us. I wish we can work out something." *[MUK PL21; Position: 79-79]*

The participant claimed that one of the reasons why existing members of academic staff do not concentrate a lot on university work is because their remuneration is still low. They have to divide the time to look for additional resources to supplement the little they get from the university. The participant contends that if the remuneration of academic staff can be improved it would make them more committed to climate change interventions at the university. This will improve the quality of programmes and their impact.

Participants also argued that a conducive environment with necessary infrastructure would motivate those involved in climate change programmes to worker harder and achieve more. One said;

> "then try to develop necessary infrastructure to enable people work in good environment and that can facilitate realization of greater benefits." *[MUK PL22; Position: 51-51]*

Therefore, the university needs to seriously invest in developing infrastructure such as well-equipped laboratories and training facilities for climate change science.

One of the challenges highlighted during the study is lack of adequate expertise in climate change science in the country and the region. One argued;

> "But probably most important is to train more staff, because sometimes student numbers can also be a challenge. So if we can have more staff, then the student to lecturer ratio

> really becomes so small, and that helps us to create more time to do research, community engagements and outreaches instead of spending all the time in class." *[MUK PL21; Position: 75-75]*

According to her, this challenge can be resolved by a deliberate effort and investment in training more academic staff of the university on climate science. Others suggested retooling of existing staff in various disciplines since climate change cuts across, and developing capacity developing initiatives for junior staff to specialise in climate science at graduate levels. This would strengthen the capacity of the university to provide quality teaching since the lecturer-student ratio will reduce to manageable levels. It would also create ample time for academics to conduct research on climate change and engage in other community and policy related work on the same.

Other institutional improvement strategies suggested included establishing regional collaborations and partnerships; exploiting the role of indigenous knowledge in climate change mitigation and adaptation; encouraging the government to pick interest in university climate change programmes; and encouraging government agencies to open up facilities to the university.

The participants argue that establishing regional collaborations and partnerships is good for climate change work because the challenge of climate change especially in Africa needs concerted efforts from various actors. One said;

> "universities should collaborate and work under the notion that we are Africans and we should be the first to solve African problems. In so doing we can have this network. I want to thank again Makerere university for these achievements and again our department, because we have developed, am an urban scholar and we have this urban action laboratory, it already has a website that is running and its now working with other universities like the university of Nairobi. We are calling more students and under such collaborations and partnerships, I think we should be the number one people to solve African problems." *[MUK GD22 PGD MUK; Position: 59-59]*

Participants noted that Africans have to work together in solving their own problems before others outside the region come in to support. Regional collaborations and partnerships with

other universities and organisations would be very important in improving the implementation of climate change efforts by the university.

Partnerships with communities can also enable the university to exploit the role of indigenous knowledge to develop climate change interventions. As one participant noted:

> Communities have indigenous knowledge, which they apply in adapting to climate change, which we researchers don't know. So we need to document it and find out whether what works in area A can also be applied in area B. Then we see weather can collectively empower the nation on climate change. *[MAK GD22 PGD MAK; Position: 43-43]*

This knowledge should be documented and utilised in developing programmes in order to ensure that the programmes are relevant to the needs of those involved and feasible in the areas of operation.

The Participants proposed that the government should pick interest in the programmes of the university and open up its facilities to the university as a way of pushing the climate change agenda higher. The university has a lot in stock that the government needs for example scientific evidence on climate change and policy guidance. In their own words, one was quoted saying;

> "Yeah, I think sometimes the government should also have an interest and if the university can't do certain things alone, then they should I think convince the government where necessary and see that certain things really get done." *[MUK GD21 UG MUK; Position: 60-60]*

The government should support activities that the university implements on climate change especially research programmes.

Government agencies such as the Uganda National Meteorological Authority, which are involved in collecting climate data, also have to open their facilities to the university. One participant supported this when he said;

> "Now, and so also government units should open up their facilities to the universities. There should be a very good close collaboration and interlinkages, otherwise we are just wasting time. Because it is the same blame game, that continues where government don't understand us, the government saying universities are theoretical. But the

> universities are theoretical, don’t blame them. There is a reason why a university is a university, and a policy environment is different." *[MUK PR21; Position: 82-82]*

University researchers and students need to easily access the data for their research from these agencies. Some participants argued that collaboration between the university and government agencies would help to advance climate change work because they will supplement each other’s efforts.

Chapter summary

This chapter analysed the contextual background about Makerere University and the key findings of the action situation for each theme. The key findings of interview and focus group data focused, first, on the role of the case university in supporting climate change education programmes in the country. Second, it gave an overview of the current university programmes on climate change implemented at the case university. Third, it explored participants’ views on the challenges faced by the university in implementing climate change education programmes. Forth, it discussed the key drivers for climate change education work at the university and, finally, it explored participants’ suggestions on the way the university could improve its interventions on climate change education.

CHAPTER SIX: KEY FINDINGS FOR CASE 2; UNIVERSITY OF DAR ES SALAAM

Introduction

This chapter covers the contextual analysis and the action situation at University of Dar es Salaam (UDSM). It provides a brief overview of the climate change situation in the United Republic of Tanzania and background information about the UDSM case. It also presents the key findings for each theme.

6.1 Contextual analysis of the case

Location, demographics and economic outlook of Tanzania

The United Republic of Tanzania is located in East Africa. It is the largest in East Africa with Uganda and Kenya as neighbours to the north, Mozambique, Malawi and Zambia to the south, while DRC, Burundi and Rwanda neighbour it to the west. To the east the country borders the Indian Ocean. Tanzania is located between latitudes 1° and 12° south of the equator and longitudes 30° and 40° East of Greenwich Meridian (GOT, 2007, p. 1). The country has an area of 945,087 km² with a land area of 883,749 km² and inland water bodies covering 59,050km². Tanzania is endowed with key features like mountain Kilimanjaro which is 5,950 meters high and its peak is the highest point in Africa; Lake Tanganyika the deepest lake on the continent, river basins and forests as well as other natural resources (ibid).

The population and Housing Census of 2012 indicated that Tanzania had a population of 44,928,923. Of these, 43,625,354 lived in Tanzania mainland while 1,303,569 lived in Zanzibar. The census showed that 48.7% were males while 51.3% were females. It also revealed that 70.4% of the population lived in rural areas while only 29.6% were urban dwellers. The annual population growth rate for the period 2002-2012 was 2.7% (TNBS, 2014, p. 2). The country had a literacy rate of 71.8%. The statistics showed that 50.1% of the population is aged 0-17 years depicting a young population and therefore a high dependency rate with 58% of those above 15 years married. The total fertility rate is high with 5.4 children per woman and one of the highest in the region (GOT, 2016, p. 14).

The economic outlook of the country clearly showed that in 2016, Tanzania was the second biggest economy in East Africa with a GDP of $ 47.34 billion and annual GDP growth rate of 7.0%. Data from World Bank shows that the GDP per capita in PPP terms was $ 2,740 in 2016 (WB, 2018). The key economic sectors of the economy were agriculture employing 66.9% and contributing 23% to GDP, tourism and manufacturing with a 5.2% share to GDP in 2015. The other key sectors were building and construction as well as trade and commerce. The poverty

rate was at 28.2% in 2012 while the Human Development Index (HDI) value for the country was 0.521 in 2014 (GOT, 2016, p. 13).

The climate change profile for the country

Environmental statistics show that Tanzania does experience two categories of rainfall patterns, the unimodal and bimodal rainfall patterns. The unimodal pattern is where there is only one rainy season and this is usually evident in the southern, south western, central and western areas of the country. In these areas, the rainy season is often between November and April in a year. The bimodal pattern is where two rainy seasons are experienced. This is often experienced in the "coast north of mafia, north eastern highlands, areas around Lake Victoria and the islands of Unguja and Pemba (GOT, 2014, p. 12). These rainy seasons happen between March and May for the longer episodes while the shorter episodes occur between October and November every year (ibid).

The same statistics show that Tanzania experiences high temperatures between September and April with an average maximum temperature ranging 27°C and 32°C while the minimum range is between 22° C and 26°C monthly (GOT, 2014, p. 13). The UNDP country profile for Tanzania reported an increase in mean annual temperature at an average rate of 0.23° C per decade and decreasing trends in annual rainfall averaging at a rate of 2.8mm per month (McSweeney, New, & Lizcano, 2014). The UNDP General Circulation Model projections for Tanzania indicate increases in frequency of hot days and nights as well as extreme rainfall related events like floods (ibid).

Tanzania has experienced "frequent and prolonged droughts, declining crop yields, loss of livestock, lower water availability and quality, severe floods, sea level rise and an increase in vector and water-borne diseases" (GOT, 2012, p. 1). The country's development and survival is "dependent on the use of natural resources, rain-fed agriculture and biomass for household energy" (GOT, 2007, p. v). This makes it more vulnerable to impacts of climate change and therefore needs interventions through mitigation and adaptation measures. In response, the government enacted some laws to address challenges of climate change. These include; the National Environmental Management Act 2004, the National Adaptation Programme of Action (NAPA), the National Climate Change Communication Strategy 2012-2017 and the provisions on climate change in the National Five Year Development Plan 2016/17- 2020/21 (GOT, 2012, p. 2).

The Environmental Management Act 2004 has several provisions on climate change specifically article 75 sections a, b, c, d and e. These provisions call for action to address climate change through issuing guidelines, strategies and action plans including provisions for dealing with climate change through education. The Act requires that government takes position at global level by ratifying and implementing conventions and protocols on climate change (GOT, 2004, p. 57).

One of the key indicators in the National Five Year Development Plan 2016/17-2020/21 is to "increase the proportion of districts with climate change and disaster risk reduction strategies to 60%". The plan identifies various interventions related to climate change, including putting more emphasis on emission reduction, fostering environmentally sustainable policies and strategies including climate change adaptation and mitigation, as well as supporting research for mitigation and adaptation to climate change (GOT, 2016, p. 58). The plan calls for enforcement of environmental impact assessments and audit regulations. It provides for development of participatory climate change adaptation measures, strengthening climate change projection and early warning as well as natural disaster response (ibid). These provisions show governments commitment towards climate change mitigation and adaptation in the country.

Background information about UDSM case

The University of Dar es Salaam has 5 campuses located in different parts of the country. The main campus popularly known as the Mwalimu J. K. Nyerere Mlimani campus is 13km west of Dar es Salaam city and comprises several academic and non-academic units (Office of the Deputy Vice Chancellor, 2016, p. iv) . The Colleges and Schools at this campus include School of Business Studies, School of Education, School of Law, College of Humanities and Social Sciences, College of Engineering and Technology as well as the College of Natural and Applied Sciences (Directorate of planning & finance, 2015, p. 4).

The other campus is the Kijitonyama Campus that houses the College of Information Technology and the School of Journalism and Mass Communication. This campus is located in Kijitonyama area on Bagamoyo road (ibid). Another campus is the Chang'ombe Campus where the Dar es Salaam University of Education (DUCE) is found. This campus is located on Chang'ombe road, Keko, near the Tanzania National Stadium. The Faculties of Humanities and Social sciences, Science and Education are located at this campus (ibid).

The Mkwawa Campus houses the Mkwawa University College of Education (MUCE). Both the Dar es Salaam University College of Education (DUCE), the Mkwawa University College of Education (MUCE) "focus on training teachers for secondary schools" to cater for "the needs of the Primary Education Development Programme (PEDP) and Secondary Education Development Programme (SEDP)" (Directorate of Planning and Finance, 2015, p. 2). The Mkwawa campus is "located in the southern highlands of Tanzania in Iringa municipality about 3kms from the bus stand" (www.muce.ac.tz, accessed on 12/01/2017). The MUCE like the DUCE also has the Faculty of Humanities and Social Sciences, Faculty of Science and Faculty of Education (Directorate of planning & finance, 2015). The last campus is one that houses the Institute of Marine Sciences (IMS) located "at Buyu, about 13km south of the stone town of Zanzibar" (https://ims.udsm.ac.tz/about-ims, Accessed on 12/01/2017). This institute focuses on research and training in marine sciences.

The University of Dar es Salaam (UDSM) is known to be "the oldest, second largest public research university in Tanzania" offering undergraduate and post graduate training, research and consultancy services (Office of the Deputy Vice Chancellor, 2016, p. iv). The university "started as a college under the tutelage of the University of London in October 1961" with the aim of training "high level, requisite human resources for the development of the nascent nation." At that time, it was "an instrument for the ideological and social orientation of the national elite" in the country (Office of the Chancellor, 2015, p. 1). The college later became a constituent college of the University of East Africa in 1963.

In 1970, the University of East Africa was dissolved and this gave birth to three independent universities: Makerere University (Uganda), University of Nairobi (Kenya) and University of Dar es Salaam (Tanzania). Subsequently, it became a national university by Act 12, 1970 with three main objectives:

a) To transmit knowledge as a basis of action, from one generation to another.

b) To act as a centre where the frontiers of knowledge could be advanced by scientific research.

c) To meet the high level human resource needs of the Tanzanian society.

(Source: Directorate of Planning and Finance, 2015, p. 2)

After operating for some years as an independent university, fully fledged with several faculties, institutes and schools, the University of Dar es Salaam expanded its academic programmes and disciplines (UDSM, 2015, p. 1). Records show that "by 1996, UDSM had grown into an all-round university, offering all major traditional university disciplines including the humanities, social sciences, physical and biological sciences, medicine, agriculture, commerce and management, engineering, lands and architectural sciences and Journalism" (ibid).

The university later gave birth to other 3 independent universities: Sokoine University of Agriculture (formed out of its Faculty of Agriculture, Forestry and Veterinary Medicine in 1984); Muhimbili University of Health and Allied Sciences from the UDSM College of Health Sciences (2007); and Ardhi University from the UDSM College of Lands and Architectural Studies (2007) (ibid). Following the establishment of the three independent universities, the University of Dar es Salaam established other units to "restore its capacity to address development challenges relating to health, agricultural development and decent housing" (Office of the Chancellor, 2015, p. 3). Of recent, the university has once again re-established the "School of Health Sciences and the College of Agricultural Sciences and Fisheries Technology to plug the gap" (ibid).

The university has been growing in terms of student enrolments over the years. Records show that in 2006, the university enrolled 14,339 and 2,576 students for undergraduate and postgraduate programmes respectively. In 2010/11, the enrolment rose to 16,896 and 2,658 students for undergraduate programmes and postgraduate studies respectively (Directorate of Planning and Finance, 2015). The academic year 2015/2016 saw an enrolment of 22,963 students at undergraduate while 2,486 students were enrolled for postgraduate studies (Directorate of planning & finance, 2017).

Regarding staffing at UDSM, the number of academic and administrative staff has been growing over the years. In 2006/07, UDSM had 2,855 staff and by 2010/11, the number shoot up to 3,179 (Directorate of Planning and Finance, 2015). The academic year 2015/2016 ended with 1,545 academic staff and 1,208 administrative staff giving a total of 2,753 staff at UDSM (Directorate of Planning and Finance, 2017).

With respect to academic qualification of the staff, by 2010/11 UDSM had 21% of its staff with PhDs, 26% with Master's degrees and 21% with Bachelor's degrees while the rest of the staff had undergraduate diplomas and certificates (Directorate of Planning and Finance, 2015). The

academic staff by qualification for the year 2015/16 were 604 had doctorates, while 672 had Master's degrees. Those with Bachelor's were 269 while the rest had Ordinary Diplomas and Certificates. For administrative staff, 2 had Doctorates while 96 had Master's degrees. Those with Postgraduate Diplomas were 15 and 94 held Bachelor's degrees. The rest of the administrative staff had Ordinary Diplomas and Certificates (ibid).

Academic programmes at UDSM have been increasing over the years. The university started with the Faculty of Law with 1-2 programmes only. However, by the year 2002/03, UDSM had 147 academic programmes. These increased to 242 in 2006/07. However, as mentioned above, the establishment of Muhimbili University of Health and Allied Sciences as well as Ardhi University out of 2 academic units of UDSM in 2007, reduced the number of programmes to 150 only (Directorate of Planning and Finance, 2015).

In 2017, the university had 54 Doctorate degree programmes, 100 Master's degree programmes, 20 Post-graduate Diploma programmes and 72 undergraduate programmes, giving a total of approximately 200 programmes offered (www.udsm.ac.tz, Accessed on 14/01/2017).

6.2 Action situation for Case 2: University of Dar es Salaam

This section presents findings from semi-structured in-depth interviews, and focus group discussions conducted at the University of Dar es Salaam. The participants' views and opinions were categorised into five themes answering the three research questions as shown in the table below:

Table 6.1: Code structure for case 2; University of Dar es salaam

Research question	**Themes and sub themes**
What are the current academic, research and community engagement programmes on climate change implemented by the higher education institutions (Universities) in selected cases?	**Theme 1: The role of the university and institutional support for climate change interventions** **Sub theme 1.1: The university in action** • A knowledge generator on climate change • A home for training and capacity building on climate change • A source of information and guidance on climate change phenomenon

	• A leader of action on climate change in communities **Sub theme 1.2: Institutional support for climate change** • Strategic support for climate change programmes • Administrative support for climate change interventions **Theme 2: University programmes on climate change** **Sub theme 2.1: University training menu** • Short courses on climate change • Long courses on climate change • Postgraduate programmes on climate change **Sub theme 2.2: University research menu** • Climate change science research • Climate change mitigation research • Climate change adaptation research **Sub theme 2.3: The University goes out** • Engaging policy and decision makers on climate change issues • Supporting communities to deal with climate change effects • Sensitizing communities on climate change
What are the key challenges faced by the implementing units in carrying out programmes on climate change within the universities in selected cases?	**Theme 3: Enemies of progress to university climate change education interventions** • Institutional barriers • Resource related challenges Organizational environment related obstacles
What are the success factors that would support universities to adequately address climate	**Theme 4: The key drivers and current openings for our work**

change issues in their programmes and what can be done to improve the situation?	**Sub theme 4.1: The key drivers for our climate change work** • Internal influences • External support mechanisms **Sub theme 4.2: The current openings for our climate change work** • Legislation backup • The nature of the phenomenon • The conducive environment around the university **Theme 5: Ways to do things better** • Training and capacity development improvement strategies • Research capacity improvement strategies • Community outreach improvement strategies • Institutional management improvement strategies

Theme 1; The role of the university and institutional support for CCE interventions

Box 6.1: participant's views and perspectives on the role of the university and institutional support for climate change education interventions at University of Dar es salaam

Sub theme 1.1: The university in action

- A knowledge generator on climate change
- A home for training and capacity building on climate change
- A source of information and guidance on climate change phenomenon
- A leader of action on climate change in communities

Sub theme 1.2: Institutional support for climate change

- Strategic support for climate change programmes
- Administrative support for climate change interventions

Sub theme 1.1; The university in action

University of Dar es Salaam is engaged in training, research and community outreaches on various disciplines. It is a premier institution held in high esteem as the epitome of academia in the country. The participants identified several roles regarding the role that the University of Dar es Salaam play in addressing climate change issues in its programmes. These have been categorised into four: a knowledge generator on climate change; a home for training and capacity building on climate change; a source of information and guidance on climate change phenomenon, and a home of action on climate change in communities. Findings for each of these categories are presented below;

a) A knowledge generator on climate change

The study participants argued that the University of Dar es Salaam is well positioned to generate knowledge on climate change through its research activities. Through conducting climate change science, mitigation and adaptation research the university can ably contribute to the much-needed knowledge to support mitigation and adaptation to climate change at various levels of society. One of the participants noted:

> "I think [the] university is…a hub of knowledge, so it should perform…to the best levels that…can now generate knowledge that can be used by others. So, we need to make sure that we have…we conduct quality research and that can inform policy and can inform adaptation practices on the ground." *[Interview A13; Position: 76-76]*

The participant acknowledged that University of Dar es Salaam ideally is a hub of knowledge and therefore called for conducting quality research that can inform policy and adaptation practices. Through supporting scientific research on climate change, the university can ably be a source of knowledge to individuals, corporate firms, voluntary organisations, public entities and the policy makers on climate change. To support this, one other participant argued that "the university has been for years setting aside a certain budget for research" which shows its commitment to advancing research and knowledge including climate change research. They continue to argue that the university should not only generate knowledge on climate change through research but also share and interpret the research findings. One of them observed:

> "The role in fact, first is to make the interpretation of, this scenario we call climate change. Because we believe this area is where we get people with such knowledge in science. Climate change a need science, so at university level you get people who are informed with the science and therefore, these findings cannot be interpreted by some

> people down town. So, you need to come into the university where we have scholars who can interpret these climate sciences and that is it. And this will benefit other people and therefore try to harmonize actions to assist." *[Interview L14 ; Position: 19-19]*

According to the participant, the university is "where we get people with such knowledge in science" who should share and help interpret the findings to other actors in order to "harmonise actions" regarding climate change mitigation and adaptation. He indicates that because the university has experts, well-grounded scientists and knowledgeable people on issues of climate change, these should support interpretation of research findings to other people who are not experts. One of the participants supported the role when he said:

> "So if they have that knowledge…it will be a lot easier for you know, mainstreaming climate change in various sectors and both at ministerial level, at local government level, even in the private sector, even local government authorities." *[Interview A11; Position: 15-15]*.

The participant argued that when the university generates and disseminates this knowledge, then actors in various sectors at all levels will be able to mainstream issues of climate change in their operations and decision making processes.

b) A home for training and capacity building on climate change

The university was seen as a home for training and capacity building on climate change. The participants looked at the university as a place where all kinds of trainings and capacity building activities on climate change can be delivered to different groups of actors. They argued that through the university, issues of climate change can easily be mainstreamed across sectors. According to them, university education offers many opportunities to ensure that all who go through the system get a dose of climate change. This will ensure that university graduates take into account issues of climate change in whatever they engage. One participant noted:

> "Obviously…education is important at all levels, because we are talking about mainstreaming climate change issues in the development process, and these are the people who at one stage will be, you know, hmm working in various areas." *[Interview A11; Position: 15-15]*

The participant contemplates that if all who attend university education can get a dose of climate change education, they will support "mainstreaming climate change issues in the development process." The participants also looked at the university as a place where the

capacity of experts in climate change can be developed. Through training programmes at undergraduate and postgraduate levels, and tailored short courses on climate change, the university can ably develop capacities of various actors and create an array of experts in the field. Some of the graduates could end up supporting governments, voluntary agencies and institutions on climate change mitigation and adaptation as experts or consultants.

The participants also indicated that the university can play a technical role in supporting the various actors through training and capacity building. One respondent noted:

> "…. I think the university can play a technical role. There are institutions out there NGOs, private, governmental, that are involved in this. But how much do their staff know? How much are they informed? Because you cannot deal with the unknown, you need to know for you to address the issue. [T]hey can do training of the Staff…to handle it, I think the issue of climate change should be translated, simplified into a lay man's understanding. It has been complicated for people. It has become a song yes, everyone knows the word now but, what is it? To a layman's language, because…someone who didn't go to school should be able to know by what they mean by climate change. So, the translation into the local understanding to a layman's language I think that will help a lot. Then, there should be dissemination of the research." *[FGD PG UDSM; Position: 22-22]*

The training and capacity building should not be limited to experts but also people who are involved in climate change work especially at grassroots levels. As noted in the excerpt above, NGOs, private companies and staff in government departments need to be trained and supported to understand technical issues related to climate change. The participant argues that the university can ably do this kind of training and capacity building since it has the experts. In the process of training and developing capacity for such people, the university can also disseminate research findings to them and make them more informed on what is happening. The university was seen as a place where experts can be sourced to provide consultancy services to organisations and agencies. A participant observed:

> "[W]e have mobilised human resources who are working with different partners and the university has been in one way or another applying for consultancy…jobs that people can…put forth their expertise in the region and contribute to the society in that regard." [Interview L11; Position: 19-19]

Often, public agencies, voluntary organisations and private firms require experts to support in undertaking consultancy assignments related to climate change issues. The participant argues that the university can provide 'expertise' to apply for such consultancy work and "contribute to the society in that regard." This role does mainly two key things. First, the university generates resources through these consultancy assignments because the client organisations pay for them; secondly, the University offers its expertise and knowledge to the client organisation to deal with the problem or situation that need expert knowledge and skills.

c) A source of information and guidance on climate change phenomenon

The university being a place where knowledge is generated, participants felt that it can be a key source of information and guidance on climate change phenomenon. The university can compile all the needed information on climate change and make it available to various actors. There are so many actors in the communities dealing with climate change issues. These include government agencies, NGOs, private firms, individuals and community based groups. Many of these do not have the right information about climate change and often provide conflicting information to the population. The participants argued that the university could be a one-stop centre for providing this much needed information and guidance to these various actors. One participant noted:

> " The university…is the best place where you can now generate…inject knowledge or even information to those people who are working on the ground." [Interview A13; Position: 78-78]

The participants urged that the university can engage policy makers and other decision makers on issues of climate change through writing policy briefs. This would involve synthesising research findings into policy briefs and distributing them to the relevant ministries and agencies. The policy makers will get the relevant knowledge and information that would help them in making relevant decisions and deciding on policy options. One of the participants noted:

> "[W]e do it in several ways; one of it is to publish. But you know…politicians and policy makers don't have time to read. So what we do we synthesise these findings into policy briefs, which we just distribute to the relevant ministries and the relevant policy makers." [Interview R12; Position: 37-37]

In the excerpt above, the participant notes that though many of the research findings are published, many of the politicians and policy makers don't have time to read or access full

publications. Therefore, he called for writing synthesised key findings in form of policy briefs that should be distributed to relevant ministries or agencies. The other way is holding conferences and dialogue as well as climate change week events. As one of the participants observed:

> "You have the government; you have even the private engagement, have a lot of conferences…a lot of researches that are going on, a lot of publications. We normally host…this year we had all five days, what we call the climate change week, where we had conference presentations. People were invited from the government side, international stakeholders, students, lecturers and all had the opportunity to do their presentations for five days. From Monday to Friday." [Interview L13; Position: 43-43]

The excerpt above illustrates the need to organise conferences and other events like climate change week events. During such events, government officials and other actors can be invited to attend and be sensitised on current research and they can be given up-to-date information on climate change. The participant points to the fact that such events would give experts in climate change an opportunity to guide the policy makers and actors on the best options on climate change issues.

d) A leader of action on climate change in communities

Regarding the role of the university as a leader on climate change in communities, participants argue that take the lead in supporting them to deal with climate change effects. Through outreaches, communities could be engaged in local adaptation initiatives that are simple and friendly or easy to be implemented by members. One of the participants said:

> "[W]e need to have this local based adaptation initiatives being supported or routed from communities themselves, rather than injecting sophisticated information, science based information to our local communities." [Interview A13; Position: 17-17]

The participant called for “local based adaptation initiatives” with the participation of the local communities. Such initiatives can be championed by the university based on research conducted within the community. The experts from the university would then support the communities through these initiatives. The participant argues that these initiatives would be better than “sophisticated, science based information” that is not easily understood and comprehended by community members. Through such initiatives, the university will be closer to the communities and therefore support them in addressing their immediate needs.

Sub theme 1.2: Institutional support for climate change interventions

The university plays a big role in ensuring effective implementation of the climate change education (CCE) programmes. The institutional arrangements and effectiveness of the university management determines how efficient and timely CCE interventions will be. The researcher categorised the views and opinions of participants regarding institutional support for CCE in two areas: strategic support for climate change education programmes, and administrative support for climate change education interventions. These are explained below;

a) Strategic support for climate change education programmes

The strategic support refers to the commitment and decisions by management to put in place long term mechanisms that support effective implementation of the interventions. Participants looked at the university decision to establish the Mwalimu Nyerere Research Chair and support the Centre for Climate Change Studies to become a fully-fledged institute as strategic support for CCE programmes.

The establishment of Mwalimu Nyerere Research Chair on Pan-African Studies was seen as a key milestone for supporting climate change research and policy engagements. The chair has promoted debate and policy engagements annually on aspects of environment related aspects including climate change. The participants reported that every year, events like the climate change week are organised by this research chair and a wide range of actors are engaged in these activities.

Participants indicated that the university continues to support the CCE programmes at the Centre for Climate Change Studies and there is a strategic intension to make the centre a fully-fledged institute within the university system. One of them commented:

> "[T]he university management has always, and continues to be, happy with what we are doing in the centre, and IRA with respect to climate change, and there are 2 areas that they would like to intervene. One is to strengthen the centre, so that it becomes a fully-fledged institute in the university system, and this will give us 1 or 2 opportunities. First, is to be considered in the budget, but also to be considered in terms of staffing. So, that is a very good move. And this comes out of the recognition by the university management that what the centre is doing, much as it is still very new, … is commendable. So, this means that we have full support from the university management on what we are doing on climate change." [Interview R11; Position: 17-17]

The participant notes that the university management is very happy about the work being done by the centre for climate change studies. He reported that there is a plan 'to strengthen the centre, so that it becomes a fully-fledged institute' which will enhance its budget support and staffing levels. This is a strategic kind of support because with increased budget support and staffing, the new institute will have a wider mandate and expanded operations. In the long run, climate change education programmes will be more effective and comprehensive creating wider impact on society.

b) Administrative support for climate change interventions

Administrative support refers to ensuring that programmes get the necessary facilities, funding, resources and procedural clearances needed to achieve their objectives.

Participants reported that the university provides many of the facilities required to run the programmes. Facilities like infrastructural services, stationery and secretarial services as well as other necessary equipment for the running of the programmes are provided. The participants mentioned that the university is very supportive when it comes to developing new programmes and courses on climate change. The approval process of new programmes has been smooth and swift due to the support of management. One of them observed:

> "[T]he administration has been very supportive. We have designed many new programmes here…and they have been helping us to accomplish those. So, even the donors…trust us. Once you have put up a very good proposal you are assured of that funding." [Interview R12; Position: 57-57]

This kind of support is very important especially when more new programmes and courses on climate change need to be developed. New programmes and courses enable more actors to gain knowledge, skills and attitudes on climate change mitigation and adaptation. The participants also argued that management has been helping in research clearance processes, and assisting staff to get to the research sites in the communities. The administrative support offered by the university management to climate change programmes is a very good step in enhancing climate change mitigation and adaptation interventions.

Theme 2: University programmes on climate change

Box 6.2 Participants views on climate change interventions at University of Dar es salaam

Sub theme 2.1 University training menu

- Short courses on climate change

- Long courses on climate change
- Undergraduate programmes on climate change
- Postgraduate programmes on climate change

Sub theme 2.2: University research menu

- Climate change science research
- Climate change mitigation research
- Climate change adaptation research
- Climate change policy research

Sub theme 2.3: The University goes out

- Mobilizing communities to deal with climate change
- Providing onsite solutions
- Introducing new products

Sub theme 2.1; The university training menu

Training is one of the cardinal functions of a university. This function is fulfilled through offering various programmes and courses in various disciplines to people who later join the labour force. This sub-theme explores views, opinions and ideas regarding the various programmes and courses on climate change offered by the university of Dar es salaam. The theme has been categorized into three; short courses on climate change, long courses on climate change and postgraduate programmes on climate change. Each is explained below;

a) Short courses on climate change

Short courses are usually designed for specific groups of actors to sensitise them on some aspects related to their work. Many of these courses run for a short period say between one to six weeks. These are usually hands-on with various practical activities. The participants reported that the university has been running several short courses on climate change. These have particularly targeted agricultural extension workers, community leaders and other professionals in the communities. The short courses empower people on what climate change is and make them realise their role in addressing it. One participant said:

> " We have some short courses and…some are driven by themes that are allocated or stipulated in the projects. So…we identify the relevant stakeholders who can be engaged in that…capacity building." [Interview A13; Position: 40-40]

The participant noted that many of the short courses are “driven by themes that are allocated or stipulated in the projects.” They are more of scheduled short courses within research projects implemented by various departments across the Institute of Resource Assessment (IRA). Depending on the schedule, various relevant stakeholders are identified and invited to attend as a form of capacity building on climate change. Such short courses focus on creating awareness and providing soft skills that actors can use to mitigate and adapt to climate change. They also enable them to review their activities and make them climate friendly.

It was reported that the Centre for Climate Change Studies at the university is also engaged in conducting short courses. These short courses have been developed and run for community leaders, stakeholders and other groups of decision makers, to create awareness on climate change issues. They also help these actors to map out ways of dealing with the problem in their activities and engagements.

The participants reported that the university has been engaged in conducting seminars and workshops on climate change targeting different groups of actors. One participant said:

> "[S]ometimes you find we…have been…. conducting seminars and workshops, for different groups of interest; for instance, we have been offering workshops, seminars to primary school teachers. The Centre for Climate Change Studies has done that several times. Sometimes to students, we do conduct these though we also conduct public talks on climate change." [Interview L11; Position: 21-21]

The participant noted that the university has been conducting seminars and workshops on climate change for various groups of actors. He cited Primary school teachers and students as groups of actors who have benefited from such workshops and seminars. One participant noted:

> " We also engage in seminars, we also have this annual forum, we have some projects supporting capacity building, so we run seminars and we run workshops of capacity building to stakeholders…working with the pastoral communities or even farmers. …[E]ven government technical officers yeah from different departments." [Interview A13; Position: 13-13]

These capacity building workshops and seminars have targeted mainly government technical officers working in various departments. They involved actors in pastoral communities as well as farmers. The participant argues that the seminars, workshops and annual forums enable stakeholders to have the necessary knowledge and information about climate change. The other

form of short-term trainings on climate change conducted targeted teachers from other levels of education. One participant said:

> "[I]nitially I think it was in 2014 we had some funds to support capacity building to primary school teachers. So it was now, the essence of trying to trickle down the knowledge, so that at least if these people they understand they can impart that knowledge to their young students, so that they can understand this agenda while they are growing. So, they grew (grow) with the knowledge until they reach to the sophisticated knowledge system at the university." *[Interview A13; Position: 19-19]*

Participants reported that the university attempted to develop the capacity of teachers at lower levels of education since 2014 as a way of "trying to trickle down the knowledge" of climate change to students and pupils. The purpose was to ensure that the trained teachers "impart that knowledge to their young students, so that they can understand" issues of climate change as they grow up. This will help to prepare the young people for the sophisticated knowledge on climate change science at higher levels of education. This is a very strategic move for the university. Targeting young people at an early age would ensure sustainable climate change mitigation and adaptation practices.

b) Long courses on climate change

The university also offers long-term courses on climate change. Long-term courses are structured courses that run at least a semester within a structured programme at either undergraduate or postgraduate level. Such a course (compulsory or optional) is part of other courses within a programme offered by the university. The participants reported that there are various long courses on climate change offered within specific programmes. A participant observed:

> "But the long term is that, for us in Geography we have courses that are taught every year, every year and they are put permanently in a certain program. [For] Master's we have a programme is called Climate Change and Human Adjustment. That is offered to those who are taking Geography and Environmental Management." *[Interview L14 ; Position: 26-26]*

The participant stated that within the Department of Geography, an integrated course runs across various programmes to create awareness on climate change for all students within the department. He cites Climate Change and Human Adjustment, which is taught to students

taking a Master's programme in Geography and Environmental Management. The other long course on climate change is Climatology. Participants indicated that many of the undergraduate programmes within the Department of Geography have to take Climatology as one of the compulsory courses. A participant noted: "so far, we have…in the Institute of Resource Assessment…a Master's programme in Natural Resource Assessment and Management and we have one of the courses, being climate change mitigation and adaptation." *[Interview A12; Position: 17-17].* It was thus revealed that a course on climate change mitigation and adaptation is taught within a Master's programme in Natural Resource Assessment and Management at IRA.

c) Postgraduate programmes on climate change

The university offers a wide range of postgraduate programmes in various disciplines. Such postgraduate programmes range from Post-graduate Diplomas to Master's degrees and PhDs. This category explored the participants' views regarding the existing post-graduate programmes on climate change offered at the university. One participant said:

> "…….but in PhD, because we are teaching in both aspects at the thesis and the coursework part. In the coursework part, is definitely the aspect of Climate Change all that has been covered, but to be more specific, the Climate Change Centre, is providing the long term Master's and PhD. We have PhD Climate Change, then a Master of Science in Climate Change and Sustainable Development as a programme. So…I think Climate Change is most tackled by the Climate Change Centre." *[Interview L14 ; Position: 30-30]*

The participant reported that the IRA and specifically the Department of Geography runs a PhD programme in Geography where various aspects of climate change are covered during the course work part within the programme. He, however, mentioned that the Centre for Climate Change Studies offers two main programmes that are specifically on climate change. These are the PhD and Master of Science programmes in climate change and sustainable development. These two programmes are solely on climate change and cover both course work and research or thesis components. A participant observed:

> " [….] So, the university offers these particular programmes through the Centre, but teachers and other resources come from different units of the university. Different colleges are being mobilised but also we outsource the expertise from…the Tanzania

> Metrological Agency and we find expertise which…will be very meaningful." *[Interview L11; Position: 21-21]*

In the above excerpt, the participant reported that the teachers and other resource persons are mobilised from the various units of the university and other agencies with expertise on climate change. This is a very innovative strategy since the university may not have adequate expertise particularly on climate change science.

Sub theme 2.2: University research menu

University of Dar es Salaam carries out several research projects across disciplines, including climate change and sustainable development. This sub-theme explores the multiple realities for study participants regarding the various research programmes undertaken at the university on climate change. The sub-theme is categorised into three: climate change science research, climate change mitigation research, and climate change adaptation research. The findings for each of these are presented below;

a) Climate change science research

This category relates to research conducted on climate change science. The participants reported that most of this research is done by PhD and Master's students. One of the participants who is a research supervisor observed:

> "Actually my student who was…trying to link whether the problem of land use conflict is directly related to climate change. First of all, he tried to prove that there is climate change by looking at the temperature increase and he confirmed through the data that there is temperature increase in that stretch. And the other way round he also confirmed that the rainfall is decreasing over time where the temperature is rising. And he also established that there was…the farmers/herders conflict is also related in one way or another with climate change among other factors. So it is not only the climate change because like the…expansions of the farming area, the problem like urbanisation and more developments like establishment of protected areas and whatever, it is…taking a lot of pastoralist's land. But they also relate as one cause of this kind of conflict. But we also acknowledge that…as drought increases, the pastoralist also migrates to…wetland areas where they have water throughout. It is now where they clash with farmers." *[Interview L13; Position: 23-23]*

The participant argues that one of his students researched on climate change and how it affects land use conflicts in Tanzania. The student research focused on providing scientific evidence

on changes in temperature and rainfall patterns and how such changes have led to increase in land use conflicts especially among pastoralists in Tanzania.

The participants talked about research on climate change vulnerability conducted by some of the university academic units. One of them noted:

> "As a Department of Geography, we have been, you know the university was a partner in a project which was started in 2010. This research is called CHIESA. I cannot give the long form but it had to do with climate change you know vulnerability analysis. It was a research project covering three countries Tanzania, Kenya and Ethiopia…and you know it included a number of sectors in it. I remember to have participated fully in one of their meetings. So, the department benefitted by getting some research funding and also we had some Master's and PhD students sponsored from the project." *[Interview L11; Position: 27-27]*

In the above except, the participant illustrates an example of a large research project on climate change vulnerability analysis covering three countries Tanzania, Kenya and Ethiopia. The project covered climate change vulnerability analysis across sectors and countries and supported some Master's and PhD students in the Department of Geography. From the analysis, it is clear that not much is being done in the area of climate change science research possibly due to the limited number of climate change science experts within the region. The funding for such research was reported to be less.

b) Climate change mitigation research

The participants reported that the university has participated in research on reducing emissions from deforestation and forest degradation in developing countries (REDD+). The research project focused on mitigation of climate change caused by emissions due to degradation of forests within communities in Tanzania and other areas of East African region. One of them observed:

> (….) so the other project is actually looking at issues of REDD+, but again its funded by the Norwegian government. It is a capacity building programme so, we have PhDs, we have master students who are in that field, but also senior researchers are also doing some work, so again there are a number of papers that will come out of that." *[Interview A11; Position: 19-19]*

The participant noted that the project had a capacity building component supporting some PhDs and Master's students working on research related to the field. The project involved a number of senior researchers working alongside the supported students as a way of mentoring young scientists.

The other project on mitigation research was the Climate Change Impact, Adaptation and Mitigation (CCIAM) project. Participants reported that this project was implemented in partnership with the Sokoine University of Agriculture and the government Ministry of Natural Resources and Tourism. In his own words one said:

> "….the climate change impact, adaption and mitigation, the CCIAM. This one I think was funded by Norwegian government I am not so sure but it was implemented by this University but through other departments. So, it was ah partnering with another the other institution, the Sokoine University of Agriculture and we had the Ministry of Natural Resources and Tourism. So, we also had students who were sponsored for Master and PhD programmes and we had some members of the academic staff who took part in that particular research project the CCIAM." *[Interview L11; Position: 27-27]*

The participant noted that several academic staff participated in the research project alongside the students. However, it was revealed that climate change mitigation research is not carried out on a large scale, due to the high cost and the limited funding opportunities available.

c) Climate change adaptation research

Climate change adaptation research is concerned with generating scientific evidence on ways individuals, communities and institutions cope or deal with the effects of climate change at their various levels. The participants reported several research projects on climate change adaptation that have been implemented by the university. One of the research projects under this category was on climate change and coastal resources. One participant explained:

> "[T]here is one research that we finalised two to three weeks ago, in Mtwara, south eastern part of Tanzania, and this is a coastal area. So we had a recent project, which was all about assessing the impacts of climate change along the coast, looking at how you know, various livelihood options are being impacted by climate change, particularly along the coast. The idea was to cover the whole coastal area but later we decided that we concentrate in south eastern part of the coast because this is an area which has not been researched so much unlike you know Bagamoyo and the other

eastern parts which have been receiving a lot of research." *[Interview R11; Position: 13-13]*

The participant reported that the research project on climate change and coastal resources was implemented in Mtwara, south eastern part Tanzania which is a coastal region. The project focused on assessing impacts of climate change on livelihoods for people along the coastal area. He claimed that this area had not been researched a lot and, therefore, the research project was viable and ideal in this particular coastal area. The project was funded by the Norwegian government and it recommended various adaptation strategies and options for communities around these coastal areas.

The other research project mentioned by participants under this category was on climate change and agriculture in semi-arid areas in Tanzania. One of the participants noted that this project focused on assessing the effects of climate change on agricultural production in the semi-arid areas in Tanzania. The project had a big capacity building component with several PhDs and master students supported.

The other research project focused on assessing the impact of climate change on rice and maize production in Tanzania. The project was funded by the United States Agency for International Development (USAID). One participant said:

The other research project on climate adaptation focused on assessing the impact of climate change on rice and maize production in Tanzania. The project was funded by the United States Agency for International Development (USAID). One participant said;

> "[S]o far successfully we have done one program with the USAID whereby we were looking at resilience of maize and rice and the importance of climate change. I think it was one of the activities, which was really done with engagement of various stakeholders across levels from the beginning to the end." [Interview A12; Position: 36-36].

The study participants reported that the Centre for Climate Change Studies and various departments within IRA conducted research projects focusing on effects of climate change on various resources like water, forests, livestock and community livelihoods. One respondent explained:

> "[W]e have some projects basically focusing purely on addressing climate change agenda. Especially though we link with various natural resources, like how climate

> change is affecting water, affecting forests, affecting community livelihoods and especially agriculture and livestock keepers or pastoral communities, especially for our case and Uganda." *[Interview A13; Position: 13-13]*

In the quote above, the participant claims that various research projects have been carried out linking climate change to various natural resources especially within Tanzania and the neighbouring Uganda. One research project explored the effects of climate change on resources and the available adaptation options for communities affected especially the livestock keepers or pastoral communities. The other research project was carried out at regional level in collaboration with other universities is the research project on climate change and pastoralism in East Africa. One participant noted:

> "We also have another project, specifically focusing on climate change and how it will affect pastoral communities. This is a regional, regional one, covering Tanzania, Uganda, South Sudan and Kenya. It is quite interesting, because we had, we did some research and we have produced a book, you may wish to get a copy from (name of participant), just focusing on pastoral communities, quite a very nice book and it is also supporting students…it has a provision of how many students, quite a good number." *[Interview A11; Position: 19-19]*

The participant argues that the research project covered four countries: Tanzania, Kenya, South Sudan and Uganda. According to him, the research project focused on climate change and how it affected pastoral communities. The research findings were published and the book is currently used for teaching Master's and PhD students on the climate change and sustainable development programmes. The project supported several PhD and Master's students as part of capacity building. The other set of research projects on adaptation focused on the effects of climate change on coastal resources. The participant argues that good progress has been registered in this area and, therefore, was happy about the implementation. Generally, research on climate change adaptation at University of Dar es Salaam seems to be more funded compared climate change science and climate change mitigation research.

Sub theme 2.3: The University goes out

This other role of the university is what others call outreach. It relates to the activities the university implements outside its boundaries. These activities aim at supporting communities, industry and institutions to deal with problems and helping them to improve their operations and livelihoods. This sub-theme explores multiple realities of participants regarding the various

community outreach programmes on climate change. The findings are categorised into three: engaging policy and decision makers on climate change issues; supporting communities to deal with climate change effects; and sensitising communities on climate change. These are presented as follows;

a) Engaging policy and decision makers on climate change issues

Participants reported that the university has been involved in various activities that engage policy makers and decision makers to create awareness about climate change. Such activities were to support the policy makers to make climate friendly decisions and draw plans to implement them. One of the ways to engage policy and decision makers was running focused meetings with government officials. One participant said:

> "We run climate change festivals every year and so what we are going to do now is you know, we have worked on the deliberations and then we want to run more focused meetings in these different countries with government officials again, that this was what was deliberated, now how do you accommodate some of these recommendations? So they will work out and see… So we will do the same for other…sectors as well." *[Interview A11; Position: 21-21]*

The participant indicated that after holding the climate change and environment festival, the next move is to run focused meetings with government officials who attended from various countries. This will help to follow up on the key issues and recommendations deliberated on during the festival. This is a very good strategy of engaging actors who are already informed about climate change. It would support them to reflect on how best to take action at their level towards climate change mitigation and adaptation. This move is intended to ensure the actors put in place ways to implement the recommendations or ignite their actions in addressing issues of climate change in their country's policies and programmes.

The participants reported that as part of their research programmes on climate change, they have been engaging policy makers through sharing research findings and producing policy briefs. One participant mentioned that the university has been "synthesised information" through policy briefs on issues identified through research projects presented in a simpler language which can be comprehended by the policy makers. This is a very important engagement strategy because various decision makers and policy makers need such information to support their decision making at various levels. Through this strategy, decision makers are supported to make evidence based decisions in their various sectors and

responsibilities. This may enhance climate friendly practices as well as implementation of mitigation and adaptation measures at various levels.

The other way of engaging policy makers on climate change adopted by the university was through supporting them to develop decision-making tools for communities. This was one of the innovative strategies adopted to support community leaders in effective decision making on climate change. A participant noted:

> "The district officials as well, extension officers, district agriculture officials, the district management as well was participating throughout. And we finally developed what we call a decision making tool that can help various stakeholders including district officials and extension officers to put in or peg in some variables and they get the results of what they should advise farmers if temperature and rainfall regimes changes." *[Interview R11; Position: 21-21]*

The development of such decision-making tools helps district officials and extension workers to gather and organise facts and information that can be used to advise farmers and other groups within the communities. With the participation of the leaders, the research team supported the development of these tools to ensure that the key recommendations are included in the decision making process at lower levels. This is a very good initiative and can enhance implementation of research findings at community levels.

The other key community engagement strategy adopted was supporting districts in producing district and village adaptation plans. The participants reported that using participatory approaches, the researchers supported communities and district leaders in developing these plans. One of them noted that;

> "[O]ne of the things that we produced in that project was…village, district and village adaptation plans. So it is more interesting with village adaptation plan because again, the way it was prepared, was also together with the stakeholders and hence they started implementing some of those, you know, adaptation plans, which is, we are very proud of it. So we are now negotiating with donors to see whether we could get an extension of this, because it is coming to an end." *[Interview A11; Position: 23-23]*

The participant explains that the development of village and district adaptation plans was one of the outputs of a research project carried out by the centre for climate change studies. He argues that it is more interesting with village adaptation plans because these were prepared

with the participation of the stakeholders and hence the actors started implementing them immediately which makes initiative more sustainable.

b) Supporting communities to deal with climate change effects

This category relates to activities on climate change implemented to support communities as they deal with climate change effects. The findings indicate that the university has been engaged in such activities in communities where research programmes are implemented. Participants reported; engagement in community mapping activities, developing rice and maize breeds that are climate resilient and providing technological solutions to communities.

Community mapping activities involved providing information about climate change related disaster prone areas within communities. One of the participants said:

> "Community mapping was…using the knowledge that the people have in the community, to map the disaster prone areas. So they produce the entire map of Dar-es-Salaam, defining areas with extreme disaster risk cases and try to propose some interventions and whatever. And have come up with very concrete maps. I think those maps can even help people who are buying plots. Where should buy a plot and where we should not? For me actually from my expertise I see that it is a very important factor. That program was very engaging because we actually invited…even the local government officers; the entire government and the others were coming to engage the process of mapping. We invited them at Nkrumah Hall and we had very good discussions, going to the field and doing the mapping with GPS and others. The issue of participation that I am talking about making it to work, there was funding from the World Bank and it was very, very interesting, so we were engaging the community." *[Interview L13; Position: 84-84]*

As shown above, the participant explains that through community mapping exercise the researchers used the knowledge of community members to map out climate change related disaster prone areas. Communities were supported to come up with clear maps with information for them to make informed decisions regarding settlements and production. He argues that the mapping exercise was participatory, engaging 'local government officers and other stakeholders in identifying these disaster prone areas. The programme was supported by World Bank. The communities would then use the map and information to decide on where to settle or produce from. In case they operated in such disaster prone areas, they would be helped

to come up with adaptation plans to avoid serious effects. This was a great idea to support such communities to deal with effects of climate change at their level.

The other strategy was engaging communities in climate change adaptation initiatives. The centre for climate change studies carried out initiatives in the central semi-arid areas and the southern humid areas of Tanzania. During an interview, one of the participants said;

> "[W]e have worked with communities in the climate change adaptation programmes. Particularly we have worked with communities in the central semi-arid zones of Tanzania and the southern arid and humid areas of Tanzania… I think there have been appreciation on what climate change is and the uncertainty associated with it and the need to become…the need for local communities to become researchers for their own situations. Like trying various agricultural packages or practices." *[Interview A12; Position: 42-42]*

The participant highlighted that through these engagements, communities have appreciated the realities of climate change and the "uncertainty associated with it." They also recognised the need to act or adapt to the effects of climate change in their own situations. These community engagements are reported to have empowered the community members on what climate change is and aspects of adaptation given their local contexts. The concept of community engagement is very important in addressing climate change issues because it puts the research findings and knowledge generated to use at community level. The community is given the opportunity to work with experts from the university in addressing problems created by climate change in their activities and livelihoods.

The other way of supporting communities was developing climate resilient crop breeds for the farmers in selected communities. One participant reported that through community engagement as part of the research projects, the researchers developed climate resistant rice breeds and these were tested and adopted by a selection of farmers. The developed breeds are said to "do well in a short time and with very little rainfall." They are resistant to pests and diseases. This is part of a strategy to provide onsite solutions to the problems affecting communities due to climate change. The university can do more of these to help communities adapt to climate change effects.

c) Sensitizing communities on climate change

This category relates to activities on climate change implemented by the university focusing on sensitising communities on climate change. Participants reported that the university was involved in various community sensitisation activities including; organising events for action on research findings, carrying out community outreaches to raise awareness, holding climate change and environmental festivals, and engaging students in community work as part of their field work.

According to participants, the Centre for Climate Change Studies organised events to translate findings from the research done on climate change into actions for the community. One reported:

> "… the Climate Change Center is organizing such events. In the last three months we had an event to transform these research findings to the community. So, we had the gathering and all that. So I think the centre for climate change studies is doing quite a lot, quite a lot." *[Interview L14 ; Position: 38-38]*

The events are aimed at translating research findings into local community practices and therefore community members are mobilised and during the event, the researchers disseminate these findings. The event will include engaging the members on specific actions that they can take at their level to deal with climate change issues. This is a good practice to promote dissemination of research findings and engage actors on ways to deal with the issues raised in the findings.

Theme 3: Enemies of progress to university CCE interventions

Box 6.3; Participant's views and perspectives on challenges for climate change education at University Dar es salaam

Theme 3: Enemies of progress to university climate change interventions

- Institutional barriers
- Resource related challenges
- Organizational environment related obstacles

This theme presents the multiple realities of participants regarding the challenges that the University of Dar es Salaam face in implementing climate change education interventions. The theme is categorised into three: institutional barriers, resource related challenges, and organisational environment related obstacles. These are presented below:

Institutional barriers	Resource related challenges	Organization environment related obstacles
•Inadequate access to learning materials by students •Inadequate facilities for climate change programmes •A lot of research done but not accessible to communities •Poor teaching of climate change science at the university •Scepticism among university staff regarding reality of climate change •Failure to customize climate change knowledge to specific sectors	•Inadequate funding by government and local sources •Donor driven funding makes programmes unsustainable •Limited resources for mitigation interventions •Limited funding for student research and excursions outside the university	•The challenge of facilitating district officials •The challenge of working with parallel community leadership structures •Political influence affecting community interventions •High beauraucracy in accessing communities •Lack of central coordination of climate change activities •The difficulty in understanding what climate change is by local people.

Figure 6.1; Challenges faced by implementing units of climate change education at University of Dar es salaam

Institutional barriers

This category relates to those challenges that stem from institutional weaknesses and inefficiencies within the university management system. The participants mentioned several challenges. These included: inadequate access to learning materials by students; inadequate facilities for climate change programmes; a lot of research done but not accessible to communities; poor teaching of climate change science at the university and limited number of full time academic staff at the university. Others mentioned were scepticism among university staff regarding reality of climate change; limited time for student research; students not being fully engaged on community programmes and; failure to customise climate change knowledge to specific sectors.

Inadequate access to learning materials by students and inadequate facilities for climate change programmes were mentioned by participants as key institutional barriers to CCE programmes at the University of Dar es Salaam. One of the participants explained:

> "We are also facing some challenges on accessing materials. For us PhD for example we have been given opportunity to have several visits abroad. For example, last year

> we were in Norway for some months, we have some experience in what they are doing there when it comes to research and publications. You can get access to different journals and articles, which are freely available. The same journal, the same line that we are accessing the journal, when we come back in Dar es Salaam when we come back here at the university you cannot access it. In other developed universities in Europe, they have contracts with several publishers that as a student you can access this on website this one, this one and this one. But this is happening at the University of Dar es Salaam but it is not adequate compared to the number of students available and the number of disciplines that we have. That is one of the challenges when it comes to research." *[FGD PG UDSM; Position: 63-63]*

In the excerpt above, the participant decries the challenge of inadequate access to learning materials to support them especially with research on climate change. The participant talked about inability to access various journals and articles freely. At the case university, access to learning materials is not comparable to the huge numbers of students who need them. This is a serious challenge that affects student research on climate change.

Another participant explained that the facilities for climate change education programmes at the university are inadequate. He said:

> "I have a few things I have to say, research is about guidance, the research and the supervisor and then the environment like you said the structures are available. I should say, the students are good, supervisors are good…but the environment. About the environment, structures, you find that some classrooms are shared. A Masters course doesn't have a permanent class prescribed to them. They have to come in the morning and they have to leave it in the evening or afternoon. Now that is quite disturbing, disturbs the daily routine, about the reading places, we have one central library. You do not find a library of the department. As in all wherever they are from they have to line up in the library." *[FGD PG UDSM; Position: 60-60;]*

In the excerpt above, the participant decries the poor learning and research environment stemming from inadequate facilities at the university. She reports that "some classrooms are shared" and at a certain period, students have to use them in shifts "morning and evening" which is "quite disturbing." With respect to reading space, the participant reports that there is only "one central library" which is not enough for all students at the university and therefore people have to line up in the library. She proposes a need to have library services at

departmental level so that more students can easily access the services.

The other challenge put forth by the participants was that a lot of research is done but not accessible to the communities. One of the participants noted:

> "I see there is a challenge in research. Yeah research has been done, been documented, at the ground level people are not understanding, they cannot access that information. Also there is a challenge maybe the researchers who complete their work maybe disseminate that information about their work to CBOs, NGOs. So, they can reach to the ground there where people can get some information, can read and understand what they…about the status of the climate change." *[FGD PG UDSM; Position: 54-54;]*

The participant revealed that despite the fact that a lot of research on climate change has been done, the communities haven't been able to access the findings on ground. This is a common problem in many universities because they do a lot of research, but findings end up in publications and libraries, which are not often accessible by local communities. Many of the community members in African societies cannot read and understand these research reports or articles. Therefore, there is a need to find a way of disseminating it in a way comprehensible for communities. The participant suggested that researchers work with Community Based Organisations (CBOs) and NGOs to "reach out to the ground" so that research findings can be effectively disseminated to the local communities in a language and form easily understood.

The other institutional challenges cited by the participants were poor teaching of climate change science at the university and failure to customise climate change knowledge to specific sectors, as one participant explained:

> "[T]he Centre for Climate Change tries to hire the staff from different units. So you find people coming from the Biology, Zoology, they are coming from Education if you …. from education trying to come to teach climate change but that is…fine but will miss something on how to link education with climate change. Because he is missing climate change science though…experienced in education, so we struggle much to try to capture that you see! That is a very big challenge that the centre of climate change has no staff that are specialised on climate change science, it is hiring people from different

> units. There are trying but there is something which is missing." *[FGD PG UDSM; Position: 39-39;]*

The participant argues that the biggest challenge with academic programmes run by the Centre is lack of specific academic staff on climate change. The centre draws staff from other units and outside the university who may not be always available whenever needed. Many of these drawn from other units are not competent enough to handle climate science from a general perspective. They often try to attach climate change to their areas of expertise say Zoology, Biology and Education. There is a need to do retooling of these before they are deployed to teach on these programmes and courses to empower them on the subject matter.

Relatedly is the failure of academics to customise climate change knowledge to specific sectors. One of the participants explained that customising climate change knowledge to make it "relevant" to specific sectors was a challenge to academics. This challenge is mainly faced when the climate change scientist tries to integrate climate change knowledge into other disciplines where they are not experts. This challenge seriously affects comprehension of climate change knowledge by students especially those from other disciplines other than geography and environmental related disciplines.

The other institutional barrier to climate change programmes at the case university is scepticism among university staff regarding the reality of climate change. One participant explained:

> I think even the university community is diversified. So you have those who believe in this discourse and who do not believe in the reality of climate change problem. So in such aspect you have two sides you know those who don't and those who believe it exists. *[Interview L14; Position: 56-56;]*

Like President Donald Trump, there are some academic staff and members of the university community who are sceptical about the reality or existence of climate change phenomenon. They do not seem to accept that climate change exists. This is a serious challenge impeding the progress on climate change mitigation and adaptation. These academics need serious buy-in to support initiatives and programmes.

Resource related challenges

This is yet another category of challenges that implementers of CCE programmes face. Participants identified several challenges related to resources including: inadequate funding by government and local sources; donor driven funding making programmes unsustainable;

limited resources for mitigation interventions and; limited funding for student research that affects quality of student research.

The participants noted that inadequate funding from local sources and donor driven funding are serious challenges to climate change education programmes at the case university. One of them lamented:

> "[T]he other issue about resources now, the centre was established by the university, but with financial support from Norway, and there was also financial support from Michigan State University. Yeah, in a way I must admit that our government has not been providing a lot of support, in terms of budget not only to the centre but also to the university as a whole even in research. I do not know about Uganda, but I guess it is the same issue. So what we normally do, we look for projects or opportunities or call for proposals, and submit so many write-ups. And fortunately we do sometimes get a lot of funding. At some point the centre had almost 6 projects amounting to around 15 million US dollars. This is from our own initiative and it is what keeps the centre running. Am not in the management of the centre, but I get time to talk to the director and get to know all these details, and I participate in writing the proposals." *[Interview R11; Position: 17-17;]*

The participant contends that despite the fact that UDSM established the Centre for Climate Change Studies, its funding is mainly from Norwegian government and Michigan State University. Government has not been providing a lot of support in terms of funding. This makes the programmes donor driven which is a challenge in itself. He notes that most of the funding used for the programmes is got through writing grant proposals to foreign donors and such funding comes with conditions. This funding is not adequate for the interventions at the university. Another participant said:

> "Sometimes we get funding from different donors, who have their specific objectives that “we want you to address the issue of climate change in your research.” And these we have been receiving many such kind of funding and they cannot be adequate in relation to the size of the problem itself as it is. But we have been getting such kind of particular support, that kind of financial support but always in Africa you find that budgetary allocations are not adequate." *[Interview L11; Position: 19-19;]*

The other resource related challenge reported was limited funding for climate change mitigation interventions by donors. One participant said:

> "Most of the research funding is coming for adaptation you know. But there are so many issues for instance in ah, when it comes to mitigation or issues of natural resources vis-a-vis mitigation, adaptation stuff like that, I think that is the area of research where we are having a challenge in terms of how we respond adequately, adequate response. I think adequate attention is needed in that activity." *[Interview L11; Position: 29-29;]*

The participant reported that resources for research and other interventions on climate change mitigation are meagre and inadequate compared to those of adaptation. More work for adaptation has been done; however, most funders do not give adequate attention to mitigation. This challenge may also link to the challenge of limited expertise. This is because mitigation experts are also rare in most developing nations. The participant calls for attention to mitigation interventions at the case university.

The other resource related challenge is limited funding for student research at the case university. One of the participants decried the challenge of inadequate funding for student research especially at PhD level where often research studies are “expensive” for students. In most African countries, research funding for students in terms of scholarships and student loans are limited which greatly affects the quantity and quality of student research. Participants also lamented about limited resources to support student excursions and involvement in community engagement programmes. One of them noted:

> "I can give you an example with the project I mentioned which is being implemented by Uganda, it was basically meant to share experience. In Tanzania we had this…pilot phase for REDD PLUS with nine projects. The project now basically wanted to learn more about what was the success in Tanzania and how can Uganda take that lesson into the policy development when they want to implement REDD PLUS. So, the approach was to have money or funds to support PhD students, who can undertake the comparative analysis or study, but unfortunately…funds are not enough to support students to have sites in Rwanda, in Tanzania." *[Interview A13; Position: 53-53;]*

The participant argues that one of the key challenges faced is limited resources to support students on climate change programmes to go for excursions or do comparative studies in different countries to learn more about climate change aspects in other countries. The challenge

seriously hinders the possibility of students to get up to speed on routine changes in climate variables and situations within the region and neighbouring countries. Climate change is evolving and therefore needs vigilance, up-to-date information and comparative analysis of climate change situation of other countries.

Organizational environment related obstacles

This category relates to those challenges that stem from the organisational environment around climate change education interventions. Participants identified several challenges under this category including working with parallel community leadership structures, political influence affecting community interventions, high bureaucracy in accessing communities, and the challenge of facilitating district officials whenever they are to be involved in programmes. Others mentioned were lack of central coordination of climate change activities in the communities and the difficulty to understand what climate change is by local communities.

Working with parallel leadership structures at the community level was identified as a key challenge. One of the participants noted:

> "Working with the communities that have a parallel…leadership. It is very difficult to harmonise these two. So, that has been quite challenging…. Finally, …there comes a moment that they actually see the whole activity, exercise as an exercise in solving real problems, the problems they are facing. So they agree with it, "ok let's go on" actually at the end of the day they accept the project as theirs. And actually when you move out they will continue. We have left several villages with projects that are still continuing. On coming back, "Eh, Professor, we have a problem here can you help us?" "Yes, are you ok but I won't come but I will send someone else." So you know that these guys are working…" *[Interview R12; Position: 51-51;]*

The participant argues that working with communities that have parallel leadership systems is a serious challenge. Most communities in Tanzania have the local government system and the traditional leadership system working alongside each other. Harmonising the two systems is quite difficult. Convincing the two leadership groups to accept the programme and buy into its activities was found to be challenging. He however contends that once both leadership systems buy into the programme, they really support the initiatives to succeed.

Politicisation of issues in communities was mentioned as one of the organisation related challenges affecting climate change education programmes especially at community level. A

participant said:

> "To me the main challenge is what you call the political related ones. … Many of the issues are politicised whenever you want to engage community so…politics anywhere you go. When you want to research in an area where probably, your family members are or the districts where you are originally coming from. When they see you they say, "this one is coming here [he] wants to contest for Member of Parliament" and things like that. So the political issue that is one. But also another there is political affiliation is when you are researching they want to know if you are affiliated to a specific political party, which is also making research difficult." *[Interview L12; Position: 83-83;]*

In the above excerpt, the participant decries the challenge of politicising everything at local community level by local politicians. Almost everyone who takes a programme to the communities, would be considered having political interests or ambitions and therefore almost every issue is "politicised whenever you want to engage communities" on it. The challenge has affected research programmes in communities since researchers are viewed as having political ambitions. These are often asked to identify themselves in relation to a political affiliation or party. This kind of environment makes community based research and outreach on climate change difficult to implement. Another participant explained the other form of political influence that affects climate change education programmes:

> "[T]he most difficult challenge is: how do you fit in climate change issues in local community plans and strategy? How are they being accepted? By law it gives the local communities that authority to plan for what they can do but the decision makers are seated at the district level. Whatever is planned at the local level must be sent for approval at the district level. So the way the district level…approves things, it focuses first on political issue; "what will be the political impact of this (with emphasis)" before coming to environmental impact, socio-economic impact they assess it from the political point of view first. So you find that most of the interventions are being discouraged at the district level or if they are to be promoted they are not that much fitting in the local context I mean in the community set up. So, you find that there is mismatch between the strategies, the community level kind of planning and stuff like that which is climate change intervention. You find always there is this mismatch." *[Interview L11; Position: 39-39;]*

The participant claims that in trying to incorporate issues of climate change in local community

plans and strategies, political influence makes it difficult for researchers or university academics to easily achieve their goals. This is because with high bureaucracy levels in government, local politicians often politically influence the approval process. In case the programmes are not contributing to their political capital and interests, they never support their approval. She notes that many of the ‘‘interventions are being discouraged at the district level’’ especially if they do not promote political agenda of powerful political groups. Also to note is that a few of those that are approved with influence of political elite, do not fit in the local context since they are never well designed thereby creating what the participant called a “mismatch” between the interventions and local needs or contexts.

The participants also identified high bureaucracy in accessing communities as another serious obstacle to effective climate change education programmes by the case university. One of them reported that the process of getting to the local communities is so bureaucratic and therefore impedes easy access to local communities. One has to go through a long process to access local communities. The process requires applying through the district level leadership to the lower administrative levels. Lower local leadership would always want the researchers or the university team to be cleared by the district leadership before they can allow them to access the local communities.

The other organisational environment related obstacle cited was lack of central coordination mechanism for climate change among the various actors in the community. One of those interviewed explained:

> "Of course, I think the major one is…we don’t have a clear coordination of this climate change initiatives. …I appreciate what is being done by NGOs but it is not the case that most of the NGOs are competent enough to come up and even disseminate clearly to these communities. So for example there are some cases that even the definition of climate change…is a problem. You have people from the university, you have people from the district, you have people from private sector, you have people from NGOs. You have the same community receiving different definition from these people." *[Interview A13; Position: 72-72]*

The participant maintains that lack of a central coordination agency for climate change activities is a serious challenge because many of the players like NGOs and other agencies do not have expertise in climate change science. The various actors in the interventions often do

not have the same understanding of concepts and end up disseminating conflicting messages due to varied "competence levels and expertise" to the same community. This creates confusion in communities where various concepts and issues are not clear due to lack of expertise. The community actors need to be well coordinated ensuring that each plays a specific role given their expertise and resources.

Lastly, the other key obstacle under this category was the difficulty in understanding what climate change is by local people. One participant explained: "Sometimes we conduct research but at a certain point you feel like you should have trained or provided…an overview of what climate change is, before maybe they really understand what you are talking about…" *[Interview A12; Position: 40-40;].* The participant highlights the challenge of conceptualising climate change among local people. He reports that despite the fact that local people have been living with climate change over the years, there is a difficulty in clearly understanding what it is. He reported that often during research work in the communities, researchers reach a point where they feel like they should provide an overview of what climate change is before engaging local communities in research work. This greatly affects the quality of the responses and data the local communities provide on climate change.

Theme 4: The key drivers and current openings for our climate change work

Box 6.4 Participants views and perspectives on key drivers and opportunities for climate change education at University of Dar es salaam

Sub theme 4.1: The key drivers for our climate change work

- Internal influences
- External support mechanisms

Sub theme 4.2: The current openings for our climate change work

- Legislation backup
- The nature of the phenomenon
- The conducive environment around the university

This theme explores multiple realities of the study participants regarding the key drivers and existing opportunities for CCE programmes at the case university. These key drivers are explored in the sub theme 4.1 while the opportunities are covered in sub theme 4.2.

Sub theme 4.1: Key drivers for our climate change work

This sub-theme presents the multiple realities of participants regarding the factors drive the climate change education work at the case university. There are categorised into two: internal and external key drivers. The findings are presented below;

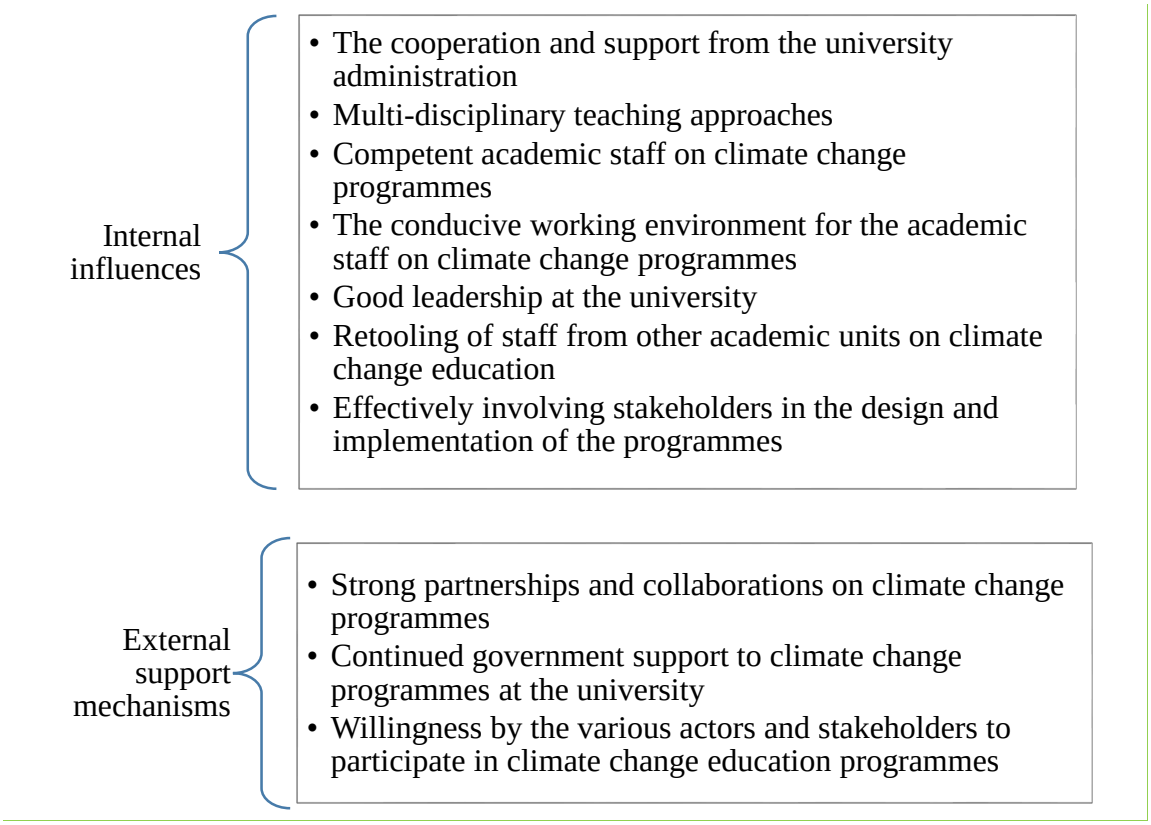

Figure 6.2; Key drivers for climate change education at University of Dar es salaam

Internal influences

These are factors that originate within the university system and have been key in driving climate change work. Participants identified several of these including the cooperation and support from the university administration; multi-disciplinary teaching approaches; competent academic staff on climate change programmes; the conducive working environment for academic staff on climate change programmes; and good leadership at the university units implementing climate change education programmes. Others factors mentioned include retooling of staff from other academic units on climate change education and effectively involving stakeholders in the design and implantation of programmes.

It was reported that one of the internal key drivers to climate change education work was the effective cooperation and support from the university administration towards CCE programmes. One of the participants noted that at the case university, the administration "has

always been very supportive" *[Interview R12; Position: 19-19]* to all programmes including those on climate change. This is a positive factor and can significantly drive the design and implementation of the programmes. With university administration support, there will be facilities and resources provided. This also motivates implementing units to successfully implement the programmes. Another participant appreciated the cooperation within academic units of the university. This kind of cooperation enables the academic staff across the units to freely participate in implementation of CCE programmes, thereby boosting the programmes.

The other key internal driver mentioned was the adoption of multi-disciplinary teaching approaches in training on climate change within the university. One participant explained: "All disciplines are just affected by climate change. I think it is very good that we integrate them in every discipline. But lacking that capability of addressing that knowledge in climate change way, that is another challenge." *[FGD PG UDSM; Position: 43-43]*

Although other participants looked at drawing staff from other units as a challenge to CCE programmes, this particular participant appreciated the idea of drawing from multi-disciplinary knowledge and skills. The participant argues that integration of knowledge from various fields is a good thing, although he recommends that these need to have climate science knowledge. According to this participant, the challenge is developing the capacity of academic staff to enhance their abilities to integrate climate change knowledge in other disciplines across the university.

Having competent and dedicated academic staff on climate change programmes at the university was another key driver identified during the study. A participant observed:

> "But the other one is having technically good and well-dedicated staff. We work even during weekends. So people are dedicated and I think it is because they accept the leadership that is leading them. So I think…this factor has been so important and that's why people like me were attracted to join the university. When I left… people were telling me, why are you doing this, but maybe I thought that before I retire I should be part of the academic staff at the university and even become a professor. So I think these are some of the factors." *[Interview R11; Position: 25-25]*

The participant contends that having technically good and dedicated staff is key to climate

change education interventions. The academic and administrative staff who work on climate change interventions are highly trained, competent and dedicated to their work. The participant notes that because of the good leadership at the university and IRA, the staff, work so hard and are motivated to innovate and work to achieve more.

In addition to competent staff, the good working environment for academic staff on climate change programmes is an important internal driver to the success of the programmes at the case university. One of the interview participants said that The good working environment allows academic staff to move "from one unit to another." According to her, this kind of environment has promoted "a spirit of cooperation and coordination" within the university academic units hence promoting effective implementation of CCE programmes across the university.

The good leadership at the university units implementing climate change education programmes was also seen as a key internal driver. One of the participants observed:

> "First and foremost I must admit that the Institute of Resource Assessment has good leadership. We are proud of the good leadership at IRA especially the Director. It is [he] who initiated the idea of having the Centre. (…) So he thought it was better to establish a Centre, which would have climate change mandate. Now the Centre is becoming successful. So one factor is leadership, frankly." *[Interview R11; Position: 25-25]*

The participant argues that the good leadership at both university level and the Institute of Resource Assessment which houses climate change programmes has been very key to the achievements. University leadership is supportive and continues to provide strategic direction and administrative support to the climate change education interventions. According to the participant good leadership at the IRA was responsible for the establishment of the Centre and its continued success.

The participants identified retooling of staff from other academic units on climate change as a key factor that has helped to drive CCE programmes at the university. A participant reported:

> " (…) There are a number of other related programmes like Integrated Water Resources Management at the Master's level, …Ecosystem Management in other units, you know, almost in different units. But what we did was to, because some of these Faculties actually teaching climate change programmes are the ones teaching in those units. So what we did was to have some…one week or five days…of orientation, how does

climate change link with these different sort of programmes or disciplines? For them now to be able to realise the extent to which they can actually accommodate climate change in their teaching programmes without necessarily altering their programmes. So I think they are quite good and they are teaching our programmes, and so it is a lot easier for them to draw lessons from our programmes that they are teaching at our centre and use it in their programmes." *[Interview A11; Position: 31-31]*

The participant explains that as a way of integrating climate change aspects in all other units of the university, the Centre for Climate Change Studies has been retooling staff from other units to enable them support the programmes at the centre. Retooling has enabled these academics to integrate climate change aspects in their programmes in various units. This is a very good approach for mainstreaming climate change in other programmes of the university. It is also good for developing capacity of staff to create a pool of knowledgeable and competent labour force in the discipline.

The last internal key driver at the case university was effectively involving stakeholders in the design and implementation of programmes. One of the participants said:

> "This was interesting because right from the inception phase, you know, we had to involve stakeholders at all levels for them to endorse that ok, these issues that we want to work on, they are actually relevant and so at every stage when we accomplished a one milestone, we had to go back to them and say, these are the findings, how do you see? Are there some issues that have been, you know, omitted? Then they do the validation, and they also move on to the next stage." *[Interview A11; Position: 23-23]*

The participant reports that stakeholders were involved throughout the stages of design and implementation of one of the research project on climate change and its impact on rice and maize production. He argues that they had to involve stakeholders at all levels so that they could endorse the issues they wanted to work on. This implies that the stakeholders were put at the centre of the management of the research project.

External support mechanisms

These are key drivers for climate change education programmes that originate outside the university systems. They are support mechanisms for the programmes from the external environment. Under this category, participants mentioned strong partnerships and collaborations on climate change programmes; continued government support to climate

change programmes at the university and; willingness by the various actors and stakeholders to participate in climate change education programmes implemented by the university.

Strong partnerships were mentioned as a key support mechanism for the programmes. In her own words one of the study participants noted that:

> "But the second one is this strong collaboration that IRA and the university has established over years with different partners across the world. Currently we are implementing projects within the Centre with Makerere University, for example, University of Nairobi, there is University of Lilongwe, the Norwegian government, the United States government, and Canada, SIDA, etc. So there is this strong collaboration that has been established and continues to grow that is supporting our undertakings and Its been part of the success we having." *[Interview R11; Position: 25-25]*

In the excerpt above, the participant reports that the strong partnerships created by the university across Africa and the globe have been key to the success of CCE. She cites partnerships and collaborations with Makerere University, University of Nairobi, University of Lilongwe, and other foreign governments like United States, Canada and Sweden. All these have strongly supported the climate change education programmes at the case university. To support the point, another participant added:

> "Outside Tanzania we have worked with Kenya as a country, worked with Malawi very much, University of Malawi particularly in climate change and adaptation programme, the CCA programme. So we have done action oriented research which has been carried out in Tanzania, and similarly in Malawi. We have worked through collaboration with Kenya and Uganda through training sessions, conferences and some consultancies work like review of the agricultural systems on climate change practices have done on the regional level. There was funding for various workshops, but also participated in…the UNFCC COPS." *[Interview A12; Position: 22-22]*

The collaboration with the universities in Uganda, Kenya and Malawi has been mainly on joint training, conferences and consultancy work related to climate change. Specifically, these focused on agricultural systems and climate change practices, research on climate change and pastoral communities as well as participation in UN climate change conferences like COPs. Such collaborations are very handy in sharing knowledge and expertise. They also help in engaging governments at national levels and international levels on policy issues related to climate change. These collaborations have been key in mobilising resources, technical support

and engaging policy makers in the respective countries.

The other key external support mechanism identified was the continued government support for the climate change education programmes at the case university. A participant appreciated the efforts government has made to support climate change programmes at the university. He argues that although not much funding comes from it, the "government is committed to support initiatives." The participant reports that government has been handy in topping up the inadequate resources they receive from donors.

Willingness by the various actors and stakeholders to participate in and support climate change education programmes at the university was also identified as a key external driver for the programmes. One participant said:

> "Stakeholders are various across levels like ministries, various ministries especially we have been working closely with ministry of agriculture, ministry of natural resources, ministry of water and lands. Those are some of the key ministries that we have worked with at the higher level. But at Sub national level we have been working with various district officials across various districts, depending on the nature of research. So we have been engaging them in the process, the local government." *[Interview A12; Position: 19-19]*

The participant identifies various stakeholders and actors at both national and local levels and explains how the university has been working with them on climate change education programmes. It is clear that the willingness of various actors right from national to community level to participate in the interventions was key for their success.

Sub theme 4.2: The current openings for our climate change work

This sub theme covers the multiple realities of the study participants regarding the existing opportunities for the climate change education work at the case university. The participants identified various opportunities that universities could exploit to adequately address issues of climate change in their programmes. The researcher categorized these into three; legislative backup, the nature of the climate change phenomenon and, the conducive environment around the university. These are explained below;

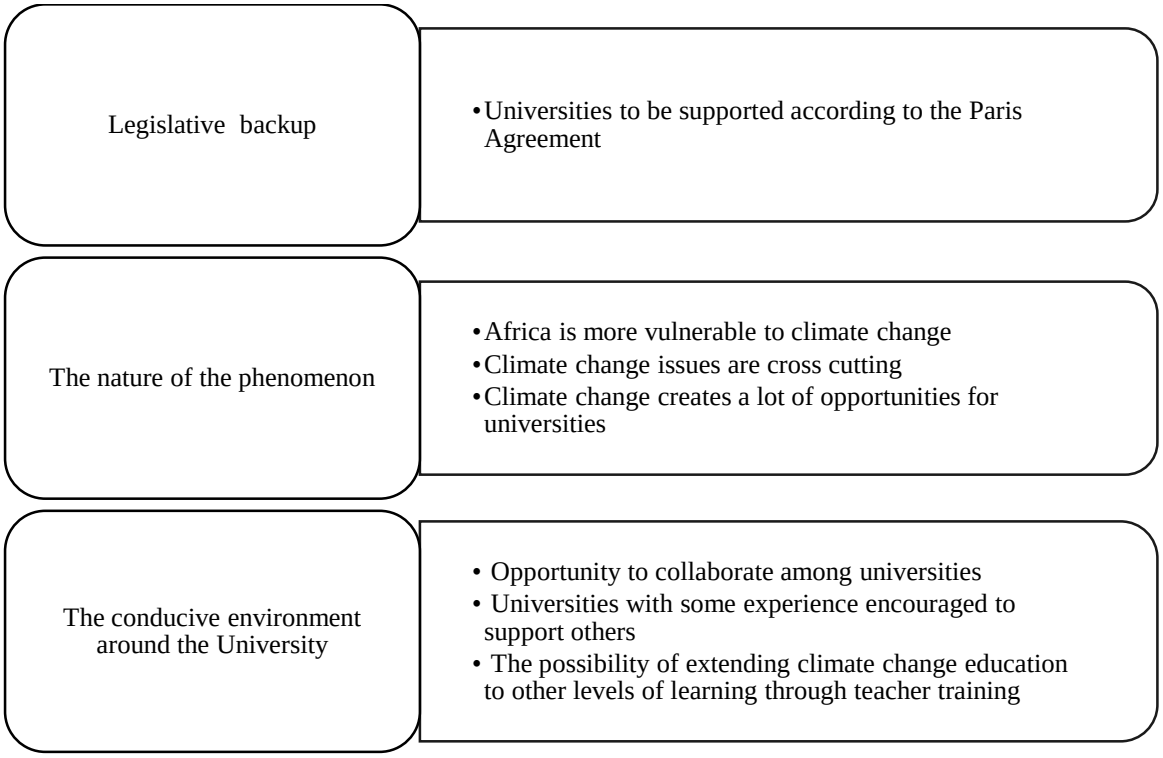

Figure 6.3: Current opportunities for climate change education at University of Dar es salaam

Legislation backup

This category includes those openings related to the existing legal frameworks that universities could explore to adequately address issues of climate change in their programmes. The study participants identified the provisions within the Paris Agreement to support universities on climate change education interventions as a key opportunity. One of them reported:

> "Good news is, I just came back from Bangladesh, we had a meeting…to strategize on how all the African universities can come in on issues of capacity building on climate change. [T]his is based on a decision or agreement (Paris Agreement) UNFCC conference that was held in Paris. That Paris agreement has been…what do you call it? Generally endorsed by all countries or member states. So it is a legal document. So…it was agreed that developed countries should provide money to support universities so that they can actually run capacity building programmes in least developed countries. So that is a decision and that is good news." *[Interview A11; Position: 33-33]*

The participant argues that universities in Africa have vast opportunities to be supported in their effort to address climate change issues in their programmes. Countries that are signatories to the Paris Agreement agreed that money should be made available by developed countries to

support universities in the developing countries to design and implement climate change education programmes. This is an opportunity for universities in Africa to exploit.

The nature of the phenomenon

This category of opportunities relates to those that arise due to the nature of climate change problem. Participants identified three aspects: Africa is more vulnerable to climate change than other continents; climate change issues are cross cutting; and climate change creates vast opportunities for universities in Africa. One of the participants noted despite the fact that "Africa contributes very little to climate change" *[Interview L12; Position: 21-21]* compared to other continents in the world, it is more vulnerable to the phenomenon. This is due to its low capacity to mitigate and adapt to the impacts of climate change. Another participant claimed that the livelihoods for Africans depend on natural resources, rainfall and moderate temperatures especially for agriculture. Any change to these will greatly affect livelihoods for most people on the continent because the continent has "limited means to adapt to climate change" *[Interview L11; Position: 15-15]* which makes it worse. This presents opportunities for universities in Africa. This is because they can be very handy in supporting their vulnerable societies and economies to find possible mitigation and adaptation strategies through scientific research, training and outreaches.

The other source of opportunities for the universities is that climate change issues are cross-cutting. Participants explained that climate change affects nearly all aspects of society. Therefore, almost every discipline would need a dose of climate change education to address specific aspects of climate change in a particular sector. One participant argued that all fields of study within the university "teach several courses and there are some components of climate change within them." *[Interview L12; Position: 13-13]*. This is a form of mainstreaming of climate change aspects in other programmes.

The participants also noted that climate change creates opportunities for the universities to exploit for their growth and development. One of them for example observed:

> "The first one is that climate change is a challenge, but it has a lot of opportunities in terms of research. So we probably need to make sure that universities identify these opportunities and tap them for the development of the universities and that of our people. I am saying this because universities are the areas where experts are developed,

> researches are undertaken, results from the research are taken into policy, the policies are implemented to help people. So we have to identify these opportunities; financial opportunities, collaboration opportunities." *[Interview R11; Position: 27-27]*

In the quotation above, the participant cites opportunities such as starting new research agendas, creating more training programmes on climate change issues, supporting policy makers to make climate friendly policies, and initiating community interventions on climate change mitigation and adaptation. There are opportunities for funding.

The conducive environment around the university

The environment around the university was also seen as a key source of opportunities. Participants identified three possible opportunities arising from the conducive environment: collaborating on climate change education interventions among universities; universities with climate change education experience supporting those with no experience; and introducing climate change education to other levels of learning through teacher training. Moreover, the positive environment opens up even more opportunities for universities to collaborate on climate change education interventions. One respondent supported this when she said:

> "[E]ach country has their own set of problems as far as climate change is concerned. So if you concentrate on only one country to solve problems, you miss the other experiences of the university from the rest of the continent. …I would love researchers to…work together so that we handle the problems either region wise, just like we did in East Africa situation. But it would be much better if we could go even beyond the region and handle continental issues together…." *[Interview R12; Position: 41-41]*

As shown above, the participant argues for collaboration among universities on the continent to solve common problems and sharing experiences. She encourages collaborative research projects on specific regional or continental issues exploring various perspectives and solutions.

The other opportunity that could be explored is some universities with experience on climate change education supporting those with no experience. One participant reported an agreement in Morocco during a UN body meeting on climate change that universities with experience in climate change education should support those that are yet to initiate CCE programmes. Therefore, universities like UDSM and Makerere can support others that are yet to start CCE interventions through signing memoranda of understanding. This kind of partnership between universities within the same region would enhance opportunities of learning from each other, sharing expertise and working on joint programmes on climate change in the region. It would

also enable universities to have a collective voice for policy advocacy within the region.

The other opportunity arising from the conducive environment identified was the possibility of extending climate change education to other levels of learning through teacher training. Participants reported that universities could take the lead in extending climate change education to Primary, Secondary and tertiary institutions. This can be done either through their conventional teacher training programmes at the university or during short term training courses organised in the field. One participant noted:

> "[W]e have received some requests from the Primary [and] Secondary teachers, particularly those teaching Geography, that they would like to be trained [in] climate change issues. … [T]hat would have been the best way of mainstreaming climate change issues in education institutions…particularly at Secondary [school] level and even at Primary level for that matter." *[Interview A11; Position: 15-15]*

As the participant observes, there is a high demand for courses and training on climate change. Training Primary and Secondary school teachers on climate change would provide an opportunity for mainstreaming climate change issues at various levels of education. With Primary and Secondary school children learning climate change issues, behavioural change as well as action on activities that cause climate change would happen, thereby creating a serious positive impact on the phenomenon in communities.

Theme 5: Ways to do things better

Box 6.5; Participants perspectives on strategies for improvement in implementing climate change education at University of Dar es salaam

Theme 5: Ways to do things better

- Training and capacity development improvement strategies
- Research capacity improvement strategies
- Community outreach improvement strategies
- Institutional management improvement strategies

This theme presents key findings from the multiple realities of study participants regarding their views and opinions about the various ways universities can adopt to improve their climate change education programmes. The researcher categorised these into four: training and

capacity development improvement strategies; research capacity improvement strategies; community outreach improvement strategies; and institutional management improvement strategies. These are presented and explained below:

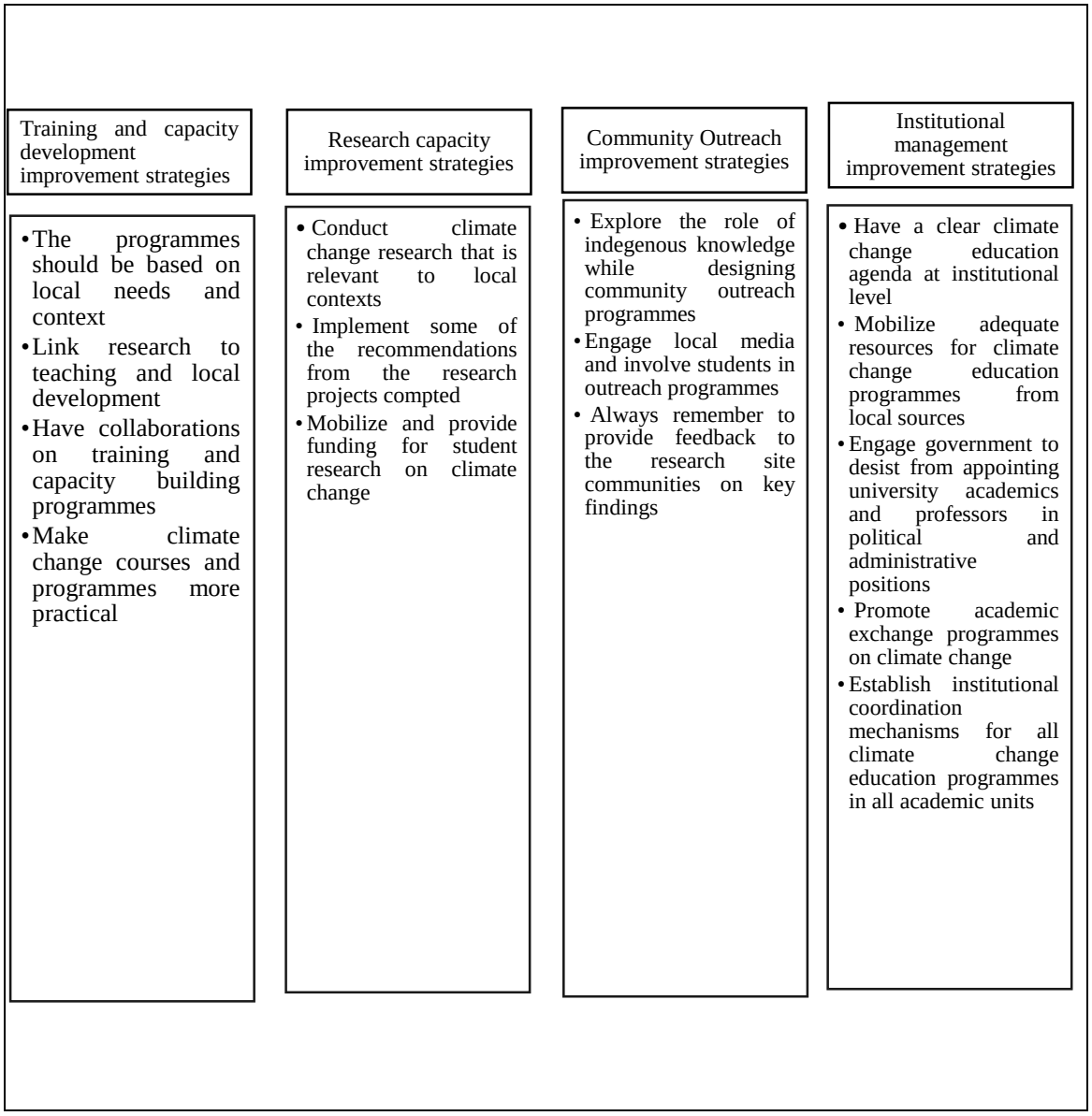

Figure 6.4 Suggested strategies for improvement of climate change education programmes at University of Dar es salaam

Training and capacity development improvement strategies

Study participants made several suggestions regarding strategies that African universities can adopt to improve training and capacity building on climate change. These included ensuring that climate change training and capacity building programmes are designed and delivered based on local needs; linking research to teaching and local development; having collaborations

and partnerships on training and capacity building programmes; and making climate change courses and programmes more practical.

African universities were encouraged to design and deliver relevant climate change training and capacity building programmes that are based on local needs. One participant proposed as follows:

> "[W]e need to have curriculum that are university based, but the university should…link with the industries and it should also link with communities to come up with robust programmes. For example, it is one thing to know the needs, [but] the needs assessment from the community should drive the formulations of the university programmes or secondary school programmes… We should not just take those from the Kyoto Protocol". *[Interview L13; Position: 98-98]*

The participant recommends having training curricula on climate change that takes care of local needs. He urged designers and implementers to listen to people as they develop programmes that address climate change at their respective universities.

Other participants called for linking research to teaching climate change related courses and programmes. One of them argued:

> "[A]s I said we are supposed to teach and we are also to do research and finally to do outreach programmes. This is service to the communities. … [T]he two…teaching and research normally go together. We need information, we need new knowledge to be able to teach the young people. So, you have to do research…when you go into the field, you collect your data…come and process it…you write something out of that, it could be a paper. But the materials you are using [are] normally tested in class. We normally use that same information to teach and actually you get a very good feedback because the students…have experienced these things and they are coming from a variety of places. So, if…we can really link research and development that would be excellent if courses would utilise the research findings in teaching." *[Interview R12; Position: 25-52]*

The participant argues that there is a need for universities to link research findings to the teaching of students. In her own words, this aspect of linking research to teaching and outreach

is not often deliberately emphasised in many universities both in developing and developed nations. Most universities conduct these in isolation without linkage. Therefore, this would create linkages between research and local community needs.

Another participant acknowledged the various programmes and courses on climate change so far introduced, but he observed that they are largely theoretical. He argues that although the climate change phenomenon is new, universities should ensure that the programmes and courses are practical. He cites an example where many Master's degree students cannot develop a climate change adaptation plan for any community. Practicability of the knowledge acquired would promote utilisation of knowledge at local levels.

The last strategy on training and capacity development was creating collaborations and partnerships to support training and capacity development on climate change programmes at the university. One participant commented:

> "[W]ith the University of Malawi, we have been doing similar things so we have that close collaboration, and…we also have a programme which links us with Makerere University in capacity building. We have been working [on] it. So, we can still have…seminars, workshops, share findings or eve package information, which could be useful with other stakeholders." *[Interview A12; Position: 48-48]*

In the quotation above, the participant reported that they have been engaged in various collaborations with other universities such as Makerere University and University of Malawi specifically on capacity building. She mentioned that through seminars and workshops they engaged various stakeholders jointly across the participating universities. It is clear, therefore, that collaborations among universities for capacity building and information sharing can be very helpful in supporting capacity building initiatives and sharing research findings on climate change.

Research capacity improvement strategies

Participants identified various strategies for improving research on climate change within the African universities. These include ensuring that the research conducted is relevant to the local contexts; implementing some of the recommendations from the research projects completed; encouraging more participation of actors and decision makers in research programmes; and

providing funding for student research on climate change. They suggested that one of the strategies to improve research capacity is to ensure that all studies conducted on climate change at the universities are relevant to the local contexts of the communities in which the universities are located. One of them explained that universities need to conduct research that is relevant to the needs of communities instead of producing mainly for the scientific community. She calls for research that can be understood by the community so that they understand the implication of whatever they are doing. This is true because most of research carried out by universities ends up in academic research journals and libraries without being utilised by the communities. One wonders why a lot of resources and time is invested in research in communities but the findings are never made relevant or even understood by the communities where such research is conducted. The journal papers written and published in scientific journals are only accessible to a few elites in academia. This is a very serious attack on academia where research is not translated into practical solutions to community problems.

The other suggestion was to implement the recommendations from completed research projects. A participant noted:

> "[I]f there is enough money, especially for a call which goes up to 5 million USD, we need also to pilot…some of the recommended adaptations options so that at the end we can document lessons and these lessons are very important… So, basically we do not face [many] challenges especially on dissemination, we try as much as we can to link major components of research." *[Interview A13; Position: 57-57]*

The participant argues that for bigger research projects, there should be a component to pilot some recommendations within the communities. This is a very important suggestion because many of the recommendations end up in journals and libraries without implementation. The suggestion to pilot implementation of some recommendations would motivate policy makers to implement more recommendations after sharing results of the pilots.

One of the student participants decried limited funding of student research in Tanzanian universities where budgets for research projects are capped at, say, 8 million Shillings without justification. He argues that this compromises the quality of the research. Therefore, he recommends that the university seeks more funding for student research.

Community outreach improvement strategies

The participants proposed several strategies to improve community outreach programmes on climate change. These include exploring the role of indigenous knowledge while designing community outreach programmes; the need to engage local media and involve students in outreach programmes; and universities providing feedback to the research site communities on key findings from their research projects. One participant argued that there is indigenous knowledge within the local communities about weather and climate change. The local communities have various ways of knowing about variability in climate and how to respond *[Interview L12; Position: 71-71]*. Such responses are indigenous adaptation practices. However, the university has not gone out to the community to document this kind of knowledge. Such knowledge and practices can play a key role in climate change education especially during engagement of communities in adaptation activities.

Furthermore, in a Focus Group Discussion, one participant suggested that African universities should engage local media and involve students in community outreach programmes on climate change. The participant argued that the university should make use of the media especially local radios to sensitise communities on climate change *[FGD PG UDSM; Position: 32-32*. He contends that student movements on climate change can be formed and engaged in educating masses instead of restricting them to class work. This is a good idea because it would increase on the level of sensitisation and outreach on climate change.

The participant argues that the university should make use of the media especially local radios to sensitize and also provide trainings on climate change. He contends that student movements on climate change can be formed and engaged in educating masses on climate change rather than restricting students to class work. This is a brilliant idea since it would increase on the level of sensitization and outreach on climate change. It would also give students an opportunity to engage with the communities on climate change issues.

The last strategy participants proposed was that African universities should always provide feedback to the research site communities on key findings from completed research projects on climate change. One of the participants commented:

> "Communities want to get feedback. You see [in] most of our research we do not provide feedback. Even when you go…back to tell them…at least key results of your research, they may even tell you that it is not common for most of our researches… So the communities…want to be engaged from the research process, they will provide information and they also wish to hear from you what has come out of the research. It is important that we provide feedback." *[Interview A13; Position: 70-70]*

The participant argues that for all research projects, there should be a way of providing feedback to those communities where research has been conducted. Feedback to research sites about findings should be part and parcel of the projects design. The various stakeholders should be engaged in coming up with policy actions or strategies to be implemented in the community based on these research findings.

Institutional management improvement strategies

Participants identified various strategies for improvement at management level. These included: having a clear climate change education agenda at institutional level; mobilising adequate resources for climate change education programmes; and engaging respective governments to desist from appointing university academics and professors to political and administrative positions. Others were promoting academic exchange programmes and establishing institutional coordination mechanisms for all climate change education programmes in academic units.

Participants proposed that African universities will be more effective in addressing climate change if they have a clear climate change education agenda at institutional level. One of them recommended that universities in Africa should follow a clear agenda based on which all their interventions and programmes are implemented *[Interview L14; Position: 66-66.* Another participant suggested that universities come up with a clear strategy for addressing climate change, based on local needs rather than just implementing donor programmes *[Interview L13; Position: 66-66].* This will ensure coherence in the efforts of each actor and also avoid duplication of programmes, since each actor will know the specific areas for their action given their expertise and resources.

The other strategy proposed was that African universities should mobilise adequate resources

for climate change education programmes. The participants maintained that having adequate funding from within the university (locally generated resources) is important. One of them explained:

> "[T]he university need to try [and] find funds… [to] support researchers to venture in this discipline. So, as the university if so many sources of funds you can at least capitalise 10% of the fund to sponsor those people who are doing research on climate change, I think that can encourage us to do more research on that." *[Interview L14 ; Position: 62-62]*

In the excerpt above, the participant calls upon African universities to fund climate change education research. According to her, if the university allocates 10% to fund researchers, this will encourage more academics to research on climate change aspects across the various units. The participant argues that the university can play a key role in mobilising resources for implementing climate change programmes and environmental management and conservation. Through partnerships and networking, it can ably engage donors and government to mobilise resources for climate change interventions.

The other very interesting proposed strategy was that African universities should engage governments to desist from appointing university academics and professors to political and administrative positions. One participant observed a serious wave across Africa where senior academics are being appointed by governments to take up political positions *[Interview L12; Position: 103-107]*. This makes them leave universities and research work to do government work. This wave is not healthy because fewer experts will be available to conduct training and research.

Promoting academic exchange programmes on climate change is equally important. Participants advised that academic exchange programmes significantly enhance learning among academics involved and their ability to initiative climate change programmes. One of them explained that he has been working with the Institute of Climate Change Adaptation at the University of Nairobi on the MSc and PhD programmes *[Interview A12; Position: 48-48]*. The participant recommends that universities establish such academic exchange programmes to enable students and faculty to share knowledge and experiences on climate change science and research. Seminars and workshops jointly organised among universities on climate change

can be key in moving the climate change agenda ahead.

Lastly, African universities should establish institutional coordination mechanisms for all climate change education programmes in all academic units. One of the participants observed that although the university has an established Centre for Climate Change Studies, there is no specific unit that coordinates climate change programmes across the university *[Interview L12; Position: 67-67]*. Lack of a coordinating unit affects progress and quality of programmes. Therefore, the university should establish a unit that will set the agenda and coordinate the joint mobilisation of resources for climate change programmes.

Chapter summary

This chapter analysed the context for the climate change situation in Tanzania and provided a short background about the University of Dar es Salaam. It presented key findings organised in five themes. Theme one explained the existing institutional support for climate change education at the University of Dar es Salaam. Theme two, on the other hand, explored the various academic, research and community outreach programmes on climate change being implemented at the University of Dar es Salaam. Theme three presented the challenges faced by the case university in implementing climate change education programmes, while theme four discussed the key drivers for climate change education work. Theme five presented suggestions offered by participants on areas for improvement in climate change education in African universities.

The next chapter offers a cross case analysis and discussion of key findings. It also summaries the major conclusions and key recommendations of this multiple case study.

CHAPTER SEVEN; CROSS CASE ANALYSIS, DISCUSSION OF FINDINGS, CONCLUSION, CONTRIBUTION AND RECOMMENDATIONS

Introduction

Chapter Five and Six presented the key findings for both cases and gave a contextual background for each case based on the IAD framework. This chapter provides a cross case analysis and discussion of the key issues, outlining the common and divergent findings for each theme. It sums up the findings, conclusions and recommendations as well as the contribution of the study.

7.1 Cross case analysis

The study established similarities and differences in perspectives and multiple realities of participants at both case universities, regarding the opportunities and challenges they face in addressing climate change issues in their programmes. The common and divergent perspectives for each theme are presented below.

Theme 1: The role of the university and institutional support for climate change education at the case universities

The common and divergent findings on this theme across the case universities are as follows:

Common key findings regarding the role of the university

Participants at both case universities agreed that the university can generate the much needed scientific knowledge on climate change through research. A participant from Makerere University, for example, looked at universities as "centres with expertise to do research and bring out the real picture of what is happening because of climate change" *[MAK GD22 PGD; Position: 18-18]*. A participant from University of Dar es Salaam agreed that the university is a "hub of knowledge and therefore should generate knowledge that can be used by others" *[Interview A13; Position: 76-76]*.

Participants across the cases agreed that universities can offer training and capacity building on climate change. A Makerere participant noted that the "university produces the human resource for the country and therefore integrating climate change in its curricula, teaching and learning would be able to produce this human resource" *[MAK PA21; Position: 19-19]* while the one at University of Dar es Salaam talked about "mainstreaming climate change issues in university programmes" *[Interview A11; Position: 15-15]*.

The participants agreed that universities can carry out sensitisation and provide guidance to communities, policy and decision makers on climate change. A participant from Makerere University argued that "universities can be centres of sensitization since these are centres of learning where people come from various regions and countries to learn" *[MAK GD22 PGD MAK; Position: 16-16]*. The one from university of Dar es Salaam talked about disseminating information and guidance to "politicians and policy makers who don't have time to read by synthesizing research findings through policy briefs" *[Interview R12; Position: 37-37]*.

Divergent key findings on the role of the university

There were divergent findings that emerged from the cases. For example, participants from Makerere University identified advancing innovations and technological solutions for climate change mitigation and adaptation as a key university role. This was not mentioned by participants at the University of Dar es Salaam. Participants at Dar es Salaam identified other peculiar roles such as: providing technical support to NGOs and other community based organisations on climate change; providing consultancy services on technical aspects related to climate change; and engaging communities in local climate change adaptation initiatives that are simple and community friendly.

Common key findings with respect to institutional support for climate change education interventions

Participants at both case universities agreed that universities provide infrastructural and operational facilities for training and research programmes on climate change. One participant from Makerere University reported that "the university provides the facilities, like …office space, labs, the time and at least supervision time and the students are our students here in the College" *[MAK PL24; Position: 27-27]*. This was supported by someone from University of Dar es Salaam who indicated that the university has been key in "supporting the infrastructure…providing venues…and other support" *[Interview L12; Position: 27-27]*.

Divergent key findings

However, participants at Dar es Salaam had other forms of institutional support they mentioned that were unique to the case. These included the university's commitment to support and strengthen the Climate Change Centre into a fully-fledged Institute which will enhance its budget support and staffing; robust approval processes for new programmes and proposals for research funding; support for research clearances and administrative support to help staff on

climate change programmes to get to the research sites. These kinds of support were not mentioned by Makerere university.

Theme 2: University programmes on climate change

This theme presented findings from the views of participants relating to the current university programmes on climate change being implemented by the case universities. The key findings for this theme were focused on training, research and community engagement programmes implemented at the case universities.

Comparative analysis with respect to training programmes

Common key findings

Participants at both case universities reported that a number of short courses on climate change are developed and run within various departments and the climate change centres. They target students, professionals and actors in climate change related sectors. A participant in Makerere reported that there are "those that are targeting policy…targeting farmer focused trainings, and so on…" *[MAK PA22; Position: 43-43],* while the participant from Dar es Salaam said that they usually "identify the relevant stakeholders who can be engaged in that…capacity building" through short courses *[Interview A13; Position: 40-40]*.

The other common key finding was that across cases, the universities run long courses that are integrated in existing programmes. A participant from Makerere reported that they "have courses…focusing on climate change science, courses dealing with climate weather and atmospheric processes, we have energy, environment and climate change, climate change and forestry" *[MAK PA22; Position: 45-45]* that are integrated in various programmes. The one from Dar es Salaam talked about a course on "climate change and human adjustment" *[Interview L14; Position: 26-26]* which is taught across students taking a Master's programme in Geography and Environmental Management. Both participants agreed that there are courses on climate change running through existing programmes.

Divergent key findings

However, there were some key findings related to training that were unique to particular cases. Participants at Makerere university reported having two academic programmes on Meteorology focusing on climate change: a BSc. Meteorology and a Postgraduate Diploma in Meteorology. This was unique to that particular case. The other unique finding at this same

university was that they have proposed and developed new programmes on climate change that are under approval process, like the MSc. Disaster Risk Management, MSc. Climate Change and Sustainability, MSc. Meteorology and a PhD in Climate Risk Management. All these will begin once approved and accredited.

The divergent key findings from university of Dar es Salaam related to training programmes were two. First, participants reported that the university currently runs two specialised programmes solely on climate change: MSc. Climate Change and Sustainable Development and a PhD Climate Change and Sustainable Development. Secondly, they reported that the university has been engaged in running seminars and workshops for school teachers and students as well as other stakeholders like government technical officers to give them skills and knowledge on climate change mitigation and adaptation. These key findings were unique to this particular case.

Comparative analysis with respect to research programmes

Common key findings

Participants from both case universities seem to agree that climate change science research conducted focused on understanding processes, the scale and impact of climate change across different sectors as well as vulnerability assessments for these sectors. For example, a participant from Makerere University reported that "a big chunk of what we have to do and science means we have to conduct research in these fields to understand the processes, to down scale or understand climate change at the lowest level possible" *[MAK PL22; Position: 25-45]*. The one from university of Dar es Salaam talked about a large research project CHIESA which "had to do with climate change you know vulnerability analysis. It was a research project covering three countries Tanzania, Kenya and Ethiopia" *[Interview L11; Position: 27-27]*.

The other common key finding across the cases was that most of the research done at these universities was on climate change adaptation and focused on assessing effects of climate change on agriculture, pastoralism and livelihoods of people along coastal areas and semi-arid areas. A participant from Makerere reported that, "there is quite a lot of work that has been done with specifically to agriculture, where people are looking at the interfaces between the predominantly livestock dependent and eco dependent livelihoods" *[MAK PA22; Position: 63-63]*. The one from university of Dar es Salaam talked about "a recent project which was all about assessing the impacts of climate change along the coast, looking at how you know,

various livelihood options are being impacted by climate change, particularly along the coast" *[Interview R11; Position: 13-13]*. Both participants reported on the same kind of research, which is focused on adaptation.

Divergent key findings

Participants at Makerere reported that the university has been engaged in conducting weather forecasts and providing monthly bulletins for specific regions in Uganda. They also talked about working on ways to integrate indigenous knowledge into their weather forecasting programmes. This was unique to the case. At university of Dar es Salaam, participants reported that most of the research conducted is focused on providing scientific evidence on changes in temperature and rainfall patterns and how these changes have led to increase in land use conflicts among pastoralists. They also reported that the university participated in the REDD+ research programme that focused on reducing emissions from deforestation and forest degradation. These key findings were unique to this case university.

Comparative analysis with respect to community engagement programmes

Common key findings

Participants from both case universities reported that festivals on climate change and environment as well as meetings with government officials were organised and implemented to raise awareness to the general public and decision makers on issues of climate change. One participant at Makerere university who is a student reported that she "presented about climate change at the festival and it was one of the ways of creating awareness about climate change to the general public, because that was the only place that people had gathered" *[GD21 UG MAK; Position: 50-50]*. The one from university of Dar es Salaam said that they "run climate change festivals every year and so what we are going to do now is you know, we have worked on the deliberations and then we want to run more focused meetings in these different countries with government officials" [*Interview A11; Position: 21-21]*. Both participant reported on the same activity.

The other common key finding across the cases was that both universities were engaged in local climate change adaptation initiatives that aim at helping communities to deal with effects of climate change. A participant at Makerere reported that the university supported communities on water management practices, landscape adaptation in Kapchorwa coming up with better ways to manage forage for their animals amidst climate change. The one from Dar

es Salaam reported about the university engaging in local adaptation initiatives in central semi-arid zones and south arid areas of Tanzania. Both participants reported on the same kind of activities done.

Another common finding across cases was that the universities have been engaged in introducing new products and technologies to communities as a way of helping communities to deal with effects of climate change. A participant from Makerere University reported that they introduced "drought escaping technologies and early maturing crops to local communities" in various parts of Uganda that have been seriously affected by climate change *[MAK PL21; Position: 61-61]*. The one from Dar es Salaam talked about "introducing climate resistant rice breeds for farmers" as a way of providing onsite solutions to communities affected by climate change in Tanzania *[Interview R11; Position: 21-21]*. Both participants reported on the same kind of community engagement activities.

Divergent key findings

There were a few findings that were unique to a particular case university. For example, at Makerere participants reported that the implementation team identified a number of climate change champions in various communities who were equipped with relevant knowledge on climate change through trainings. These are useful links between the communities and university researchers and they have started various community-based interventions on climate change in their respective communities. The other unique finding at Makerere was that although the university is engaged in community outreaches on climate change, these are not well planned. A participant said:

> the trouble is that, our community engagement programme is not fully well developed. It is not coordinated by one single unit. So each research has a component here and there. So in that way, we kind of tend to lose out the totality of the community engagement *[MAK PR21; Position: 63-63]*.

These two key findings were unique to Makerere University. At Dar es Salaam, participants reported that the university has been engaged in developing decision making tools for district officials, extension workers and other local government officials on climate change issues. The university supported districts and villages in developing climate change adaptation plans together with various stakeholders. The participants reported that the implementing units are working on a programme to translate research findings on climate change into local community practices; that is, identifying feasible actions for the community from the research findings

resulting from the various climate change research projects that have been implemented over time. These findings were unique to this particular case university.

Theme 3: Enemies of progress to university climate change interventions

This section presents a comparative analysis of the key findings that emerged regarding the challenges that implementing units face in carrying out climate change programmes across case universities. The common and divergent key findings in this respect are highlighted.

Common key findings

Participants from both case universities similarly reported the challenge of limited access to reference materials on climate change and facilities by students on climate change programmes at the case universities. One participant from Makerere decried that "books are not very many at the moment, so we resort to using internet, but there are other things that really require using hard copies for references" *[MAK GD21 UG MAK; Position: 44-44]*. On the other hand, the one from Tanzania talked about "challenges on accessing materials like journal articles" by students *[FGD PG UDSM; Position: 63-63]*. Both participants are reporting about the same challenge.

Another common finding across the case universities was the challenge of inadequate funding support by government and local sources towards climate change education programmes implemented by the case universities. For example, one participant at Makerere said, "so the university, government, have not reached that level of investing or putting money in research. So much of the research that is done now is donor funded" *[MAK PL23; Position: 31-31]*. On the other hand, the Tanzanian participant lamented, "in a way I must admit that our government has not been providing a lot of support, in terms of budget not only to the centre but also to the university as a whole even in research" *[Interview R11; Position: 17-17;]*.

Participants at both case universities reported that understanding climate change is difficult for local people in communities especially those with low literacy levels. One of those in Makerere said, "climate change is a problem, except that the scientists or people who have gone to school, they know it, they know the causes. But when you come to the communities, what they call climate change is not actually climate change" *[MAK PL24; Position: 17-17]*. On the other hand, the one from Dar es Salaam noted "sometimes we conduct research but at a certain point you feel like you should have trained or provided like an overview of what climate change is, before maybe they really understand what you are talking about" *[Interview A12; Position: 40-*

40;]. Accordingly, both participants referred to the same challenge making this key finding a common one.

Divergent key findings

At Makerere University, participants reported that they face a challenge of high bureaucratic tendencies in approving and accrediting new programmes, some taking between 3-4 years to be accredited. They also reported lack of proper coordination over which academic unit should host the climate change education programmes at the university. One of them said, "the biggest challenge is much more of the scattered nature of these projects, …lack of programmatic arrangement" *[MAK PA22; Position: 33-33]*. The participants also identified the challenge of failure to adopt climate friendly management practices on campus despite having climate change programmes and courses at the case university. One participant said that "it hurts me so much going around the university halls of residence, the kitchens and restaurants of the university are still using wood fuel. I do not know whether that is helping the communities in any way, because the more you use the wood, it is like encouraging people to cut down trees" *[MAK GD22 PGD MAK; Position: 50-50]*.

The other key finding from Makerere was the challenge of donor driven funding which compromises local interests and issues in the programmes implemented. Participants reported that most of the funding is from donors who determine the areas of research and other interventions to be implemented. This makes it difficult for local interests to be taken into considerations in designing and implementing programmes. This was unique to this case university.

The challenge of negative attitude by local communities towards new technologies and products introduced by the university was also reported. According to the participants, local communities are sceptical about new technologies and products especially new varieties of crops. The other challenge, which was very key to the participants, was limited access to quality climate data spanning 5 years and more in the country. One of them said:

> The other problem, which I find very crucial, is the challenge of data. Data, you could have all resources you need to collect data, but the data is a challenge. Getting good quality data say on agriculture, getting good data that span say 40-50 years of climate data, rainfall, temperatures and solar radiation is a huge challenge *[MAK PL21; Position: 53-53]*.

All these key findings were unique to Makerere University.

From the analysis of data from the University of Dar es Salaam, participants reported limited funding for climate change mitigation research by donors. One of them said:

> Most of the research funding is coming for adaptation you know. But there are so many issues; for instance, …when it comes to mitigation or issues of natural resources vis-vie mitigation, adaptation stuff like that, I think that is the area of research where we are having a challenge in terms of how we respond adequately, adequate response *[Interview L11; Position: 29-29;]*.

Another key finding was the challenge of scepticism among academic staff about the reality or existence of climate change phenomenon. Participants reported that some of the academic staff are sceptical about the reality of climate change which affects the interventions at the case university. The other challenge mentioned was lack of funding for student research especially at PhD level, which affects the quantity and quality of student research. One of the participants reported, "for example, when you are doing your study which is a bit expensive and your accessing let us say three-quarters of the fund you will suffer…. It is a challenge but opportunities are restricted to some extent" *[FGD PG UDSM; Position: 69-69;]*.

Other findings included the challenge of working with parallel leadership structures at the community level and high bureaucracy in accessing communities, which affects community engagement programmes on climate change implemented by the university. A participant in noted that "working with the communities that have a parallel sort of organisation…leadership. It is very difficult to harmonise these two. So, that has been quite challenging" *[Interview R12; Position: 51-51;]*. The two structures the participant talked about are the cultural leadership structure and local government structure in most of the Tanzanian communities. Another participant reported about the high bureaucracy in accessing communities. He noted that "the bureaucratic process of getting to the local communities. It is sometimes very discouraging" *[Interview L11; Position: 39-39;]*. These key findings were unique to this case university.

Theme 4: The key drivers and current opportunities for our work.

Common key findings with respect to key drivers

The first common key finding was that universities have competent and dedicated academic and administrative staff on climate change education programmes that drive the CCE work. A participant from Makerere University reported that, "Makerere though has few Professors and

lecturers, but they do good work" *[MAK GD22 PGD MAK; Position: 55-55]*. On the other hand, one from Dar es Salaam talked about "having technically good and well dedicated staff. We work even during weekends. So people are dedicated and I think it is because they accept the leadership that is leading them" *[Interview R11; Position: 25-25]*. Both participants are talking about the same key driver.

The other common key finding was the multi-disciplinary and interdisciplinary teams and engagements or approaches at both universities implementing climate change education programmes. Participants at both universities reported that these teams and approaches were key in driving their climate change education work. For example, a participant from Makerere mentioned that "the university also does a lot of multi-disciplinary, interdisciplinary and trans-disciplinary kind of engagements within and outside the university" *[MAK PL21; Position: 73-73],* while Dar es Salaam talked about "hiring teachers from different institutions or disciplines to teach on climate change programmes" *[FGD PG UDSM; Position: 43-43]*. These participants are all talking about the same key driver.

The last common key finding on key drivers was the strong partnerships and collaborations on climate change education programmes. One participant from Makerere reported that the university has:

> partners around communities mentioned above, at national level we partner with various ministries and institutions, for example we have the water development department, NEMA, KCCA, etc. At international level we have various organisations, for example, GIZ, various international universities and organisations like UN Habitat, the DfID *[MAK GD22 PGD MAK; Position: 55-55].*

On the other hand, the one from Dar es Salaam talked about:

> strong collaboration that IRA and the university has established over years with different partners across the world. Currently we are implementing projects within the centre with Makerere University, for example, University of Nairobi, there is University of Lilongwe, with the Norwegian government, the United States government, and Canada, SIDA, etc *[Interview R11; Position: 25-25]*.

Both participants talked about the same key driver.

Divergent key findings with respect to key drivers

At Makerere participants mentioned African social and cultural systems or *Ubuntu* philosophy as a key driver indicating that these motivate and drive those involved to work for their communities. The other key finding unique to this case university was the continuous funding from donors to support climate change education programmes. The last divergent key finding for this case was the high reputation of the university in the region. One of the participants reported that, "number one thing is legacy. We have a very big name to protect. They say Makerere is number 1 university in east and central Africa. That alone drives the students, the lecturers and the governance body of the university to do a lot of research so that we can keep our name" *[MAK GD22 PGD MAK; Position: 54-54]*. These key findings were unique to this case university.

The unique key findings at Dar es Salaam included: effective cooperation and support from the university administration; the conducive working environment for academic staff on climate change education programmes and; the good leadership at both university level and implementing units. The other key finding was effective involvement of stakeholders in design and implementation of climate change education programmes. For example, a participant reported that "right from the inception phase, you know, we had to involve stakeholders at all levels for them to endorse that ok, these issues that we want to work on, they are actually relevant and so at every stage when we accomplished a one milestone, we had to go back to them and say, these are the findings" *[Interview A11; Position: 23-23]*. This was peculiar to this particular case.

Common key findings regarding opportunities for climate change education programmes

Comparative analysis of key findings regarding opportunities revealed two common key findings across the cases. One of them was Africa's high vulnerability to climate change compared to other continents and its effects across the sectors in Africa. A participant from Makerere noted:

> Africa being one of the regions that forms part of the developing world, already in many countries of the continent, sectors like agriculture is rain fed. And since climate change is causing a lot of seasonal variations, for example when farmers are expecting rains, they don't see the rains and because they can't use irrigation because of the low levels of technology, they are really affected" *[MAK GD22 PGD MAK; Position: 12-12]*.

On the other hand, the one from Dar es Salaam mentioned that, "if you compare climate change in Africa, the impact of climate change in Africa and the rest of the world, we may realise that, Africa contributes very little to the impact of climate change. But it is one of the major victims because of the capacity in addressing those impacts" *[Interview L12; Position: 21-21]*. Both participants talked about the same opportunity.

The other common key finding across cases was the opportunity to partner and collaborate with other universities on the African continent in dealing with issues of climate change through education interventions. A participant from Makerere said that "most universities realise it is a challenge, and those we are partnering with have already, put in place climate change programmes" *[MAK PR22; Position: 99-99]*. One participant from Dar es Salaam noted that climate change opens up an opportunity for:

> researchers to collaborate to work together so that we handle the problems either region wise, just like we did in East Africa situation. But it would be much better if we could go even beyond the region and handle continental issues together and you get a wide ranging perspective but also you get eh you know solutions *[Interview R12; Position: 41-41]*.

Divergent key findings regarding opportunities for climate change education interventions

Comparative analysis of key findings revealed a number of these that were unique to specific cases. At Makerere University, participants identified various opportunities for climate change education interventions. For instance, Uganda is a signatory to the UNFCC which is a legislative backup for climate change education interventions by the university; the limited capacity of government to deal with climate change which calls for the support of the university; and climate change research being part of the university's research agenda. These key findings were peculiar to this particular case.

For Dar es Salaam, the divergent findings included: the possibility of extending climate change education to other levels of education through teacher training; opportunities for widening research agendas; creating more training programmes; and supporting policy makers and other interventions for mitigation and adaptation to climate change. The others identified were: the provisions within the Paris agreement to support universities on climate change education

interventions; and integrating climate change issues into programmes and courses in other disciplines. These were peculiar to this particular case.

Theme 5: Ways to do things better

This section covers the common and divergent key findings regarding the strategies for improvement in implementing climate change interventions at the case universities.

Common key findings

The first common key finding was that universities should encourage more practical training programmes and courses on climate change. One participant from Makerere university recommended that:

> in Africa, I think one of the issues that African universities need to do. I think we need to encourage more practical than doing theoretical stuff, so that even the products we get like our students and staff come up with things that are really tangible and could be more useful to communities and universities *[MAK PL21; Position: 85-85]*.

On the other hand, the one from Dar es Salaam called for the same when he said that, "the courses are…too theoretical. If you asked one of the…climate change students to develop an adaptation plan, I doubt how many of them would do it. So we need to go to the field…be shown practically the progresses of the current projects and how we go through the cycles of their development" *[FGD PG UDSM; Position: 34-34]*.

The other common key finding across the cases was that universities need to engage governments and local institutions to invest in and support climate change research, rather than depending on donor driven funding for climate change research. A participant from Makerere called for increased government investment in climate change research when he said, "it is high time they [government] prioritise and begin investing in research. If we have a call, this is money for research, come and apply, write proposals and you know that is money in the Ministry of Finance, it would really help a lot. And people will solve key problems that are of national nature" *[MAK PL23; Position: 33-33]*. The participant from Dar es Salaam supported the same when she argued that "the university need to try [and] find funds within themselves and support researchers to venture in this discipline" *[Interview L14; Position: 62-62;]*. These participants are talking about the same thing.

The last common key finding was that universities should explore the role of indigenous knowledge when designing climate change education programmes. One participant from Makerere mentioned that, "communities have indigenous knowledge which they apply in adapting to climate change, which we researchers don't know. So we need to document it and find out whether what works in area A can also be applied in area B" *[MAK GD22 PGD MAK; Position: 43-43]*. Supporting the same strategy, the one from Dar es Salaam said, "we have not gone out to the community to engage them directly" and use the knowledge they have of their environment *[Interview L12; Position: 71-71]*.

Divergent key findings

At Makerere University, participants proposed a number of strategies including: universities building the capacity of academic staff through PhD training in areas related to climate change; mainstreaming climate change aspects across university programmes and courses and; universities creating a conducive environment for quality research on climate change. The other key findings were: having a clear research agenda for climate change research; promoting multi-disciplinary research teams; developing a comprehensive community engagement and outreach approach for climate change education; and developing the necessary infrastructure for climate change research and training at the case universities. All these proposed strategies were only mentioned by participants at this case university.

For Dar es Salaam, the divergent key findings included: designing and delivering relevant climate change training and capacity building programmes that are based on local needs; undertaking climate research that is relevant to local contexts of communities or societies; and implementing the recommendations from research projects completed through pilot initiatives. The other key findings were: mobilising and providing adequate funding for student research on climate change; engaging local media and involving students on community outreach programmes on climate change; and establishing effective institutional coordination mechanisms for all climate change programmes across academic units. At the case university, participants also called for engaging governments to desist from appointing university academics and professors to political and administrative positions in order to promote research and training at the universities *[Interview L12; Position: 103-107]*. These were unique to university of Dar es Salaam.

7.2 Summary and discussion of key findings

Section 7.2 presented the cross case analysis indicating the common and divergent key findings for all the themes. This section provides a summary of key findings per research question across the cases linking them to findings and the varied debates related to the scope of this study by other prior scholars and authors.

Research Question 1: What are the current academic, research and community engagement programmes on climate change implemented by the higher education institutions (Universities) in selected cases?

In answering this research question, two themes emerged from the interview and focus group data collected at both case universities. The two themes are summarised and discussed linking the findings with the theory, model and framework adopted for the study.

Theme 1: The role of the university and institutional support for climate change education interventions

The social learning theory provides several theoretical concepts that help to explain not only the social learning by individuals but also the social units. Barth (2015) contends that social learning supports individuals, groups and social units or organisations to reflect on their roles and how they can significantly contribute to sustainable development. Through this theoretical lens, participants across the cases were asked to share their views, perspectives and opinions regarding the role that the university can play and the nature of institutional support the university can offer in addressing issues of climate change in their programmes. The researcher investigated these aspects based on the principal of reciprocal determinism where the role of the universities would help to determine the contributions they make to climate change mitigation and adaptation.

The study findings revealed that across the cases, participants agree to the fact that universities have key roles to play in addressing climate change issues in their respective societies. They identified a number of roles including: generating the much needed scientific knowledge on climate change through research; providing training and capacity building on climate change; carrying out sensitisation and providing guidance to communities and policy as well as decision makers on climate change; and advancing innovations and technological solutions for climate change mitigation and adaptation. The other key roles mentioned were: providing technical support to NGOs and other Community Based Organisations (CBOs) on climate change; providing consultancy services on technical aspects related to climate change; and engaging

communities in local climate change adaptation initiatives that are simple and community friendly. Virtenen (2010, p. 232) argues that, "institutions of higher education can choose between two roles": either as mere "indicators of changes in attitudes, knowledge and practices within a society but do not themselves provide the impetus for change" or as "proactive leaders in promoting societal change." Either way, the author agrees to the fact that the university has serious roles to play in addressing climate change issues, which is consistent with the key findings of this study.

These key findings are also consistent with the arguments for universities to address climate change across disciplines and programmes by Lemons (2011). The author argued that universities have a huge responsibility of educating people on important issues that affects society across all academic disciplines. Therefore, he calls for serious university reforms and coming up with a comprehensive approach to deal with climate change through their programmes. The key findings also support the report by O'Keeffe (2016, p. 809) that "various universities have established climate change research centres to assist Ethiopia in addressing the potential problems of climate change." The author cites Addis Ababa University and the University of Gondar; the centre established by Gondar aims to "empower local communities to improve their living prospects and works" amidst climate change through various interventions including climate change adaptation and mitigation, education and awareness.

With respect to institutional support for climate change education programmes, participants across the cases reported on the various kinds of support that case universities offer towards implementation of climate change education programmes.

The social learning theory explores the nature of behaviour of individuals, groups and social units given their social interaction (Bandura, 1977). With respect to this particular study, therefore, the researcher explored the behaviour of actors and the institutions towards climate change education interventions and how this behaviour supported the interventions. The IAD framework provides contextual variables that are key for institutional analysis like the key actors, community attributes and rules in use which support social learning theory. A combination of these concepts was employed to analyse institutional support for climate change education interventions at the case universities.

Findings revealed that universities have provided, and continue to provide, infrastructural and operational facilities for training and research programmes on climate change. The other kinds of support include: the university's commitment to support and strengthen the climate change

centres in terms of budget and staffing; administrative support on research clearances and helping staff on climate change programmes to get to the research sites; and supporting implementation units in mobilising resources through research grant proposals.

Theme 2: University programmes on climate change

The various programmes offered by the universities indicate the nature of social learning that takes place at those institutions. The social learning theory focuses on how this learning takes place and how individuals and groups involved acquire it (Gavazzi, 2011). Through this theoretical lens, the researcher investigated the various climate change education programmes offered at the case universities and how they are implemented. With the support of systemic thinking offered by the model of learning for sustainable development, the researcher asked participant to share their views and perspectives regarding current university programmes on climate change at the case universities. The researcher sought views and perspectives on the current training, research and community engagement programmes being implemented at the case universities.

With respect to training on climate change, findings revealed that across the cases, implementing units run short courses on climate change targeting students, professionals and actors in climate related sectors based on demand. Such short courses run for 1 to 4 weeks aimed at creating awareness and engaging decision makers on climate change issues. On top of the short courses, the case universities also organised climate change festivals and seminars for the public as well as workshops for school teachers, students and government officials to empower them with knowledge and skills on climate change. Fernandez et al. (2014, p. 59) support training of teachers on climate change education arguing that "these need to be equipped with knowledge, skills and attitudes on" because they "have a pivotal responsibility" in helping their learners to be aware of the impacts of climate change on various aspects of life.

Findings also revealed that case universities implemented long courses that are integrated into existing programmes within certain academic units. One of the critical factors provided by the model of learning for sustainable development is integration. Rohweder and Virtanen (2009) argued that universities should integrate aspects of sustainable development into their programmes. The participants reported various examples of such courses that included courses on climate change science, weather and atmospheric processes, energy, environment and climate change, and climate change and forestry resources running on a semester basis in specific undergraduate and postgraduate programmes. However, Filho (2010a) reports that in

Africa issues of climate change are dominantly emphasised in natural and social science programmes compared to other disciplines which calls for increased integration of these issues across all disciplines at African universities.

The other kind of training offered on climate change across the cases were specialised undergraduate and postgraduate programmes. At Makerere University, participants mentioned that currently they run a BSc. Meteorology and a Postgraduate Diploma (PGD) in Meteorology. They also reported that they have developed and submitted for approval other programmes namely; a MSc. Disaster Risk Management, MSc. Climate Change and Sustainability, MSc. Meteorology and a PhD in Climate Risk Management. At the University of Dar es Salaam, findings reveal that currently there are two postgraduate specialised programmes on climate change: MSc. Climate Change and Sustainable Development and a PhD in Climate Change and Sustainable Development. These findings are consistent with C. Vogel (2010) who claimed that a good number of universities on the African continent had integrated climate change issues in their curriculums and were developing undergraduate and postgraduate courses solely on climate change.

Regarding research programmes, findings revealed that the case universities were involved in research on climate change science specifically focusing on understanding the processes, scale and impact of climate change across different sectors as well as vulnerability assessments for these sectors. It was also found that most of the research conducted focused on climate change adaptation and less on climate change mitigation. This was conversely related to what Akinbami and Akinbami (2017) found regarding climate change research studies and their uptake and integration into policy. The authors reported that mitigation research was more visible in the publications on climate change in Nigeria compared to adaptation research.

The other type of research included conducting weather forecasts and providing monthly bulletins at regional level especially in Uganda and studies on changes in temperature and rainfall patterns and how these changes have led to increase in land use conflicts among pastoralists especially in Tanzania. The findings reveal that the University of Dar es Salaam was also engaged in the REDD+ research programme that focuses on reducing emissions from deforestation and forest degradation. Morgan (2017) noted that universities as "producers of research" continue to be at the "forefront of climate change research" and this make them to subsequently be actively involved in all processes of ensuring that climate change issues are integrated in into policy (p.118). However, the author argues that, "the highly political nature

of climate change" will often affect the process of getting this "evidence accepted into the policy process" (122).

The model of learning for sustainable development calls for effective interaction between the university and community to support sustainable development. Based on this theoretical concept, the researcher investigated the existing community engagement programmes being implemented at the case universities. Findings on community engagement programmes across cases revealed that implementing units have been involved in organising festivals on climate change and environment annually as well as various meetings with government officials to raise awareness to the general public and decision makers on issues of climate change.

The findings also reveal that the case universities are engaged in local climate change adaptation initiatives that aim at helping communities to deal with the effects of climate change. Most of these have focused on water management practices, management of forage for animals and dealing with adaptation issues in semi-arid areas and pastoral communities in both Uganda and Tanzania. It also emerged that at Makerere University, the implementers identified community climate change champions across the country and equipped them with skills and knowledge on climate change to support research and other community engagement activities in their areas. This was a very innovative way of engaging communities and making the programmes more sustainable.

The findings from Dar es Salaam, on the other hand, revealed that implementing units have been engaged in developing decision-making tools for district officials, extension workers and other local government officials on climate change issues. They also supported districts and villages in developing climate change adaptation plans in various areas in Tanzania. The team at this case university is now working on a programme to translate research findings on climate change into local community practices for those research projects that have been completed over time.

These key findings confirm what Scheltinga and Geene (2011) found out during their work on climate change adaptation in East Africa. The authors argue that high levels of poverty and meagre resources make people in developing countries to be more vulnerable to effects of climate change due to their limited capability to adapt to climate change. They report that universities and other partner organisations in the East African region have been engaged in supporting rural farmers and other people who are more vulnerable to effects of climate change to adapt to these effects in the communities.

Research Question 2: What are the key challenges faced by the implementing units in carrying out academic, research and community engagement programmes on climate change within the higher education institutions (Universities) in selected cases?

In order to answer this research question, the researcher sought participants' views and perspectives on the challenges faced in implementing climate change education interventions. One theme emerged from the data. Findings on this theme are summarised, discussed and linked to theoretical underpinnings as explained below.

Theme 3: Enemies of progress for university climate change education interventions

One of the propositions of social learning theory is reciprocal determinism where social learning of an individual is determined by the social environment. Bandura (1977) claimed that the social environment and its context including the motivators and demotivators would often determine the behaviours of the individuals. Based on this theoretical lens, the researcher investigated the challenges within the social environment and context of the case universities that affect climate change education interventions. Thematic analysis of the data revealed a number of challenges across the cases. These included: limited access to reference materials and facilities by students on climate change programmes at the case universities; inadequate funding support by government and local sources towards climate change education programmes implemented by the case universities; and the challenge of conceptualising climate change among local people or communities. These findings were in support of the claims by Teferra and Albach (2004), who indicated that "African universities are under considerable financial pressure and face serious financial problems." According to the authors, over the years there has been "constant decline" in government funding to higher education institutions despite increased student enrolment trends across the universities on the continent (p. 28).

The other key challenges were: high bureaucratic tendencies in approving and accrediting new programmes; lack of proper coordination and conflict over which academic unit should host the climate change education programmes at the case university; and failure to adopt climate friendly management practices on campus despite having climate change education programmes and courses at the university. This set of challenges was particularly experienced at Makerere University. Gale et al. (2015) contend that "the institutional structure of universities" is often a challenge to embedding sustainability aspects like climate change education. This is because such education calls for interdisciplinary and multi-disciplinary

approaches, which are difficult to achieve in an institutional structure characterised by "loosely coupled networks of semi-autonomous centres of influence and decision making" (p. 253). This supports the findings above related to coordination and conflict among units as well as high bureaucracy in decision making.

The key findings revealed other challenges such as donor driven funding which compromises local interests and issues in the programmes; negative attitudes by local communities towards new technologies and products introduced by the university; and limited access to quality climate data spanning 5 years especially in Uganda. Participants talked about scepticism among academic staff about the reality or existence of climate change phenomenon; the challenge of working with parallel leadership structures at the community level; and high bureaucracy in accessing communities, which affects community engagement programmes on climate change implemented by the university especially in Tanzania. Though Higgins and Thomas (2016) identified several challenges that universities face generally including "globalization, massification, diversification, financial pressures and changing economic situations" but many of these were not similar to those mentioned by participants in this study.

RQ3: What are the success factors that would support universities to adequately address climate change issues in their academic, research and community engagement programmes and what can be done to improve the situation?

To answer this research question, the researcher asked participants to share their views and perspectives on key drivers and opportunities that support climate change education work at the case universities. Participants were also asked to suggest ways or strategies for improvement in implementation of climate change programmes at the case universities. Two themes emerged from the data and these are summarised, discussed and linked to theory as explained below.

Theme 4: The key drivers and current openings for our work

Social learning theory extends learning from the individual to the groups and social units or entities. The social learning within an entity is seen as "a trigger to system wide change processes" within the entity and society (Barth, 2015, p. 165). Based on this view, the researcher investigated the key drivers for climate change education and opportunities that universities as institutions can tap, in enhancing their contribution to climate change mitigation and adaptation. Drivers and opportunities for climate change education were seen as triggers for enhanced climate change education at the case universities. The key findings revealed

several key drivers: the competent and dedicated academic and administrative staff on climate change education programmes; the multi-disciplinary and inter-disciplinary teams and engagements or approaches at both universities implementing climate change education programmes; and the strong partnerships and collaborations on climate change education programmes at national and international levels.

Other key drivers reported were: the African social and cultural systems or *Ubuntu* philosophy that motivates those involved to work for their communities; the continuous funding from donors to support climate change education programmes at the case universities; and the high reputation of the case universities in the region. Effective cooperation and support from the university administration; the conducive working environment for academic staff on climate change education programmes; and the good leadership at university level and implementing units were also reported to be key drivers for climate change education programmes at the case universities. Participants especially at the university of Dar es Salaam reported effective involvement of stakeholders in design and implementation of climate change education programmes as a key driver.

Analysis also revealed interesting findings regarding opportunities that are available for enhancing climate change education programmes at the case universities. These include: Africa's high vulnerability to climate change and its effects across the various sectors; and the opportunity to collaborate with other universities on the continent and beyond through education interventions. The other opportunities identified were: the legislative back up for Makerere University since Uganda is a signatory to the UNFCC; the limited capacity of governments to deal with climate change which calls for the support of the universities; and climate change research being part of Makerere's research agenda in its five-year strategic plan.

Participants especially at the university of Dar es Salaam talked about the possibility of extending climate change education to other levels of education through teacher training; and opportunities to widen the research agenda, create more training programmes, support policy makers and other interventions for mitigation and adaptation. Other opportunities included: the provisions within the Paris agreement on climate change to support universities on climate change education interventions; and the fact that climate change is a cross-cutting issue which every discipline can mainstream in their programmes and courses.

Theme 5: Ways to do things better

The model of learning for sustainable development offers useful theoretical concepts that supported the researcher in investigating the strategies for improvement in implementing climate change education programmes at the case universities. One of the mental aspects in the model is "critical reflection" (Rohweder & Virtanen, 2009, p. 37). This aspect calls for universities to engage all stakeholders including students to reflect on how they can continuously improve their actions to enhance sustainable development. Critical reflection supports social learning as a trigger to system wide change processes within the entities. Therefore, based on these theoretical constructs, the researcher investigated the views and perceptions of study participants on the strategies for improvement in climate change education interventions at their respective universities.

Findings revealed several proposals: to encourage more practical training programmes and courses on climate change at the case universities; to engage governments and local institutions to invest in and support climate change research rather than depending on donor driven funding for climate change research and; and to explore the role of indigenous knowledge when designing climate change education programmes at the case universities.

Participants also proposed that there is a need for case universities to build capacity of academic staff through PhD training in areas related to climate change; mainstream climate change aspects across the university programmes and courses; and create a conducive environment for quality research on climate change. Participants called for having a clear research agenda for climate change research; promoting multi-disciplinary research teams; developing a comprehensive community engagement and outreach approach to climate change education and; developing the necessary infrastructure for climate change research and training at the case universities. These key findings, however, present serious institutional challenges given the characteristics of universities as institutions. Higgins and Thomas (2016) identified several "distinct characteristics" of universities that make institutional transformation difficult. These are "revenue and opportunity constraints, complex governance structures, high level of participation by staff and lack of a specific group responsible for broad-scale change" (p. 94). According to the authors, these significantly constrain the transformation process within the universities and therefore the proposed strategies above may be constrained by these characteristics.

The other proposed strategies were: designing and delivering relevant climate change training and capacity building programmes that are based on local needs; deliberate efforts to undertake

climate change research that is relevant to local contexts of communities or societies; attempts to implement the recommendations from research projects completed through pilot initiatives; and the need to mobilise and provide adequate funding for student research on climate change.

Participants suggested that universities should engage local media and involve students more in community outreach programmes on climate change; establish effective institutional coordination mechanisms for all climate change education programmes across academic units; and engage governments to desist from appointing university academics and professors to political and administrative positions. The last proposed strategy is related to issues of brain drain by academics that Teferra and Albach (2004) pointed out. The authors reported that African universities are characterised by high "internal mobility of scholars" where various academics and experts move away from the university to "better-paying government agencies and private institutions and firms that may or may not be able to utilize their expertise and talent effectively" (p. 41). This is a serious challenge to academia and consequently climate change education at universities that need serious interventions by university management.

7.3 Conclusions

Climate change education at universities in Africa is still low although a few institutions of higher learning have made some interventions. Moreover, effects of climate change are already evident in all sectors of the continent. Universities will need to do more to deal with the challenge. This study aimed at exploring the opportunities and challenges for climate change education in universities in the African context. Specifically, the study sought to answer three research questions: What are the current academic, research and community engagement programmes on climate change implemented at the case universities? What are the key challenges faced by the implementing units in carrying out these programmes within the selected case universities? What are the success factors that would support universities to address climate change issues in their programmes and what can be done to improve?

The findings have indicated clearly that the case universities run a few academic programmes on climate change, are engaged in some research especially on adaptation, and innovative community engagement programmes. This is encouraging and serves as a starting point for these case universities. It also emerged that there are a number of institutional, resource related and organisational environment related challenges that these case universities face in implementing their climate change education programmes. University management will need to find ways of dealing with the institutional and resource related challenges. Through

partnerships and effective engagement with respective governments, solutions to the organisational environment related challenges can be sought.

The findings revealed several drivers that could be key motivators for climate change education work. What also emerged were various opportunities that these universities can explore in their climate change education work. These opportunities need to be tapped and also shared with other universities that are yet to start climate change education work. The study findings revealed a multitude of proposed strategies for improvement in climate change education work and university management and implementing units need to carefully review these and find ways of improving on their work.

Finally, this study contributes to existing scholarly work on climate change education. It is expected to raise awareness to practitioners of climate change education on the situation in the case universities. The piece of work may ignite a discussion among those universities within the same context that are yet to start climate change education programmes to find where to begin.

7.4 Thesis contribution and areas for further research

This section presents the contribution of the study and the areas for further research. The thesis contribution is covered in section 7.4.1 while the areas for further research are given in section 7.4.2.

7.4.1 Thesis contribution

The findings of this study contribute to the science, theory and practice in sustainability education at universities in the African context.

Empirical contribution of the study

The findings of this study add to the existing empirical evidence on climate change education at universities within the context of Africa. The study was to examine the opportunities and challenges for higher education institutions (universities) in Africa in addressing climate change issues and explore ways to improve the climate change education programmes at these institutions. Specifically, the study sought to analyse the current academic, research and community engagement programmes on climate change implemented by the case universities; identify the key challenges faced by the implementing units in carrying out CCE programmes in selected cases; and establish the success factors that would support universities to adequately

address climate change issues in their academic, research and community engagement programmes and what can be done to improve the situation.

The study findings provide scholars with detailed knowledge on existing climate change education interventions at Makerere University and University of Dar es Salaam. It enriches the scientific community with empirical evidence on challenges that both universities face in implementing climate change education interventions. The research community will benefit from empirical evidence on key drivers and opportunities for climate change education work at these case universities and how these are unique to African context. Additionally, the findings include suggestions on how the implementing units within the case universities can improve their climate change education programmes. All this empirical knowledge was missing in the literature on climate change education and sustainability education field and therefore it is expected that this gap has now been filled.

Finally, the researcher has suggested areas for further research in relation to climate change education at universities within the African context, which is expected to stimulate other researchers to add to empirical evidence on these areas. This may widen the empirical base on climate change education in universities within the African context.

The contribution to policy and practice

The study findings may provide valuable information and evidence for decision and policy makers at the case universities on the current situation, challenges and ways they can adopt to improve their programmes. The findings on existing interventions are expected to raise awareness on the existing and successfully implemented programmes on climate change education. The decision makers may use the information to boost their programmes but also increase on support for their implementation. For universities that have not yet started, the findings will be a good starting point to think about how best to begin climate change education programmes including approaching the case universities for benchmarking.

The study findings on challenges faced may be very useful for university management, stakeholders and other policy makers in finding practical and relevant solutions to these challenges leading to effective delivery of climate change education programmes.

Findings on success factors and opportunities as well as suggestions for improvement are expected to support decision makers and implementers on how best to take advantage of the key drivers for improved delivery of the climate change education programmes but also tap

and exploit opportunities for the development of the field. The researcher has made various recommendations that can be very useful to the university management and other stakeholders in strengthening and improving their climate change education programmes.

Theoretical contribution of the study

Though literature shows the link between education and sustainable development, and also how education in general can be a useful tool in supporting mitigation and adaptation of climate change as shown by authors like (Filho, 2010b; Kagawa & Selby, 2010; Lotz-Sisitka, 2010; Rohweder & Virtanen, 2009) and many others, no explicit model explains the link between university education and climate change interventions within the African context.

Rohweder and Virtanen (2009, p. 34) attempted to develop a pedagogical model of learning for sustainable development based on the development work done in Finland between 2006 and 2008. The model was developed based on teaching cases in higher education found in 6 countries in Russia, Finland, Germany, Ukraine, Poland and Estonia. The analysis of these cases led to the identification of various ways in which sustainable development can be integrated in higher education and these were dubbed critical factors to learning for sustainability. The analysts grouped the identified critical factors into three: contextual factors (integrative approach, spatiality and time perspective); the mental aspects (value clarification, systemic thinking, critical reflection and motivation building); and activity related aspects (partnerships, cooperation and communication as well as participation). To them these are key to enhancing learning and building competences for sustainability (p. 35).

The model was developed with a focus on curriculum and pedagogical aspects of learning for sustainability in general and indeed it is a useful model in guiding curriculum developers and those delivering sustainability education at higher education institutions. Since climate change education is part of the wider education for sustainable development framework, this model is still relevant to the field within the context of higher education. However, with respect to climate change education within the context of African universities, the researcher found deficiencies in the model.

First, the model was developed focusing on curriculum and pedagogical guidance within the context of developed countries and therefore it ignores the institutional management and contextual set up of the universities especially within the African context. Secondly, it only

focuses on learning and training and ignores the other key functions of a university: research and knowledge generation as well as community outreach or engagement.

Therefore, based on thematic analysis of multiple realities for participants at Makerere University and University of Dar es Salaam, the researcher attempts to theorise the linkage between university education and climate change interventions within the context of African universities as illustrated in the model below.

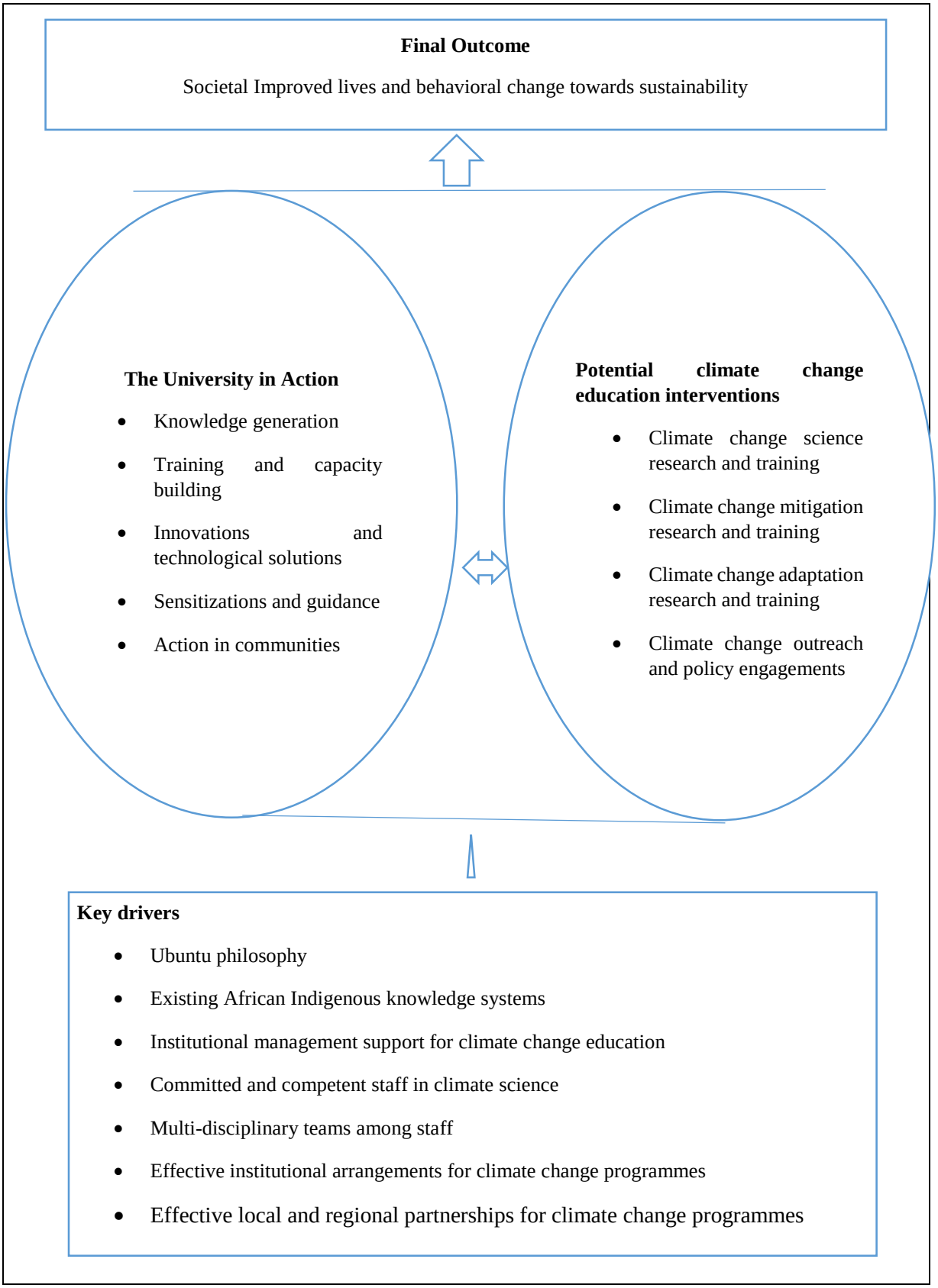

Fig 7.1 Theoretical Model: Linking University Education to Climate Change Interventions in the African Context

Figure 7.1 above illustrates the link between university education and possible climate change education interventions as well as the key drivers for climate change education within the African context. It shows how this link can significantly contribute to societal improved lives and behaviour change towards sustainability, which is the final outcome of climate change education interventions. These components of the model are explained as follows;

The University in action

This component outlines the key roles that a university can play in society especially within the African context. One of the key findings on the role of the university was that it could generate the much needed knowledge on climate change for society through its research and innovation activities. Teferra and Albach (2004) argue that knowledge and information continues to shape the world today and therefore, "universities as creators and brokers of these products are situated at the centre of knowledge and information supermarket" (p. 38). The authors however, indicate that "by all measures, research and publishing activities in Africa are in critical condition" characterised by extremely low research output due to inadequate research infrastructure and "unreliable sources of research funds" (ibid) as well as other factors. This implies that in Africa, universities must seriously focus on **knowledge generation** through research and innovation since it is scarce.

The other key role in the model is **training and capacity building**. It emerged from the data that universities can provide training and capacity building to create a pool of knowledgeable professionals and experts on climate change mitigation and adaptation. Africa remains a continent with limited capacities among her human resource in various sectors. Other than the fact that the continent has low capacity in terms of scientists and academics due to colonialism, "social upheavals, political instabilities, economic uncertainties, real and perceived persecutions and poor working as well as living conditions," the few professionals and academics are on the move to migrate to other developed nations (Teferra & Albach, 2004, p. 45). Many of the highly qualified and trained experts are driven away to other countries which is serious brain drain making the situation worse for the continent. This implies that universities have a key role in supporting training and capacity building to produce the seriously needed human resource and experts in climate change for the continent.

Findings revealed that one of the key roles that universities can play is coming up with innovations and technological solutions for climate change mitigation and adaptation. Africa is yet to advance in high-level innovations and technology. With low capacities and expertise

in various fields, it's unlikely that **innovations and technological solutions** to its challenges will be sought. This implies that universities are key in promoting innovations and coming up with technological solutions to various problems of the continent. Universities in Africa can and need to seriously invest their energies and resources in promoting innovations in various sectors and develop technologies that will support communities to deal with socio, economic and ecological challenges they face.

Across case universities, participants argued that universities could carry out sensitisation and provide guidance to communities and governments on climate change. African societies have not yet developed to the level where they can easily access information without **sensitisation and guidance** from academia. These societies are still characterised by high illiteracy levels and other constraining factors to access to information. Such factors include limited access to media, Internet and undeveloped communication infrastructure in most areas especially in Sub-Sahara Africa. This implies that universities on the continent can undertake sensitisation of masses on various issues that may affect them based on the research and knowledge generated. The university can be handy in providing policy guidance to policy makers and other decision makers on various issues. Such sensitisation and guidance from academia would significantly enhance sustainability and informed decision-making among actors in the private, public and voluntary sectors especially in Sub-Sahara Africa.

Findings showed that universities can support communities through community based mitigation and adaptation initiatives. The universities in Africa need to actively be engaged in community initiatives by taking part in coming up with ideas, and implementing them as a way of supporting communities especially those with low capacity to deal with effects of climate change especially where specialised expertise is needed. Through community outreach programmes, the university can actively contribute to community development, resilience and application of the generated knowledge and technologies. This is what the researcher called **action in communities**.

Therefore, with the university in action as shown above, the researcher, identified four key climate change education interventions that the universities in Africa can explore undertaking as they strive to contribute to the final outcome—societal improved lives and behaviour change towards sustainability. These are explored below.

Potential climate change education interventions

Based on the analysis of the data on climate change programmes implemented at the two case universities, the researcher categorised the various interventions into four potential categories for African universities on climate change. First is engaging in **climate change science research and training**. With low capacities and expertise on the continent as well as low research output, universities in Africa especially those in Sub-Sahara Africa can be engaged in conducting climate change science research and developing a pool of experts and highly technical human resource in climate change science. Training meteorologists, climate change science experts and other professionals in climate change related sectors would enhance climate science research and generation of climate change knowledge and information for mitigation, adaptation and policy engagement. Africa lacks experts and academics in climate change science and the materials and technology to promote climate science. The university can ably invest its efforts and resources to intervene in this area thereby contributing significantly to improved lives and behavioural change towards sustainability.

The other potential intervention that African universities can engage in is **climate change mitigation research and training**. Climate change affects all aspects of life including people's health, livelihoods, water resources, air quality and infrastructure. This impact is felt harder in countries where levels of science and technology as well as adaptive capacity are low and Sub-Sahara Africa is more vulnerable. African universities therefore, can intervene by engaging extensively in mitigation research to generate knowledge on climate change impacts but also effective ways to mitigate these impacts. Research and innovations that will lead to developing mitigation technologies is urgently needed in Sub-Sahara Africa given its low capacity to mitigate climate change effects. The universities could also develop training programmes and courses to produce the much-needed experts and professional human resources in climate change mitigation especially in Sub-Sahara Africa.

African universities can intervene by conducting **climate change adaptation research and training** in their respective countries. Adaptation research is key in supporting societies to reduce on the magnitude of impacts of climate change on the various aspects of life. African universities can engage in adaptation research in sectors like agriculture, land and natural resources management, infrastructural development, water resources management, and other socio-economic aspects of sustainable development. Knowledge and information generated from such research could be very useful to communities in adaptation initiatives to impacts of climate change. African universities can be handy in conducting training of professionals and experts in climate change adaptation in their respective countries. Undergraduate, postgraduate

and short courses on climate change adaptation can be developed and run to enhance human resources capacities in adaptation, thereby producing a competent force of professionals that can support adaptation initiatives in various sectors on the continent.

The last potential climate change education intervention for African universities is actively engaging in **climate change outreach and policy engagements** in their respective countries. Communities especially in rural and semi-urban areas urgently need to be sensitised and supported in dealing with impacts of climate change at community level. Though NGOs and community based organisations are engaged in such outreaches, the university could supplement on these efforts through community outreaches where academics and students can ably reach out to communities as a way of helping out on the initiatives, disseminating and applying the knowledge generated through research. This could be an opportunity to try out applying the innovations and technologies developed by the universities for climate change mitigation and adaptation in the communities. African universities are key in policy formulation, guidance and evaluation in their respective countries. This is because most of their political and economic systems are yet to mature especially in Sub-Sahara African countries. This creates vast opportunities for the universities to support respective governments in climate change policy formulation, providing useful guidance on policy implementation, using university expertise to evaluate such policies and offer useful recommendations for effective climate change mitigation and adaptation interventions in their respective countries.

Key drivers

The analysis of data from the two case universities led to the discovery of various key drivers that can support the above proposed climate change education interventions given the uniqueness of African universities. The researcher identified 8 key factors that would drive climate change education interventions implemented by African universities. These are explained below.

***Ubuntu* Philosophy**

One of the key findings with respect to key drivers to climate change education was the African social and cultural systems or *Ubuntu* philosophy that motivates and drives those involved to work for their communities. This is one of the key drivers of various societal interventions in Africa especially Sub-Sahara Africa embedded in the individual, community and national values of many of these societies. Values of an individual, organisation, community and nation determine the course of action with respect to various aspects of society. Mugumbate and

Nyanguru (2013, p. 83) described *Ubuntu* as "an African philosophy that places emphasis on being human through other people". The authors used the phrase "I am because of who we all are" to reflect *Ubuntu*. Almost across the Sub-Sahara African societies, this philosophy is reflected in the social and political values. The "Ubuntu values like collectivity, solidarity, acceptance, dignity and hospitality" are held across these societies in various aspects of life (p.91).

Barbara Nussbaum (2003), described the *Ubuntu* philosophy as "the capacity in African culture to express compassion, reciprocity, dignity, harmony and humanity in the interests of building and maintaining community with justice and mutual caring" (Nussbaum, 2003, p. 2). To the author, *Ubuntu* is reflected in the African people's "consciousness of their desire to affirm their fellow human beings and to work and act towards each other with the communal good in the forefront of their minds" (ibid).

Based on this, therefore, African universities can invest in climate change initiatives and interventions based on the *Ubuntu* philosophy. Values of solidarity, working towards achieving the "common good" for their societies, serving African humanity and being "concerned about the welfare" of African people can be key drivers for CCE work. Providing climate change education should be looked as a way of promoting this African ethic and social justice as well as social responsibility and caring for others (Metz, 2016, p. 138).

Existing African indigenous knowledge systems

African universities can be driven by the existing African indigenous knowledge systems in their pursuit to contribute to climate change mitigation and adaptation. Eyong (2007, p. 121) did explain the concept of indigenous knowledge as "what indigenous people know and do, and what they have known and done for generations-practices that evolved and through trial and error and proved flexible enough to cope with change." The author contends that African knowledge systems have "linkages and guidelines for social equity, relationships with non-human beings, ecological responsibility and respect for the supernatural" thus contributing to sustainable development of the continent. These systems are key in supporting communities to, cope with complex ecological issues like climate change (p. 124).

Kaya and Seleti (2013) contend that there are various opportunities for African universities when they integrate African indigenous knowledge into their programmes. Such opportunities include:

a) Indigenous knowledge enables learners to acquire "community attitudes and values for sustainable livelihood, since African indigenous societies have lived in harmony with the environment and utilised natural resources without impairing nature's capacity to regenerate."

b) Indigenous knowledge is "stored in the various cultural forms like folk tales, songs, folk drama, legends, proverbs, myths etc." and therefore integrating such indigenous knowledge into university programmes would enhance learning about African cultures and local contexts.

c) Integration of indigenous knowledge would require involvement of "community knowledge holders" and this provide immense opportunities for "students to learn across generations, making them appreciate and respect knowledge of the elders and other community members" (p.34).

Taking advantage of existing African indigenous knowledge systems in developing and implementing climate change education interventions by African universities can enhance the relevance of such education to African realities and promote scholarship on African indigenous knowledge and its relevance to sustainable development.

Institutional Management Support for climate change education

The multiple realities of participants in this study identified institutional management support as a key driver to climate change education in African universities. According to them, both strategic and administrative support to climate change education programmes can significantly drive the CCE programmes at universities. CEE programmes require strategic support in terms of structural approvals, and inclusion of climate change research in the university research agenda. It also calls for mobilisation and allocation of adequate resources for climate change within the universities, top management support for the interventions and good governance practices within the universities.

The administrative support relates to provision of operational support services like; quick approval processes for new climate change programmes and courses, and prudent financial management process for financial resources. Additionally, effective and efficient monitoring and evaluation systems, robust management information systems, and effective human resource related processes are key for CCE. Many African universities especially in Sub-Sahara Africa, "suffer from poor, inefficient and highly bureaucratic management systems" which if

not dealt with can significantly affect the smooth implementation of climate change education interventions (Teferra & Albach, 2004, p. 31). Improved effective and efficient institutional management systems in African universities can significantly drive climate change education to higher levels.

Committed and Competent Staff in climate science

During the study, participants across cases indicated that one of the key drivers for climate change work was the committed and competent academic staff though few in numbers. Findings indicated also revealed that one of the key impediments to climate change education programmes in the case universities was limited number of experts in climate science at these universities. This greatly affects the development and delivery of climate change programmes and courses at these universities. African universities can effectively contribute to climate change mitigation and adaptation through climate change education interventions if they have adequate, committed and competent staff in climate science.

The problem of inadequate experts in climate science in African universities is made worse by the problem of brain drain. Teferra and Albach (2004, p. 41) argue that "one of the most serious challenges facing many African countries is the departure of their best scholars and scientists away from universities." Many of these scholars will often migrate to other countries or even to other better paying jobs other than university or academia. Fahey et al. (2014, p. 45) contends that individual academic staff can play a key important role as change agents especially in terms of curriculum design and delivery of climate change education at universities. African universities can ably drive climate change education agenda by building a large force of committed, competent academic staff in climate science that would support climate change science research and training.

Multi-disciplinary teams among academic staff

The other key driver of climate change education at African universities is the creation of multi-disciplinary teams among academic staff working on climate change education programmes. Participants across cases seemed to agree that piece meal and isolated climate change research was not making an impact at local community levels. They argued for multi-disciplinary teams of climate change researchers, putting their skills and expertise together as well as resources to address specific research questions in a single research project on climate change. Climate change affects various aspects of life and it requires an integrated approach to dealing with it.

Drawing academics from various disciplines within the university can significantly enhance an effective integrated approach to dealing with the challenge.

In explaining their model of learning for sustainable development, Rohweder and Virtanen (2009, p. 36), maintain that one of the critical factors is adoption of an integrated and interconnected approach in learning for sustainability. The authors call for "multi-disciplinary, trans-disciplinary and inter-disciplinary approaches" to support learners in higher education institutions to "understand the linkages between disciplines." According to them, such approach will provide "a greater opportunity to share knowledge, learn together and solve problems collaboratively" (ibid). African universities can form such multi-disciplinary teams and combine expertise and resources to work on bigger research projects on climate change mitigation and adaptation, thereby enhancing the quality of the research and credibility as well as the ability to mobilise resources outside the universities.

Effective institutional arrangements for climate change education programmes

African universities can effectively contribute to climate change mitigation and adaptation through establishing effective institutional arrangements for their CCE programmes within their structures. Effective CCE interventions require clear and well-established structures with well-coordinated efforts of individuals and groups among academics working on these programmes. Across the case universities, findings revealed that institutionalisation has already taken shape through establishment of climate change centres with full time staff responsible for coordinating the teaching, research and community engagements on climate change within the universities. However, these structures need to effectively and closely work with the rest of the academic units within the university for example departments and faculties. This will enable, faculty and other university staff related to climate change education programmes to be well coordinated. Establishing clear departments within the existing academic units, with clear staffing and clear roles for implementing climate change education programmes will greatly enhance the interventions on climate change in African universities.

Effective local and regional partnerships for climate change education programmes

This is another key driver for climate change education interventions implemented by the universities. Across the case universities, participants reported that success factors behind their climate change programmes include existing partnerships and collaborations within respective countries and abroad. UNESCO (2015) advocates for the formation or strengthening of "partnerships and collaborations" to promote climate change education (p. 67). Such

partnerships and collaborations can be "established between education communities, public organisations, non-governmental organisations, local communities, entrepreneurs etc." (Virtanen, 2010, p. 234). Effective climate change education interventions require local and international support in terms of technical, financial, collective learning and other kinds of support to the interventions. Partnerships with other universities, international NGOs, the private sector, donor agencies, and other public agencies within the region can boost the climate change education interventions of the African universities. This will enable them to benefit from technical expertise and competence shared, financial resources, diverse perspectives, sharing of good practices, innovation and new technologies as well as collective advocacy for policy and action on climate change issues.

Government and donor support for climate change research, training and outreach

Most African universities suffer from lack of funding especially from their home governments. Most of the participants decried the lack of financial support or limited support from governments to universities especially research funding. This significantly affects research output and innovation from African universities. Teferra and Albach (2004) noted that "most countries in Africa have practically no funds allocated to research in university budgets" and "many of the research activities that are undertaken on the continent are largely funded and to a certain extent, managed and directed by external agencies" (p. 39).

Participants indicated that research at their universities was donor driven and therefore they had no input in deciding the research agenda. They reported that the donors, mainly from developed nations, cover almost all costs related to research. This implies that African universities need to seriously engage their governments to fund research, training and outreach programmes in addition to the donor funding. This will enable them to increase research output and have a voice in determining the research agenda and training based on local needs. Consequently, locally generated funding will effectively drive climate change education thereby significantly contributing to mitigation and adaptation on the continent.

Model flow

As shown above, based on the traditional roles of an African university (university in action) the university can implement various climate change education interventions (potential climate change education interventions). For this to happen, there is a need to take into account various factors, which are both internal and external contextual factors within the African context (key

drivers). African universities will then be able to contribute to the realisation of societal improved lives and behavioural change towards sustainability (final outcome).

7.4.2 Areas for further research

A number of issues emerged that require further research. Firstly, findings revealed that most of the research on climate change focused on adaptation. The participants reported that less research has been conducted on mitigation and available funding was mainly for adaptation. Therefore, there is a need to investigate into the reasons why mitigation research is not adequately funded and conducted in these universities.

Secondly, participants reported that researchers at the universities did produce several policy briefs from their research findings and these targeted policy makers in various sectors related to climate change. However, the study did not explore the interface between these policy briefs and government policy. There is a need to investigate this interface and specifically finding out how much of these policy briefs from academia have been feeding into government policy on climate change.

Thirdly, participants across the cases argued that universities should embed climate change friendly practices in their institutional management practices. The study did not dwell into how the institutional practices and organisational culture of the case universities, do promote climate change mitigation and adaptation at their campuses and the local environment around them. There is a need to investigate this aspect in another research project.

Lastly, the study revealed that universities in Africa should exploit the indigenous knowledge systems in developing and implementing climate change education interventions. There is a need to explore the effective ways and mechanisms in which universities can integrate African indigenous knowledge into climate change education programmes in another research project.

7.5 Recommendations

Based on the key findings the researcher makes the following recommendations:

1. Findings revealed that both case universities have well-established climate change centres through which university management provides institutional support and capacity building for climate change education programmes. This is a good start and therefore there is a need to strengthen these already existing institutional support mechanisms (climate change centres) as well as climate change education programmes (academic, research and outreach

programmes). Case universities should also consider retooling of the existing academic staff across disciplines to continue supporting climate change education interventions effectively.

2. One of the key findings of the study was that despite having climate change centres through which institutional support is provided for climate change education, these have no mandate to institutionalise climate change education across the various academic units in the case universities. Therefore, there is a need to urgently institutionalise climate change education programmes within other existing academic units like colleges, faculties and departments. This will enhance training, research and community engagement interventions on climate change since it is a cross cutting issues across disciplines.

3. Findings on proposed strategies for improvement revealed that universities should build capacity of their academic staff especially in climate change science since experts on these aspects are few in the case universities. Therefore, case universities urgently need to invest in capacity building of their academic staff especially in climate change science through graduate training (PhD level training). This will significantly enhance staff capacities and competences to undertake climate change science research (which is so minimal at the moment) and conduct climate change science training at their universities.

4. It emerged from the findings that there are a few programmes mainly on climate change adaptation at both universities. Findings also revealed that they run community engagement programmes but lack a comprehensive approach for their implementation. It is recommended therefore, that there is a need to develop and roll out more climate change education programmes (academic, research and community engagement programmes) including long term, and short term programmes run across disciplines since climate change is a cross cutting issue. There is an urgent need to come up with a comprehensive approach for community engagement on climate change at both case universities.

5. Findings showed that most of the research on climate change conducted at the case universities was donor driven and therefore did not take into account the local interests and context. It emerged that universities get less financial support from governments and local sources for climate change education programmes, which makes them dependent on external funding that comes with conditions. Therefore, there is a need to deliberately contextualise the training and research on climate change conducted at the case universities. Research and training should be conducted within the African context, making good use of African

indigenous knowledge systems as well as designing programmes that address African local issues and needs, rather than using western approaches.

6. One of the findings on opportunities for climate change education was the possibility of extending CCE to other levels of education through teacher training. The case universities, therefore, should think about developing teacher training programmes on climate change mitigation and adaptation to support in training teachers from other levels of education (primary and secondary schools) to enhance their skills and knowledge in climate change education enabling them to cascade the same at lower school system.

7. Findings revealed that case universities face a challenge of limited support from government and local sources for climate change research and training. It is recommended, therefore, that case universities should seriously engage their respective governments to support research and training on climate change in their respective countries. Effective engagement strategies need to be devised to encourage governments to increase on funding for university research and also participate in setting research and training agendas on climate change in universities.

8. Findings on opportunities revealed that universities can collaborate with other universities in Africa and beyond in dealing with climate change issues. This will enable them to benefit from learning, sharing experiences and resources as well as well as expertise. Case universities, therefore, should effectively invest in creating or establishing local and regional partnerships and collaborations for climate change education within their respective countries and the region. Collaborations with other universities, local NGOs, public agencies and international universities as well as donor agencies need to be fostered to enable sharing of expertise, resources and learning on climate change aspects.

7.6 Limitations of the study

Every study will have limitations and therefore this section highlights the key limitations of this particular study. Firstly, the researcher acknowledges that the choice to adopt a case study design limited the findings to the case universities where data collection was done. The qualitative case study design used in this study, employed purposive sampling techniques to select the cases and the participants for the study. This implies that the findings cannot be generalised to all other universities since there was no randomisation in the sampling. There is limited transferability of the themes emerging from the analysis, beyond the comparative cases Makerere University and University of Dar es Salaam. Cresswell (2014) indicates that “the

intent of" qualitative inquiry "is not to generalize findings to individuals, sites or places outside of those under study" but rather it's value "lies in the particular description and themes developed in the context of "those particular sites or individual cases involved (p. 203).

Lincoln and Guba 1985 cited in Uwe (2009, p. 407), however, provides that though generalisation in qualitative research is not possible, "transferability of findings from one context to another is possible." Therefore, in the case of this study, transferability of findings to other universities with similar contexts can be done. The conclusions therefore, are limited to the selected comparative cases though a few universities within the same context and similar experiences might learn from the study findings and conclusions.

Secondly, the other limitation of the study relates to its scope. The study was limited to examining the university academic, research and community engagement programmes on climate change, the challenges faced in implementing these programmes, and the success factors and ways of improvement in addressing climate change issues in their programmes. It excluded other issues of climate change education for sustainable development in higher education institutions.

Thirdly, the other key limitation worth noting is the time and resource constraints. The researcher had limited time and resources for this study and therefore could not exhaust all the aspects related to climate change education interventions at both universities. Due to limited time and resources, the researcher did not visit all the programme implementation sites both in the university and in communities to observe the training, research and community engagement activities on climate change and get a feel of what really happens on the ground. He only conducted focus groups with students on courses related to climate change and semi-structured in-depth interviews with lecturers, researchers and administrators of programmes related to climate change in the two universities. Time and resources allowing, it would have been good to conduct an ethnographic study to exhaust all aspects of climate change interventions in the two case universities. However, the researcher has proposed areas for further research.

The fourth and last limitation of this study is that the key findings and conclusions are based on the views and opinions of the study participants. The researcher only conducted interviews and focus group discussions that involved asking participants what their views and perspectives were in relation to the key aspects under study. The views and perspectives expressed in this study are more subjective and therefore may not necessarily reflect the actual situation in the case universities with certainty since these were not validated or checked for reliability in

anyway. Thus the multiple realities of participants that the researcher based on to reach conclusions may not reflect what others who didn't participate in the study think and feel about the same issues. The findings and conclusions from this study are social constructions of the particular participants and the researcher that took part in this study.

Chapter summary

In this chapter, the cross case analysis has been presented showing the common and divergent key findings per theme across the case universities. A summary and discussion of key findings for each research question has also been given, highlighting the convergence and divergence of key findings and scholarly literature on the topic. The chapter also provided the conclusions that the researcher made based on the findings as well as the thesis contribution to empirical, policy and practice as well as theory. The chapter highlighted the areas for further research on climate change education in the African context. Lastly, it has provided practical recommendations that case universities need to seriously consider to improve implementation of climate change education interventions in their institutions. The limitations of the study have also been acknowledged in the same chapter.

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Appendices

Appendix A1: Interview Guide for Administrators

INTERVIEW GUIDE FOR FACULTY LEADERSHIP AND ADMINISTRATORS / CLIMATE CHANGE CENTRE STAFF

Time of interview: ……Date:……

Place: ……..Interviewer:……

Interviewee:…….. Position of interviewee:…….

My name is David Ssekamatte and I am researching on ***opportunities and challenges for higher education institutions in addressing climate change issues in their academic, research and community engagement programmes.*** I am particularly interested in your experiences working in the faculty housing climate change courses or the climate change centre at the university. I will keep your sensitive information anonymous during the analysis and reporting of findings. I have several questions, please answer what u feel comfortable to answer and for the time you can allow. if you feel threatened in any way during our conversation you are free to end participation in the research and all notes will be destroyed.

Respondents background information

1. I would like to begin by asking you to share with me information about your professional training background, please feel free.
2. How is your job related to the activities of climate change programmes in the faculty or centre?
3. What is your opinion about climate change? Why is it a problem that needs to be addressed?
4. What do you think about the role that education can play in addressing climate change issues in Africa?

Role of Universities in addressing climate change issues

5. How is your university addressing climate change issues in its courses and other activities?
6. What kind of support (resources) do you get from the university for climate change programmes in your faculty or centre?
7. Who are the key actors or stakeholders in your climate change activities in your faculty or centre?
8. How useful have these been in supporting your climate change activities and programmes at the faculty or centre?
9. Which partnerships and collaborations do you currently have in implementing climate change activities at the faculty or centre?

Academic programmes on climate change

10. What specialized long courses do you have on climate change? On average how many students enrol on these courses annually?
11. Which short courses do you run on climate change at your university? On average how many students enrol on each of these?
12. Tell me about the academic staff on these courses, do you have adequate staff?
13. What is their level of training on climate change issues?
14. How is your faculty or centre equipped in terms of materials, space and equipment to deliver these courses?
15. What factors have helped you to be successful in implementing climate change academic programmes or activities in your faculty?
16. What outcomes have been registered so far out of your academic programmes on climate change at your faculty or centre?
17. What specific challenges do affect delivery of academic programmes on climate change in your faculty or centre?

Research programmes on climate change

18. Tell me about the research projects on climate change at your faculty or centre. Which projects are currently being implemented?
19. Tell me about the researchers at your faculty or centre? What is their level of training and experience in undertaking research on climate change issues?
20. Has your faculty or centre held any research dissemination events in the last two years? How successful were they and what impact did they make?

21. What policy related outcomes from the faculty or centre research projects on climate change have been registered in the last 3 years?
22. What specific challenges do affect research projects and activities on climate change in your faculty or centre?
23. What interventions or strategies are being sought by your faculty or centre to enhance quality research on climate change?

Community engagement programmes on climate change

24. What specific community engagement programmes are implemented by your university?
25. Tell me more on the most successful community events on climate change that were held by your faculty or centre on climate change
26. What have been the main outcomes of your community engagement activities on climate change?
27. Which stakeholders have been key in the success of your community engagement activities on climate change?
28. What factors have helped you to be successful in implementing community engagement activities on climate change at your faculty or centre?
29. What specific challenges did your faculty encounter in implementing these activities or programmes?

Challenges in addressing climate change issues

30. What general challenges does your faculty or centre face while implementing climate change programmes?
31. What strategies does your faculty or centre have to secure adequate funding for your climate change programmes?
32. What solutions do you propose in addressing these challenges?

Effective ways to adequately address climate change issues

33. What do you think needs to be done to make your climate change programmes more effective?
34. What good practices in other universities do you feel can be adopted by your university to adequately address climate change issues in your programmes?
35. which other units in the university have integrated aspects of climate change mitigation and adaptation in their programmes?

36. How is your faculty or centre supporting these other units in the university to fully integrate issues of climate change in their programmes?
37. What other final thoughts do you have for universities on the continent to address climate change issues through their programmes?

I thank you for taking off some of your variable time to share with me your experiences. I hope you will be willing to share with me more information or clarifications on some areas. Once again I assure you of confidentiality and that your responses will be used for academic purposes only.

Appendix A2: Interview guide for Lecturers and Researchers

CARL VON OSSIETZKY universität OLDENBURG
FAKULTÄT I
BILDUNGS- UND SOZIALWISSENSCHAFTEN

INTERVIEW GUIDE FOR LECTURERS OR RESEARCHERS/ CURRICULUM DEVELOPMENT STAFF

Time of interview: ……Date:……

Place: ……..Interviewer:……

Interviewee:…….. Position of interviewee:…….

My name is David Ssekamatte and I am researching on ***opportunities and challenges for higher education institutions in addressing climate change issues in their academic, research and community engagement programmes.*** I am particularly interested in your experiences as a lecturer of climate change courses/ researcher on climate change or curriculum development staff on climate change programmes at the university. I will keep your sensitive information anonymous during the analysis and reporting of findings. I have several questions, please answer what u feel comfortable to answer and for the time you can allow. if you feel threatened in any way during our conversation you are free to end participation in the research and all notes will be destroyed.

Respondents background information

1. I would like to begin by asking you to share with me information about your professional training background, please feel free.
2. How is your job related to the activities of climate change programmes in the faculty or centre?
3. What is your opinion about climate change? Why is it a problem that needs to be addressed?
4. In your opinion how challenging is climate change to the growth and development of Africa as a continent?
5. In your opinion how can education play a role in addressing the climate change problem in Africa?

Role of Universities in addressing climate change issues

6. What role can universities play in addressing the challenges of climate change on the African continent?
7. How is your university addressing climate change issues in its programmes?
8. How supportive is the university administration towards climate change programmes carried out by your faculty or centre?
9. How adequate is the funding of the climate change programmes at your faculty or centre?
10. What strategies do you propose to acquire adequate funding for the climate change programmes in your university?

Academic programmes on climate change

11. Which of the long term/ short term courses on climate change do you facilitate on at the faculty or centre?
12. What resources are you provided with to facilitate your academic activities on climate change?
13. What do you think about the current curriculum for your climate change related courses? Is it adequate?
14. What specific challenges do affect the delivery of academic programmes on climate change in your university?

Research programmes on climate change

15. Which research projects on climate change are you currently engaged in at the faculty or centre?
16. How does the university support your research activities on climate change?
17. Which research dissemination events organized by your faculty have you participated in for the last two years? How successful were they and what impact did they make?
18. Any policy related outcomes so far from your research on climate change in the last 2years?
19. What specific challenges do you face in conducting your research programmes on climate change at your faculty or centre
20. What interventions or strategies would you propose to enhance the quality of your research on climate change?

Community engagement programmes on climate change

21. How is your university engaging the community in mitigation and adaptation to climate change?

22. What specific community engagement programmes on climate change have you been involved for the last 2 years?
23. How are students on courses related to climate change involved in these community engagement activities on climate change?
24. Who are the key actors and stakeholders in the community engagement activities implemented by your faculty or centre?
25. What challenges did you or your faculty or centre encounter in implementing these programmes?

Challenges in addressing climate change issues

26. What challenges do you think do affect universities in Africa in addressing climate change issues in their programmes generally?
27. What solutions do you propose in addressing the challenges?

Success factors for universities to address climate change issues

28. What achievements have you registered in your work on climate change programmes?
29. What factors have contributed to these achievements?
30. What outcomes have been registered as a result of your programmes on climate change in the University?
31. What do you think would make your university adequately address climate change issues on the continent?

Effective ways to adequately address climate change issues

32. What do you think needs to be done to make your climate change programmes more effective?
33. What good practices in other universities do you feel can be adopted by your university to adequately address climate change issues in your programmes?
34. What other final thoughts do you have for universities on the continent to address climate change issues through their programmes?

I thank you for taking off some of your variable time to share with me your experiences. I hope you will be willing to share with me more information or clarifications on some areas. Once again I assure you of confidentiality and that your responses will be used for academic purposes only.

Appendix A3: Focus Group Discussion Guide

CARL VON OSSIETZKY universität OLDENBURG
FAKULTÄT I
BILDUNGS- UND SOZIALWISSENSCHAFTEN

FOCUS GROUP GUIDE

Time of discussion:

Date:

Place:

Facilitator:

Number of participants:

My name is David Ssekamatte and I am researching on ***challenges and opportunities for higher education institutions in addressing climate change issues in their academic, research and community engagement programmes.*** I am particularly interested in your experiences, opinions and ideas as students of climate change courses/ participants on community climate change programmes implemented by the university. I will keep your sensitive information anonymous during the analysis and reporting of FGD findings. I have several issues for discussion, please talk about what u feel comfortable to discuss and for the time you can allow. if you feel threatened in any way during our discussion you are free to end participation in the research and all notes will be destroyed.

Role of Universities in addressing climate change issues

1. In your opinion how challenging is climate change to the growth and development of Africa as a continent?
2. In what ways do you think the problem of climate change can be addressed on the continent?
3. What role can universities play in addressing the challenges of climate change on the African continent?
4. How is your university addressing climate change issues in its programmes?

Academic programmes on climate change

5. How do you feel about the current long and short term courses on climate change offered at your university?

6. What is your view about the lecturers and their nature of teaching on these courses?
7. How adequate are the learning materials and space for the climate change courses you are enrolled on?
8. How do you feel about the current curriculum and content covered in your climate change related courses? Is it adequate and relevant?
9. What specific challenges do you face in attending academic courses and activities on climate change in your university?

Research programmes on climate change

10. What are your views about research projects on climate change undertaken at your university?
11. What impact have these research projects had on policy or practices of individuals, organizations and government towards mitigation and adaptation to climate change in the country?
12. What policy related outcomes so far have come from your research activities on climate change in the last 2 years?
13. Comment about the environment at the University and its ability to provide opportunities and support for research on climate change. Is it conducive?
14. What specific challenges do affect research programmes on climate change in your university?
15. What interventions or strategies do you propose can be adopted to enhance quality research on climate change at your university?

Community engagement programmes on climate change

16. What specific community engagement programmes have you been involved in implemented by your university?
17. Tell me more on the most successful community events on climate change that were held by your university on climate change
18. Who were the key people that made these activities successful?
19. What challenges did you encounter during the community engagement programmes or activities?

Challenges in addressing climate change issues

20. What general challenges does your university face while implementing climate change programmes?
21. What solutions do you propose in addressing these challenges?

Success factors for universities to address climate change issues

22. What achievements has your university registered so far in respect to climate change programmes?
23. What factors have contributed to these achievements?
24. What do you think would make your university adequately address climate change issues on the continent?

Effective ways to adequately address climate change issues

25. What do you think needs to be done to make your climate change programmes more effective?
26. What good practices in other universities do you feel can be adopted by your university to adequately address climate change issues in its programmes?
27. How can students of other courses be involved in climate change programmes organized by the university?
28. What other final thoughts do you have for universities on the continent to effectively address climate change issues through their programmes?

I thank you for taking off some of your variable time to share with me your experiences. I hope you will be willing to share with me more information or clarifications on some areas. Once again I assure you of confidentiality and that your responses will be used for academic purposes only.

Appendix A4: Document Review Checklist

The following items will be reviewed in the documents

a) Background information about Makerere University
   - Location of the university
   - Historical background
   - University policies and strategic plans
   - Facts and figures about students and staff
   - Any other information on climate change education programmes at the university.

b) Information about the climate change situation in Uganda
   - Location, demographics and economic outlook of Uganda
   - The climate change profile for the country
   - Existing policies and guidelines on climate change mitigation and adaptation in Uganda.

c) Background information about University of Dar es salaam
   - Location of the university
   - Historical background
   - University policies and strategic plans
   - Facts and figures about students and staff
   - Any other information about climate change education programmes at the university

d) Information about the climate change situation in Tanzania
   - Location, demographics and economic outlook of Tanzania
   - The climate change profile for the country
   - Existing policies and guidelines on climate change mitigation and adaptation in Tanzania

Appendix B: Ethical Clearance from University of Oldenburg

CARL VON OSSIETZKY UNIVERSITÄT OLDENBURG · 26111 OLDENBURG

Herr
Prof. Dr. Kersten Speck
Faculty of Education and Social Sciences
Carl-von-Ossietzky Universität Oldenburg
Im Hause

Prof. Dr.-Ing. Andreas Hein

KOMMISSION FÜR FORSCHUNGSFOLGENABSCHÄTZUNG UND ETHIK

TELEFONDURCHWAHL
+49 (0)441 798 4450

EMAIL
andreas.hein@uni-oldenburg.de

POSTANSCHRIFT
Geschäftsstelle Ethikkommission
Carl von Ossietzky Universität Olden
Carl-von-Ossietzky-Str. 9-11
Gebäude W16A Raum 1-105a
D-26111 Oldenburg

OLDENBURG, 02.06.2016

Stellungnahme der Kommission für Forschungsfolgenabschätzung und Ethik zur Erweiterung des Antrags „The challenges and opportunities for higher education institutions in addressing climate change: A comparative study of Makerere University (Uganda) and University of Dar es Salaam (Tanzania)“ (Drs. 73/2016)

Sehr geehrter Herr Prof. Dr. Speck,

die Ethikkommission hat in ihrer Sitzung vom 29.11.2016 obiges Forschungsvorhaben eingehend geprüft und ist zu der Auffassung gekommen, dass das Vorhaben ethisch unbedenklich ist. Am Antrag beteiligte Personen waren nicht in diese Entscheidung eingebunden.

Die zustimmende Bewertung ergeht unter der Annahme gleichbleibender Gegebenheiten. Die Verantwortlichkeit des jeweiligen Wissenschaftlers bleibt im vollen Umfang erhalten.

Für Ihr Vorhaben wünsche ich Ihnen viel Erfolg.
Mit freundlichen Grüßen

Prof. Dr. Andreas Hein

CERM-ESA
East and South African-German Centre of Excellence
for Educational Research Methodologies and Management

CARL VON OSSIETZKY UNIVERSITÄT OLDENBURG

CARL VON OSSIETZKY UNIVERSITÄT OLDENBURG · CERM-ESA Fak I, 26111 OLDENBURG

To whom it may concern

Monday, 09 January 2017

- **Courtesy Translation -**

Statement by the Commission for Research Impact Assessment and Ethics of the Carl-von-Ossietzky-University Oldenburg (Germany) concerning the planned research project „The challenges and opportunities for higher education institutions in addressing climate change: A comparative study of Makerere University (Uganda) and University of Dar es Salaam (Tanzania)" (Drs. 73/2016)

Dear Prof. Dr. Speck,

The Ethics Commission met on the 29th of November 2016 and thoroughly reviewed the above mentioned research project. It came to the conclusion that it is ethically unproblematic and uncritical.
Applicants were not involved in this decision. The approval is based on the assumption that the research project will be carried out under the conditions detailed in the application. The investigators remain accountable to the full extent.

I wish you all the best for your project.

Sincerely,

Prof. Dr. Andreas Hein
CARL VON OSSIETZKY UNIVERSITÄT OLDENBURG · 26111 OLDENBURG
Prof. Dr.-Ing. Andreas Hein
KOMMISSION FÜR FORSCHUNGSFOLGENABSCHÄTZUNG UND ETHIK

For the translation:

Prof. Dr. Bernd Siebenhüner, CERM-ESA Project Leader,
University of Oldenburg

CERM-ESA

Prof. Dr. Bernd Siebenhüner

PHONE
+49 (0)441 798 – 4366 (Siebenhüner)

FAX
(+49 (0)441 798 - 4379

EMAIL
bernd.siebenhuener@uni-oldenburg.de

PROJECT COORDINATOR
Malve von Möllendorff
malve.moellendorff@uni-oldenburg.de
+49 (0)441 798 - 4326

PROJECT ASSISTANT
Birgit Schelenz
birgit.schelenz@uni-oldenburg.de
+49 (0)441 798 – 4383

African Excellence
Fachzentren Afrika

POSTANSCHRIFT:
Postfach 2503
D-26111 Oldenburg

POSTAL ADRESS:
P.O.Box 2503
D-26111 Oldenburg

PAKETANSCHRIFT / PARCELS:
Ammerländer Heerstraße 114 - 118
D-26129 Oldenburg

INTERNET: http://mu.ac.ke/cermesa/

BESUCHER / VISITORS:
Campus Haarentor/Uhlhornsweg
Gebäude A5/Building A5
Raum/Room A5-0-024
26129 Oldenburg

BANKVERBINDUNG/
BANK ACCOUNTL:
Landessparkasse zu Oldenburg
BLZ 280 501 00
Konto/*Account* 1988112
BIC: BRLADE21LZO
IBAN:
DE 4628 0501 0000 0198 8112

Appendix C: Ethical Approval from Uganda National Council for Science and Technology

Uganda National Council for Science and Technology

(Established by Act of Parliament of the Republic of Uganda)

Our Ref: SS 4242

12th April 2017

Mr. David Ssekamate
Principal Investigator
Uganda Management Institute
Kampala

Dear Mr. Ssekamate,

Re: Research Approval: **The Opportunities and Challenges for Higher Education Institutions in Addressing Climate Change: A Comparative Study of University of Dar es Salaam (Tanzania) and Makerere University (Uganda)**

I am pleased to inform you that on **27/03/2017**, the Uganda National Council for Science and Technology (UNCST) approved the above referenced research project. The Approval of the research project is for the period **27/03/2017** to **27/03/2018.**

Your research registration number with the UNCST is **SS 4242**. Please, cite this number in all your future correspondences with UNCST in respect of the above research project.

As Principal Investigator of the research project, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the research protocol or the consent form (where applicable) must be submitted to the designated Research Ethics Committee (REC) or Lead Agency for re-review and approval prior to the activation of the changes. UNCST must be notified of the approved changes within five working days.
3. For clinical trials, all serious adverse events must be reported promptly to the designated local REC for review with copies to the National Drug Authority.
4. Unexpected events involving risks to research subjects/participants must be reported promptly to the UNCST. New information that becomes available which alters the risk/benefit ratio must be submitted promptly for UNCST review.
5. Only approved study procedures are to be implemented. The UNCST may conduct impromptu audits of all study records.
6. A progress report must be submitted electronically to UNCST within four weeks after every 12 months. Failure to do so may result in termination of the research project.

Below is a list of documents approved with this application:

	Document Title	Language	Version	Version Date
1.	Research Proposal	English	2.0	March 2017
2.	Informed Consent Document	English	N/A	N/A
3.	Interview Guide	English	2.0	March 2017
4.	Focus Group Discussion Guide	English	2.0	March 2017

Yours sincerely,

Hellen N. Opolot
for: Executive Secretary
UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Copied to: Chair, Gulu University, Research Ethics Committee

LOCATION/CORRESPONDENCE *COMMUNICATION*

Plot 6 Kimera Road, Ntinda *TEL: (256) 414 705500*

GULU UNIVERSITY

P.O. Box 166 Gulu Uganda
E-mail: emilio.ovuga@gmail.com
lekobai@gmail.com

Tel: 256-4714-32096
Fax: 256-4714-32913

RESEARCH ETHICS COMMITTEE

Date: 07/03/2017

REC APPROVAL NOTICE

To: Mr. David Ssekamate
Faculty of Education and Social Sciences
University of Oldenburg
Germany

Re: **Application No. GUREC 02/03/2017**

Title: **"*The challenges and opportunities for higher education institutions in addressing climate change: A comparative study of Makerere University (Uganda) and University of Dar es Salaam (Tanzania)*"**

Version 2.0: 6th March, 2017

Type: [**X**] Initial Review
[ ] Protocol Amendment
[ ] Letter of Amendment (LOA)
[ ] Continuing Review
[ ] Material Transfer Agreement
[ ] Other, Specify:_____

I am pleased to inform you that at the 23nd convened meeting on 3rd March 2017, the GUREC committee meeting voted to approve the above referenced application.

Approval of the research is for the period of 7th March 2017 to 6th March 2018.

GULU UNIVERSITY
INSTITUTIONAL REVIEW COMMITTEE
APPROVED
07 MAR 2017

This research is considered [risk level] for pediatric risk category. [√] Check box if Not Applicable.

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.

2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for re-review and approval prior to the activation of the changes. The REC application number assigned to the research should be cited in any correspondence.

3. Reports of unanticipated problems involving risks to participants or other must be submitted to the REC. New information that becomes available which could change the risk: benefit ratio must be submitted promptly for REC review.

4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.

5. Regulations require review of an approved study not less than once per 12-month period. Therefore, a continuing review application must be submitted to GUREC eight weeks prior to the above expiration date of 6th March 2018 in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study, at which point new participants may not be enrolled and currently enrolled participants must be taken off the study.

6. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following is the list of all documents approved in this application by GUREC:

	Document	Language	Version	Version Date
1	Protocol	English	Version 2.0	6th March 2017
2	Data Collection Tools	English	Version 2.0	6th March 2017
3	Informed consent	English	Version 2.0	6th March 2017

Signed,

GULU UNIVERSITY
INSTITUTIONAL REVIEW COMMITTEE
APPROVED
07 MAR 2017
FACULTY OF MEDICINE
P. O. Box 166, Gulu

Prof. Emilio Ovuga
CHAIRPERSON, GUREC

Appendix D: Ethical Approval from Tanzanian Commission for Science and Technology

TANZANIA COMMISSION FOR SCIENCE AND TECHNOLOGY
(COSTECH)

Ali Hassan Mwinyi Road
P.O. Box 4302
Dar es Salaam
Tanzania

Telephones: (255 - 022) 2775155 - 6, 2700745/6
Director General: (255 - 022) 2700750&2775315
Fax: (255 - 022) 2775313

Email: rclearance@costech.or.tz
In reply please quote: **CST/RCA 2017/10**

10th January 2017

Commissioner General of Immigration
Ministry of Home Affairs
P.O. Box 512
DAR ES SALAAM

Dear Sir/Madam,

RESEARCH PERMIT

We wish to introduce **David Ssekamate** from **Uganda** who has been granted Research Permit **No. 2017–16-NA-2017-10** dated **10th January 2017**

The permit allows him/her to do research in the country "**The Challenges and Opportunities for Higher Education Institutions in Addressing Climate Change: A Comparative Study of Makerere University (Uganda) and University of Dar es Salaam (Tanzania)**"

We would like to support the application of the researcher(s) for the appropriate immigration status to enable the scholar(s) begin research as soon as possible.

By copy of this letter, we are requesting regional authorities and other relevant institutions to accord the researcher(s) all the necessary assistance. Similarly the designated local contact is requested to assist the researcher(s).

Yours faithfully

M. Mushi

Fo: DIRECTOR GENERAL

CC:

1. Regional Administrative Secretary: **Dar es Salaam**
2. Local Contact: **Dr. Eugenia Kafanabu, CERMESA Project Leader, University of Dar es Salaam, Dar es Salaam**
3. Co-Researcher: **None**

PART IV - PARTICULARS AS TO INSTITUTION /INDIVIDUAL (As written on TFI)

25 INSTITUTION : COSTECH

26 LOCATION : DAR

27 POSTAL ADRESS 4302

28 PLACE OF WORK DAR

29 PLACE OF RESIDENCE (in Tanzania) NA

30 INDUSTRY/SECTOR NA

32 INVESTIMENT SCALE: LARGE ☐ MIDDLE: ☐ SMALL ☐ OTHERS (Specify) e.g. Mining NA

33 TELEPHONE NUMBER +255222700750

34 MOBILE PHONE NUMBER

35 E-MAIL ADDRESS rclearnie@costech.or.tz

PART V - DECLARATION BY INSTITUTION/INDIVIDUAL

36 I, Mashaburi M. Mwingihemisi

Do HEREBY SOLEMNLY and sincerely declare that to the best of my knowledge and belief the particulars stated in Part I,II,III & IV of this Data sheet are true, and in event of my application being granted, I undertake to abide by Immigration laws and the Laws of United Republic of Tanzania.

Signature of Institution/Individual with Official stamp

Declared at COSTECH this 10 day of 01 20 17.

PART VI - FOR OFFICIAL USE ONLY

37 BOSSIER NUMBER:(DN)

38 NAME AND RANK OF OFFICER ATTENDED | HEADQUATER/REGION | SIGNATURE

Appendix E: Letter of permission from Makerere University

MAKERERE UNIVERSITY

P. O. Box 7062
Kampala Uganda
Website: www.mak.ac.ug

Tel: +256 - 414 - 530983/691937
Fax: +256 - 414 - 533809
Email: drgt@rgt.mak.ac.ug

DIRECTORATE OF RESEARCH AND GRADUATE TRAINING

March 28, 2017

Mr. David Ssekamatte
PhD Researcher
University of Oldenburg, Germany

Dear Mr. Ssekamate,

RE: PERMISSION TO COLLECT DATA AT MAKERERE UNIVERSITY

I write to respond to the letter written by your supervisor Prof. Dr. Kasten Speck, on 25/11/2016. He wrote requesting the university to allow you generate data at Makerere University for your PhD study entitled "**Examining the opportunities and challenges for higher education institutions in addressing climate change issues in their academic, research and community engagement programmes within the African context"**. He indicated that data will be collected through semi structured in-depth interviews of the Dean, Heads of Department, lecturers and researchers in the School of Forestry, Environmental and Geographical Sciences in Makerere University as well as focus group discussions with post graduate and undergraduate students on courses related to climate change.

The Directorate of Research and Graduate Training (DRGT) has no objection to this research and is willing to give you all necessary support towards the collection of this data. To address ethical concerns in research, the Directorate advises that you seek Ethical Clearance for this research from the relevant authorities, which you said you have already submitted a request to the National Council for Science and Technology (UNCST) and waiting for the response. Your data collection can commence on submission of a copy of ethical clearance from UNCST.

I therefore formally grant you permission to collect this data and refer you to the Principal of the College of Agriculture and Environmental Sciences as well as the Dean and specific Heads of Departments in the school of Forestry, Environmental and Geographical Sciences to help you get access to the respondents or participants for your study. In case of any further support you may need, don't hesitate to contact the Directorate.

Sincerely yours,

Assoc. Prof. David Okello Owiny
Ag. Deputy Director, DRGT

cc: Director, DRGT
Principal, CAES
Deputy Principal, CAES
Dean, School of Forestry, Environmental and Geographical Sciences
Heads of Departments, School of Forestry, Environmental and Geographical Sciences
Coordinator Makerere University Centre for Climate Research & Innovations (MUCCRI)

Appendix F: Letter of permission from University of Dar es Salaam

UNIVERSITY OF DAR ES SALAAM

DEPUTY VICE CHANCELLOR - RESEARCH
P.O. Box 35091 ■ DAR ES SALAAM ■ TANZANIA

General Line: 2410500-8 Ext. 2087
Direct Line: 2410743
Website: *www.udsm.ac.tz*

Fax: 255 022 2410743
255 022 2410023
E-mail: *dvc-rke@admin.udsm*

Our Ref. AB3/3 Vol. LXX/27

4th January 2017

The Director General
Tanzania Commission for Science and Technology
P. O. Box 4302
Dar es Salaam

RE: RESEARCH PERMIT FOR MR SSEKAMATE DAVID (PhD STUDENT)

The University of Dar es Salaam has approved the above-named request for research associateship status while conducting his research on "The Challenges and Opportunities for Higher Education Institutions in Addressing Climate Change: A Comparative Study of Makerere University (Uganda) and University of Dar es Salaam (Tanzania) from 10th January 2017 to 9th February 2017. He will be hosted by the School of Education.

I am thus writing to recommend that Mr. David Ssekamatte be issued with research permit to enable him conduct research in Tanzania as specified in his letter of application.

Prof. C. Z. M. Kimambo
Deputy Vice Chancellor-Research

Encl: Mr. Ssekamatte's Application for Authorization to Conduct Research in Tanzania

cc: Vice Chancellor
cc: Deputy Vice Chancellor - Academic
cc: Deputy Vice Chancellor - Administration
cc: Director, Research and Publication
cc: Dr. Eugenia Kafanabo – School of Education, Coordinator CERM-ESA Project.
cc: Mr. David Ssekamatte – Phd Student

UDSM is an 'Equal-Opportunity' Institution of Higher Learning

Appendix G: Participant Consent Form

Name of faculty; Faculty of Education and Social Sciences

Name of Project Leader: Prof. Karsten Speck **Contacts**: karsten.speck@uol.de

Name of Investigator: David Ssekamate **Contacts**: dmssekamatte@gmail.com

Declaration of Consent

Title of the study: The opportunities and challenges for higher education institutions in addressing climate change: A comparative study of Makerere University (Uganda) and University of Dar es Salaam (Tanzania)

The purpose of this study has been explained to me. I can withdraw at any time without having to give an explanation and that, taking part in the interview or Focus Group Discussion is purely voluntary. I am also aware that during the interviews or Focus Group Discussions the investigator may make video/image/sound recordings and these will be made anonymous through transcriptions of interviews and Focus Group Discussions and by using a personal code or number created with my input. The coding list will only be accessed by the investigator during data analysis and will be deleted after completing the study. The recordings will remain confidential and not shared with third parties. I am also aware that I can revoke my consent to the retention of this stored data without giving reasons. I have received a copy of the participant information sheet regarding this study. I therefore agree to take part in this study based on the conditions outlines in here and in participant information sheet.

I ……(Names) agree to take part in the interview and the interview is video-taped/ recorded

I ……(Names) agree to take part in the Focus Group Discussions and that the Focus Group Discussion is Video-taped/ recorded.

Signed / Thumb print …….

Date ……. (participant)

Signed / Thumb print ……..

Date ……. (Researcher)

This revocation of consent form will be kept by the researcher for his records

Name of faculty; Faculty of Education and Social Sciences

Name of Project Leader: Prof. Karsten Speck **Contacts**: karsten.speck@uol.de

Name of Investigator: David Ssekamate **Contacts**: dmssekamatte@gmail.com

Revocation of Consent

Title of the study: The opportunities and challenges for higher education institutions in addressing climate change: A comparative study of Makerere University(Uganda) and University of Dar es Salaam(Tanzania)

I hereby wish to withdraw my consent to participate in the PhD research study above by David Ssekamate registered at the University of Oldenburg, Germany.

……

Signature

Date ……

Name ……..

Appendix H: Information Sheet for Participants

Information sheet for the study participants

Name of faculty; Faculty of Education and Social Sciences

Name of Project Leader: Prof. Kersten Speck **Contacts**:karsten.speck@uol.de

Name of Investigator: David Ssekamate **Contacts**: dmssekamatte@gmail.com

Title of the study: The opportunities and challenges for higher education institutions in addressing climate change: A comparative study of Makerere University(Uganda) and University of Dar es Salaam(Tanzania).

The research project

Welcome to our study that focuses on examining the opportunities and challenges for higher education institutions in addressing climate change issues in their academic, research and community engagement programmes. We thank you for your interest/participation in this study The researcher is using Makerere University (Uganda) and University of Dar es Salaam (Tanzania) as comparative cases to empirically analyse the above aspects in the context of Africa, making a contribution to scholarly literature on climate change education, but also inform practice in dealing with climate change issues through higher education. As a participant in the research project, you have been selected to be interviewed or participate in the Focus Group Discussions (FGDs) as a valuable source of insights, opinions, ideas and experiences on the aspects covered by the research. Your participation in this research project will significantly contribute to the availability of scholarly literature on climate change education but also support higher education institutions (Universities) in Africa to adequately address issues of climate change in their academic, research and community engagement programmes.

Voluntary participation

Your participation in this study is voluntary and therefore if you feel uncomfortable or do not want to participate you are free to with draw at any time during the interview or Focus Group Discussion. You are not compelled to answer any question or discuss any topic that you wish not to. Feel free to participate where you feel its ok for you.

Your confidentiality

All data collected will be treated as confidential. The researcher will request you to allow him record the interview or discussion as applicable and take notes in order to have a record of the data collected to support in writing the thesis. The video/image/sound recording will be made anonymous. The video/image/sound recording will be made anonymous through transcription of all recorded material and by using a personal code or number that you will participate in creating at the beginning of the interview or discussion. The code list will only be accessed by the investigator and will not be shared by any third parties. These recordings or notes will be kept and protected by the researcher against any unauthorized access and deleted 2 years after the completion of the study, by the 31st of December 2020 at the latest. This personal information will not be identified in any publication or reporting.

Questions/further information

In case you need any further information regarding the study or have questions before, and after the interview or Focus Group Discussions, feel free to contact the researcher (contacts are at the top of this information sheet).