

**SMALL-SCALE FARMERS CONSTRAINTS TO CLIMATE
CHANGE ADAPTATION STRATEGIES IN MOROGORO
DISTRICT, TANZANIA**

**SMALL-SCALE FARMERS CONSTRAINTS TO CLIMATE CHANGE
ADAPTATION STRATEGIES IN MOROGORO DISTRICT, TANZANIA**

By

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**A dissertation submitted to School of Public Administration and Management in
Partial Fulfillment of the Requirements for the Award of the Degree of Master of
Research and Public Policy (MRPP) of**

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CERTIFICATION

We, the undersigned, certify that we have read and hereby recommend for acceptance by the Mzumbe University, a dissertation entitled **Small-Scale Farmers constraints to Climate Change Adaptation Strategies Morogoro District Council, Tanzania** in partial/fulfilment of the requirements for award of the degree of Master of Research and Public Policy of Mzumbe University.

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Signature

Accepted for the Board of School of Public Administration and Management (SOPAM)

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I, Mary Amosi, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

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DEDICATION

To my late father Amosi Batakanwa, who wished to live seeing me this far in academic career

LIST OF ABBREVIATIONS ND ACRONOMIES

CCA:	Climate Change Adaptation
DEAT:	Department of Environmental Affairs and Tourism
FDG:	Focused Group Discussion
GCM:	General Circulation Model
INDC:	Intended National Determined Contribution
IPCC:	Intergovernmental Panel on Climate Change
NAPA:	National Adaptation Programme of Action
NCCS:	National Climate Change Strategy
NGO:	Non-Governmental Organization
RCM:	Regional Circulation Model
REDD+:	Reducing Emissions from Deforestation and Forest Degradation
REPOA:	Research for Poverty Alleviation
UNFCCC:	United Nations Framework Convention on Climate Change
URT:	United Republic of Tanzania
VEO:	Village Executive Officer
WEO:	Ward Executive Officer

ABSTRACT

Tanzania government has made considerable efforts by establishing various governance responses to address climate change effects. However, the effective implementation of those initiatives is limited and at the community levels no remarkable systematic implementation has been done so far. Information about constraints to effective implementation is crucial to address measure to improve the situation and agricultural production, which is mostly disturbed by climate change. The study determined small-scale farmers' constraints to climate change adaptation strategies in Morogoro District. It specifically examined the constraints for effective implementation of Tanzania National Climate Change Strategy of (NCCS) of 2012, assessed the small-scale farmers awareness on climate change related policies, analyzed climate change adaptation strategies utilized by small-scale farmers and policies available to help small-scale farmers adapt the effects of changes in climate. This study employed a qualitative approach to determine constraints to effective implementation of climate change adaptation strategies. Primary data were gathered through interviews, Focused Group Discussions, and observation; and secondary data were collected through reviewing various published and unpublished materials. Content analysis technique was used to analyze collected data together with an assistance of Atlas TI software package. The results indicate that there is no systematic implementation of National Climate Change Strategy, due to inadequate inclusion of stakeholders in policy formulation process, budgetary and human resources constraints, lack of working facilities, and political interference, the findings also show that farmers in Morogoro District Council employ self-directed adaptation strategies such as growing drought tolerant and early maturing crops, intercropping, crop rotation, and few use irrigation system, but effective adaptation through those strategies is limited by absence of National Climate change policy, limited awareness and lack of climate change information, lack of agricultural inputs and irrigation infrastructure. The study concludes that effective implementation of National Climate Change Strategy of 2012 has faced a number of constraints, which leads to ineffective systematic implementation of adaptation strategies as stipulated in

the strategy; awareness of climate change related policies by small scale farmers is generally low as a result there is ineffective implementation of those policies; small scale farmers have developed self-directed adaptation strategies to climate change, which are basically used as a means to manage crop risk and policies to address adaption to climate change and to help small scale farmers to effectively adapt to negative effects of climate change are insufficient. Formulation of National climate change policy through a participatory approach and ensure inclusion of key stakeholders is recommended, as well as provision of climate change education to small scale farmers through the use of media and social networks, and the government should invest on developing human resources so that to have enough technical staff who plays a role of extension services provision.

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CHAPTER ONE

PROBLEM SETTING

1.0 Introduction

The chapter presents background of the study, statement of the problem, general and specific research objectives. It also includes the research questions, importance of the study, scope of the study, limitations, and organisation of the dissertation.

1.1 Background to the study

Climate change is an emerging threat, which affects human wellbeing and life of other living organisms on earth. It is associated with collection of Greenhouse Gases (GHG) in the atmosphere, due to natural and anthropogenic processes. According to Intergovernmental Panel on Climate Change (IPCC) (2007), Africa (especially sub-Saharan countries) is among of the highest exposed continent to climate change effects in the world. The poor people are mostly prone to impacts of climate change at large magnitude as they have low adaptive power to reduce the effects of climate change (IPCC, 2015).

According to National Adaptation Programme of Action (NAPA) Tanzania like other less developed countries is experiencing serious undesirable impacts of climate change in different main sectors that are crucial to the development in the country. Agricultural sector is the backbone of the National economy, contributing for approximately 33% of GDP, employing over 75% of the labour force and also playing a critical role in ensuring food security (URT, 2005). However it has been reported as one of the sector, which is largely affected by ongoing climate change (*ibid*). This is because most rural communities in Tanzania are mainly small scale farmers who entirely depend on rainfall for agricultural production, while year to year rainfall patterns have been changing and decreasing in many areas within the country leading to decrease of agricultural yields. However, agriculture is extremely depending on the precipitation and people particularly

low income earners are highly depends on it to sustain their livelihoods (Slater *et al.*, 2007).

Climate change is associated with reduced crop yields; worse poverty and natural resource conflicts as witnessed in Morogoro region (Nambiza *et al.*, 2013). Currently, in Morogoro, the rain seasons that used to be predictable and reliable is no longer predictable and reliable. Rainfall is unreliable and drought has become more common and has severe impact to the environment and community at large. Increasing temperatures, regular droughts and flood intensify the vulnerability of small-scale farmers in the district who entirely depends on rainfall for agricultural production for their survival (*ibid*). For instance, persistence drought has resulted to conflict between pastoralists and crop cultivators in the district, this is due to the fact that pastoralist in searching for pasture tend to move from their areas to the areas that have been prepared for cultivation.

This sadness fact emphasizes the need for farmers to employ effective adaptation strategies to climate change. Tanzanian government has established important progress governance responses to climate change such as ratification of the UNFCCC in 1996, introduction of NAPA (2007), and NCCS in (2012). However, majority of climate change adaptation strategies remain largely unimplemented and only few have been processed and implemented in grass root level (Shemdoe, 2015). Some findings from developing countries show that implementation of those responses encounter number of setbacks in addressing climate change impacts by ensuring that small-scale farmers are in good position to effectively implement adaptation measures. Among setback for effective implementation of climate change governance responses is poor coordination among sectoral, Ministries, Departments and Agencies (Madzwamuse, 2010; Pramova *et al.*, 2015); inconsistencies between national and local adaptation policies and strategies (Stringer *et al.*, 2009; Hisali *et al.*, 2011) and absence of link at a high political level between predicted climate change impacts and development planning (Adger, *et al.*, 2007; Shemdoe, 2015). Furthermore, adaptations measures undertaken to encounter

climatic conditions are implemented for the purpose of managing climate change risk (Hella and Kamuzora 1999, Adger *et al.*, 2007).

In April 2012 the National Climate Change Strategy (NCCS) was published with the general aim of addressing both adaptations and mitigation in respect to country vision for sustainable development sustainable development (URT, 2016). The strategy stipulates guiding principles for its implementation, it pinpoint adaptation and mitigation main concern areas and suggests the essential legal and regulatory frameworks for effective implementation. Furthermore it explains roles of different stakeholders and ways for organising climate change action in the country.

Tanzania government developed Monitoring and Evaluation (M and E) framework for Climate Change Action (CCA) in the same year for the purpose of supporting integrated and comprehensive approaches to climate change adaptation. According to URT, (2012) Climate Change Adaptation (CCA) aim to: collect and provide information that will be used to track progress on implementation of all components of the comprehensive CCA activities, identify gaps and weaknesses during the course of implementation of the CCA policies, plans and programmes, plan, prioritize, allocate and manage resources, monitor the impacts of CCA activities to the communities and measure effectiveness of the projects, programmes, plans and strategies to the targeted communities

Although the country does not have an over-arching National Climate Change Policy, in the year 2014, the Ministry responsible for Agriculture, food security, and co-operative issued an agriculture climate Resilience Plan for the purpose of outlining the threats caused by change in climate to Agricultural sector in the United Republic of Tanzania, as also a plan for stabilising agricultural development and ensure effective adaptation to climate change impacts. All these strategies and policies do support the Tanzania's vision 2025 (URT, 2015), recognises change in climate to have negative impacts to key economic sector in the country and thus it is important to develop mechanism to address its adverse impacts which might include developing plans, and institutional arrangement

to ensure harmonised efforts and clear communication at national and local level government as well as giving power of decision making to lower level government units.

The Government of Tanzania established various policies plans which that acknowledge the severe climate change impacts prevailing in our country and adaptation to its impacts is necessary, although they do not have clear statement or provision on how to address climate change which include: the National Agriculture Policy of 2013, the Tanzania National Land Policy 1997, the National Environment Policy 1997, the Tanzania Forestry Policy 1998, National water Policy 2002, and National Development Plans. Most of them were drafted in the late 1990s and early 2000s, during that time climate change issue was not recognized to a large extent as a potential challenge to national development (Ampaire *et al.*, 2014). In 2013 the National Reducing Emissions from Deforestation and Forest Degradation Plus (REDD+) Strategies and Action Plan was developed, and in 2015 Tanzania presented its intended National Determined Contribution (INDC), which explores how Tanzania intends to work in climate change. All these signify the effort made by Tanzania government in addressing problems caused by climate change and adapting to it is recognized as vital in addressing effects caused by change in climate on crop production and livestock keeping.

However the situation on the ground is alarming also practices of local community in Morogoro District Council (MDC) raise doubt on whether local communities are aware of those initiatives. Adapting to climate change impacts by small-scale farmers remain poor and crop yield become lower day after day due to climate changes, which manifest in the district in different ways such as rain seasons are no longer predictable. For instance the district used to receive short rains from October to December but currently this is not happening. Farmer in the district have adapted differently to those changes, as already suggested by number of literature (Hella and Kamuzola, 1999; Biesbroek, 2014). From this background there is a need of determining why there is ineffective adaptation to climate change effects by focusing at climate change adaptation strategies employed by small-scale farmers in MDC.

1.2 Statement of the Problem

Ineffective employment of climate change adaptation strategies renders small-scale agriculture adversely impacted by ongoing changes in climate. Adaptation to climate change effects by small scale farmers in MDC is ineffective (Hella and Kamuzola, 1999) despite the presence of National Climate Change Strategy of 2012, which stipulate adaptation strategies to be undertaken by farmers to improve agricultural production (URT, 2012.) Small-scale farmers entirely depend on the rain while year-to-year rainfall patterns are changing and decreasing in various areas of the country including Morogoro District. Different studies about adaptation strategies employed to address changes in climate impacts on agriculture have been conducted by Mgula and Mkuna (2016); Shemsanga *et al.*, (2010); and Ampaire *et al.*, (2016). However, knowledge about constraints to effective implementation of climate change adaptation strategies by small-scale farmers in Morogoro District is hardly known. Therefore, this study fills that gap by determine small-scale farmers' constraints to climate change adaptation strategies.

1.3 Research Objectives

1.3.1 General objective

To determine small-scale farmers constraints to climate change adaptation strategies in Morogoro District.

1.3.2 Specific objectives

- i. To examine constraints for effective implementation of NCCS of 2012 in Morogoro District.
- ii. To assess small-scale farmers awareness on climate change adaptation related policies.
- iii. To analyze climate change adaptation strategies utilized by small-scale farmers in Morogoro District
- iv. To analyze policies which available to help small-scale farmers adapt to the

effects of changes in climate

1.4 Research questions

This study was directed by the following questions

- i. What are the constraints to effective implementation of NCCS of 2012 in Morogoro District?
- ii. How do small-scale farmers understand climate change related policies?
- iii. What adaptation strategies utilized by small-scale farmers to adapt to effects of climate change?
- iv. Which policies are available to assist small-scale farmer in MDC to adapt to climate change

1.5 Significance of the Study

The results of this study are important to the small-scale farmers, policy and decision makers, researchers as well as general public. The findings help to link policy formulation process to the identified constraints, and propose means, which would enable effective implementation in order to improve adaptation strategies, utilised by small-scale farmers so as improve agricultural production. It provides information that enhances linkages between national, District and local level actors in the effective implementation of NCCS of 2012. On the side of government (policy makers), the study findings provide empirical information to monitor and facilitate formulation of effective adaptation policies which will be suitably directed to proper mechanism in order to observe the requirement of Articles 4.1.b and 4.8 of UNFCCC, which calls for all member countries to encompassing actions to enhance suitable adaptation strategies which will address effects of changes in climate. Also information is useful in improving the implementation of the NCCS.

1.6 Scope of the study

The study focused on the climate change adaptation strategies by small-scale farmers so as to identify a policy action gap in the implementation of National Climate Change Strategy (2012). The researcher analysed how policies, which are in place to help small-scale farmers to adapt to climate change were made, analyse small-scale farmers perception on policies, strategies and regulations related to climate change, and analyse how they are implemented in Morogoro District.

1.7 Limitations of the study

Lack of knowledge on the importance of research to some of purposively selected respondents was the limitation to this study. Some targeted respondent were not interested to participate in the study despite the effort made by the researcher and village chairman to inform them on the usefulness of this research. Some asked for money so that to be interviewed. In that situation those who were not interested and who asked for money were replaced by their fellow small scale farmers in the study area who were willingly to participate in the study for free without any payment. The second limitation was bureaucracy in obtaining permission to conduct the study from the respective authorities of which in return it implicated research time frame. A researcher resolved this by insisting and explained to the MDC- DED to respond so that the researcher would meet the time frame for data collection activity.

1.8 Organization of the dissertation report

This report is made up of 6 chapters: problem setting which contain contains: background of the problem, problem statement, general and specific research objectives, research questions, scope and justification of the study and organization of the dissertation form the first chapter. Followed by Chapter two, which comprises the definition of terms, review of theoretical and empirical literatures and conceptual framework, chapter three is about research methodology, which comprises the research

design, study area, study population, sample, sampling techniques and sample size, methods of data collection and data analysis and presentation. Chapter is about the findings, basing on specific research objectives and research questions. Chapter is about discussion on findings, and the chapter six presents summary, conclusion, recommendations, policy implication and area for further studies. Bibliography and appendices form the last part of the dissertation

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter is about summary of reviewed literature about climate change as well as strategies undertaken by farmers to adapt the impact results from climate change. It comprises of definition of key terms, role of local actors in implementing adaptation strategies to effects of changes in climate conditions, types of adaptation, constraints to effective adaptation, perception of small-scale crop producers on climate change related policies, effects of climate change on agricultural output and other socioeconomic effects, adaptation measures utilized by small-scale farmers to respond those effects, and policies addressing climate change.

2.1 Theoretical Literature Review

2.1.1 Conceptualization of key terms

Key terms in this study include small-scale farmer, climate change, adaptation, and constraint to adaptation.

2.1.1.1 Small-scale farmer

According to Lupatu and Matee, (2001) small-scale farmers are those who follow under the farming practices of the following features: normally farms are small by size, agricultural production activities are done with little capital and limited knowledge and technology. The production is for consumption by household members and household's needs and requirements determine what needs to be produced without depending on external market needs. They engage in subsistence farming meaning that farmers first needs to meet the household food necessities before any production for sale or cash production is thought of. However, Mkai (2005), assert that cash crops production are normally low hence low income generation because small-scale farmers depends only on

family labour hence surplus generation is low. Small-scale farmers use resources at their disposal usually household labour and their land for production. They lack new technologies for production as results they mostly depend on traditional experiences generated around a long period. In this way knowledge for production is not enough to make them produce more. Modern technologies such as farming through using improved seeds; the use of modern farming equipment like tractor, and industrial fertilizers is not adequately applied (Mkai, 2005). Therefore in this study small-scale farmers are those who engage in small-scale farming, they utilize resource at their disposal for mainly producing food crops and limited resources are used for production of cash crops.

2.1.1.2 Climate change

According to Jarvis *et al.*, (2011) climate change refers to changes over time in the earth's global climate or in regional climates and both natural forces and human activities can cause it. Climate change is perceived as one of the emerging challenges of the 21st century. According to IPCC (2015) climate change is defined as, any change in climate over time, due to natural variability or as a result of human activity. It is also perceived as change in the state of the climate that can be recognized by variations that perseveres for a prolonged period, usually decades or longer (IPCC 2007). Often climate change is equated with global warming but it involves other disruptions of the whole world's weather and climate patterns, including effects on rainfall, and sea level rise, not just modest temperature increases (DEAT, 2004). Therefore, increased global warming is just one of the indicators of climate change. According to OECD (2003), there are models especially General and Regional Circulation Models (GCM's and RCM's) which have been used to reproduce the climate change projections, which basically involve the changes in temperature and rainfall and have been well documented globally. Least developing countries, especially Sub-Saharan Africa, are most exposed to the both current and future projected climate change impacts. According to the UNFCCC (2007), this has been contributed by its low adaptive capacity and already adverse impacts have been posing challenges to all crucial sectors across the continent. In this study climate

change is regarded as changes in statistical distribution of weather patterns that occurs over a prolonged period.

2.1.1.3 Climate change Adaptation

According to Adger *et al.*, (2007) adaptation refer to an adjustment in ecological, social, or economic system as a reaction to perceive or expected changes in environmental stimuli and their effects, in order to ease adverse impacts of those changes. The IPCC Fourth Assessment Report of 2007, referred climate change adaptation as an adjustment in natural or human systems, which moderate harm or exploits beneficial opportunities in response to actual or expected climatic stimuli or their effects. Climate change adaptation is predominant recommendation to many proposed studies for the purpose of reducing adverse effects of climate change. Also, it is one of the policy options to climate change that is shaping development practice (IPCC, 2007; Tanner and Mitchell, 2008). In this study adaptation is regarded as responses of exposure unity such as small-scale farmer or government towards effects of climate changes.

2.1.1.4 Constraints to adaptation

Constraints to adaptation refer to collections of circumstances that might hamper the implementation of specific adaptations strategies. According to Adger *et al.*, (2009) they are not necessarily complete constraints to adaptation as circumstances and available means might be changed by other means of adaptations. For effective adaptation to take place the farmers must utilize the available means and in this way climate change adaptation is conceptualized as a means to an end in which small scale farmer as an operator must utilize various means which facilitates effective implementation of climate change adaptation strategies for the purpose of improving agricultural production. Eisenack and Stecker (2004), grouped constraints to adaptation along the following aspects of the operator (implementer of adaptation) and the means to facilitate the adaptation:

Constraints that occur due to missing operator, these kinds of constraints occur when there is no operator, to implement adaptation strategies. It results from ignorance of the impacts that climate change poses on agricultural production so due to ignorance farmers and other key actor might not utilize available information on adaptation. And in most cases this kind of constraints persist since key actor do have limited awareness on effects of climate change also those actors are rigid due to their norms which limit their understanding of underlying effects as the result they climate change stimulus goes unnoticed and farmers fails to associate their low yield with those effects. Thus no operator and no implementation of adaptation

Constraints that occurs due to lack of means to facilitate adaptation, this constraints occurs when there is an operator (e.g. small scale farmer) who recognizes a need to respond to climate change effects but the necessary means to facilitate his decision to adapt are not available. Example of this constrains are like weak institutional capacity or budget constraints. These kind of constrains are popular in developing countries that are not evenly exposed to climate change and most of them have low capacities to adapt the negative impact of climate change (Eisenack and Stecker, 2004; Agder, 2007). In most cases failure to effective adapt to climate change is the result of poverty for instance most of small scale farmers in developing countries fails to utilize high technology as a means to adapt climate change due to lack of capital, also this kind of constraints occurs when the legislative framework limits adaptation in the sense that when interested farmer which to undertake a particular strategy to adapt climate change but they do not have the legal power to act.

Another group of constraints occurs due to failure to employ available means, in other word means to adapt to climate change are available but farmers fails to effectively employ them. This kind of constraints mostly results from feeling of receiving uneven economic return. Adaptations strategies are not adequately implemented while there is are farmers who have all the necessary requirement for implementation of adaptation. According Eisenack and Stecker (2004), when an adaptation has positive externalities

for other actors, the operator may choose to under-adapt if they consider that others will benefit from the adaptation activities they have done without paying for that benefit they receive. For example Most of Africans have the notion that developed countries contributes much to the climate change and they benefit more for various measures undertaken in developing nations such as afforestation with this notion some of the adaptation project are under implemented. Under this aspect there is also moral hazard situations where determined incentives of adaptation encourage actions that increase the impacts of climate change. For example, an investor may build a settlement in areas, which is vulnerable to flood with the expectation of receiving compensation from a government in the case of a disaster.

There are also constraints, which results from complex relations among various stakeholders or actors which make it difficult to make decisions, due to the fact that various stakeholders are differently affected by climate change also they have different perception which affects their decision on how to adapt. As a result conflicts of interest among stakeholders might occur and hamper the adaptation process. These types of constraints might also result also from the network of key actor of adaptation having complicated relation that facilitates adaptation decisions. According to Eisenack and Stecker (2004) these constraints might be increased by institutional arrangements that are not designed to respond to the new challenges results from climate change. In that kind of situation when a new problem arise it become difficult for those actors to respond to that problem as it might also require other means to facilitate adaptation. Generally constraints to climate change adaptation are those conditions, which can make small-scale farmer on a position of not be able to utilize or implement effectively a particular climate change adaptation strategy.

2.1.2 Role of local actors in implementing climate change adaptation strategies

Local actors are the key recipients of the impact of climate change as well as implementer of climate change adaptation measures, only if they are well informed and educated and if they fully participate in the establishment of various governance

response to climate change. According to UNFCCC, (2009) international donors and agencies and national governments play vital roles in developing conducive environments and directing financial and human resources to ensure climate change adaptation measures are undertaken. However for effective adaptation to take place through local governance, actions of local authorities, civil society organizations, and private sector should not be ignored for effective implementation of those measures. This means that the support provided by international donor and national government would not bring positive outcome if the local people were left behind in the process of developing those measures. IPCC (2015) reported that indigenous, local and traditional knowledge systems and practices, including indigenous peoples' general view of community and environment, are a main resource for adapting to climate change. Therefore it is significant for local knowledge and practices to be included in the process of planning for adaptation strategies.

World Resources Institute (WRI) assert that the level of climate change impact perceived will much depend on the existing capacity to adapt or mitigate as well as level of information available about predicted change in climate and their impacts at local level. From this notion National governments have a particular role in formulating policy and regulatory frameworks to enhance adaptation by individuals, households and private sector (UNFCCC, 2009). It imply that this can be done through strengthen the knowledge base of climate risk assessments; improving channel for communicating climate change trends in order for community to take precautions and warning, seasonal forecasts and weather alerts, from satellites to national radio stations to local meetings and other mass media like social networks and cell phones; provide the policy and legal framework for climate risk reduction measures related to land use planning, health and other sectors and ensure that infrastructure investments take climate change into account (UNFCCC, 2009).

According to UNFCCC (2012) good governance at all levels, especially at national level has an important role in establishing effective measure to address climate change across different sectors. However, action taken at international, regional and national level would have impact only when there are effective measures to reduce the vulnerabilities of local people and communities at large. This is due to the fact that local community who are vulnerable to climate change are the key player in implementing strategies for climate change adaptation, so if they are left without being empowered in the aspect of knowledge and information about climate change and how to apply available technology to address its impacts those action taken by government would have no meaning.

2.2 Empirical Review

2.1.1 Perception of small scale farmers on climate change

Climate change perception is very significant as far as the farming activities are concerned although there are different factors influencing it. The importance of perceiving something to adapt is to facilitate the identification and implementation of useful adaption methods (Maddison, 2007). Several studies wanted to draw the perception of the communities on climate change. According to Maddison (2006), perceptions about climate change indicated that a majority of farmers believe that temperature has already increased and that rainfall has declined in eleven African countries. In supporting to that, Yanda *et al.*, (2011) reported that farmers with the greatest farming experience, who have access to free extension services and markets are more likely to notice changes in climatic conditions. Therefore farming experiences, extension services and market are important factors of adaptation. Level of awareness of climate change adaptation and mitigation is associated with availability and accessibility of information on the climate change occurrence. The general understanding of climate change in Tanzania is inadequate and this has been much attributed with in accessibility of available inadequate information regarding to climate change. For instance, in the document written under the Climate Change Economics of the United Republic of Tanzania argue that variability goes unnoticed since people do not see the difference

between normal variations and abnormal change, thus climate change is not a prioritized issue. The reason for the lack of attention is then due to lack of awareness about the effects of climate change on socioeconomic development.

Hassan and Nchemachena (2008) in their research conducted in 2005 by the University of Pretoria, reported that 8000 farmers in southern part of Africa who were asked about their perception and adaption strategies to climate change. The research findings revealed that half of the African farmers perceived a long-term change of increasing temperature and declining precipitation. One third of the farmers perceived a change in the seasons of the rains and one-sixth perceived droughts as more frequent result of climate change. Another study conducted by Tessema *et al.* (2013) in Ethiopia revealed that distinctions among farmers lie on how they perceive changes in temperature and rainfall. 91.2% of them perceived an increase in temperature over the last 20 years while 5.3% and 3.5% perceived no changes and decrease in temperature respectively. Whilst, 90.3% of farmers perceived decrease in rainfall 6.2% and 2.6% perceived no change and increase in rainfall respectively. Furthermore, 0.9% percent shows rainfall is variable rather than agreeing either on an increase or decrease of rainfall.

2.2.2 Impacts of Climate change on farm-level food sufficiency and income

Researches review shows that, different sectors crucial to sustainable development initiatives are potentially impacted by climate change. Amongst those sectors, climate change has been reported to have negative effects on natural resource upon which agriculture activities depend for flourishing. Being one of the sectors supporting large population global particularly the poor one, according to (Parry *et al.*, 1999) agriculture is mostly depending on climatic conditions, it is also one of the most vulnerable activities to the negative impacts of climate change because its performance depends directly on climate condition. Changes in temperature due to climate change have influence in agriculture production in number of ways. It affects plants, animals, pests, and water supplies. For example, temperature changes directly affect crop growth rates, livestock performance and appetite, pest incidence, and water supplies in soil and

reservoirs. Another impact is on changes of precipitation. This affects the quantity of water directly available to crops and animals leading to drought-stress, interrupted supply of forage for animals, poor conditions for production of animal, reduced water supplies for irrigation, poor conditions for production of aquatic species, and changes in river flows.

Furthermore, extreme events of climate change such as drought and flood tend to effect production situations, destroying crops, and changing of water provisions. According to Parry *et al.* (2004), it is expected that climate change will continue to have negative impacts on agriculture production in different ways in various parts of the world. Apart from such variations, other projected changes are predicted to have large magnitude effects mainly in tropical zones of the developing world with rainfall managements ranging from semiarid to humid (Cline, 2007).

Available literature reports that many developing countries especially Africa will experience more impacts of climate change because of their low adaptive capacity (IPCC, 2007, Adger, *et al.*, 2007)). Tanzania is one among developing countries, which also is vulnerable to the observed and projected climate change impacts. A study conducted by Ngana (1983) on drought and famine in Tanzania reported that the incidence of dry spells in critical seasons for most crops contributed much to crop failure and hunger. This is due to the fact that majority of the citizens in Tanzania are living in rural area whose main activities is agriculture which entirely depends on rainfall. Climate change is among major factors for low agricultural production in our country, as a result food insecurity has become a major concern for many people and under production has extended the poverty line of rural dwellers due to low production and low-income generation. Droughts and floods have been reported to be the causes for failure and destruction to crops and livestock hence persistent food shortages (Liwenga *et al.*, 2007; Kangalawe and Liwenga, 2005). Studies conducted by Rosenzweig *et al.* (2002) reported that variations in precipitation patterns and amounts have resulted to damage of crops and low livestock production. Rising atmospheric carbon dioxide

concentration, higher temperatures, and changes in annual and seasonal rainfall patterns and incidences of severe events, are the manifestation of climate change occurrence. According to Nicholas *et al*, (2012), those features affect the volume, quality, quantity, stability of food production and the agro-ecological systems where farming activities by small scale farmers takes place

2.2.3 Types of adaptation strategies employed in response to climate change effects

Scholar categories adaptation strategies in different ways base on level of ownership, purpose, and measure or strategies employed. Pelling and High (2005) described them as direct and indirect adaptation. To them direct adaptation is the type of adaptation which are undertaken with the purpose of improving the situation of a system that is affected by a climate stimulus. Farmers directly undertake this kind of adaptation after being aware of the impacts it poses to agricultural production. Adaptations can also be described as indirect, in the sense that the action is intended to enable those who are affected to take certain measures, and only these kinds of adaptations are targeted at an exposure unit, which is vulnerable to climate change impacts. It is undertaken by government to assist those who are vulnerable to climate change effects. The difference between direct and indirect adaptation, match to the difference between material and institutional intervention described by Pelling and High (2005).

The IPCC (2007) differentiate autonomous and planned adaptation. Füssel (2007) asserted that planned adaptation put into action available information about expected future conditions, while autonomous adaptation does not make use of available climate forecasting information. According to IPCC (2001), autonomous adaptation comprises a deliberate response to climate stimuli, triggered by ecological changes in natural systems and by market or welfare changes in human systems. This kind of adaptation is also termed as spontaneous adaptation and private sector rather than by public is considered to initiate this kind of adaptation (Leary 1999). Autonomous adaptation often is activated by market or welfare on the other hand, planned adaptation is usually explained as being the result of a deliberate policy decision on part of public agency,

based on an awareness that conditions are about to change or have changed and that action is required to minimize losses or maximize benefits from opportunities (Osman-Elasha, 2010; Pittock and Jones, 2000). Therefore responsible person basing on their awareness and perception on climate changes impacts undertakes autonomous adaptation. On the other hand planned adaptation is policy driven adaptation developed by government or public agency to govern adaptations activities.

Technological adaptation is another categories of adaptation which involves number of adaptation strategies currently implemented to respond to current climate change and variability, these include diversification of livelihood activities, shift from one livelihood option to another, and modification of the existing technology or adopting new ones, according to Fussel (2007), collectively that process is referred to as technology adaptation example, the development of new drought resistant crop varieties or improved information systems, irrigation system and other technology adaptation process.

According to Feder *et al.* (1985), technology adaptation can be well defined as a rational process in which an individual passes from first hearing about an innovation to final implementation of adaption measure. To them final adaptation occurs at the extent of the use of new inventions in the long run when a farmers possess all the required information about new technology and its benefits. The dynamic nature of adaptation decisions involves a change as information is simulating the climate change projections, which basically involve the changes in temperature and rainfall and have been well documented globally (OECD, 2003).

Majority of reviewed literature indicated that small-scale farmers in different parts of our country have employed various strategies to adapt to effects of climate change through growing drought resistant plants and using early maturing seeds, intercropping, use of irrigation agriculture, changing of planting dates and harvesting systems,

increasing using water and soil conservation techniques, changing from farm to nonfarm activities such as casual labour, and migrating from one place to another (Komba and Mchaponwa 2012; Lymo and Kangalawe, 2010; Mary and Majule, 2009)

2.2.4 Climate change adaptation capacities among small-scale farmers

Vulnerability refer to the situation in which adaptation takes place, and adaptive capacity is the ability or possibility of a system to respond effectively to climate change, in order to decrease negative effects and take benefit of new opportunities (Eisenack and Stecker, 2004; Adger *et al.*, 2007). It is believed that farmers who can quickly react to climate change are considered to have a high adaptive capacity than those who are not. However, the high adaptive capacity farmers possess does not certainly mean the there will be effective adaptation (Rivington *et al.*, 2005, Eisenack and Stecker, 2004).

There are factors that drive adaptive capacities at different scales, which are essential to understand the way in which those drivers of climate change adaptive capacity interact for the purpose of increasing agricultural production. According to Spaling, (1995) drivers of adaptive capacity are different but may include wide structures such as economic and political processes, as well as those which function at local scale, such as access to decision making and the structure of social networks and relationships within a community. Adaptive capacity at a local scale is limited by number of issues, for example, a farmer's adaptive capacity depends on access to financial resources, access to extension services, availability of infrastructures and knowledge and information about climate change which allow them to employ effective adaptation strategies hence crop to be successfully grown.

Khalif (2008) reported that farmers have constantly adapted to climate change and that adaptation strategies already existed in many societies, for example changing planting seasons or intercropping existed for long time. From this notion therefore, traditional

knowledge and adaptation strategies utilized by local communities must be maintained and strengthened, otherwise adaptive capacity may be weakened, because local knowledge of the environment will be lost. Strengthening these indigenous techniques and building upon them also makes it easy effective implementation of adaptation strategies, as it will create a sense of community ownership and involvement in the process of adaptation. In some cases however, traditional knowledge will not be enough to adapt to new settings, which are outside the scope of those previously experienced, and new skills will be needed. In that kind of situation government intervention is needed through extension services to farmers on available technology and how they can apply them to improve production. According to IPPC (2015) building adaptive capacity is necessary for successful choice and implementation of adaptation alternatives.

2.2.5 Small scale farmers' constraints to effective adaptation strategies

According to IPPC (2014), adaptation constraints can interact to hinder adaptation planning and implementation. Common constraints on implementation of climate change adaptation result from: limited financial and human resources, limited integration or coordination of governance, uncertainties about predictable effects, different perceptions of risks, conflicting values, absence of key adaptation leaders and advocates, and limited tools to monitor adaptation effectiveness. Also effective adaptation can be constrained by insufficient research, monitoring and observation and the finance to maintain them (IPCC, 2014). Nzeadibe *et al.* (2011), reported that knowledge about climate change is very low among rural small-scale farmers throughout the African countries. Lack of awareness on climate change is considered to be one of the major constraints to climate change adaptation by farmers in the Niger Delta (Nzeadibe *et al.*, 2011))

In the study of Mburu, (2013) conducted in Yatta district in Kenya revealed that small-scale farmers encountered different challenges that limited their capacity to plan effective adaptation strategies and successfully implement them. Those challenges include financial constraints, lack of appropriate skills, lack of scientific and technical

knowledge, lack of information, and lack of infrastructure and inputs. Lack of financial resources was cited by majority of the respondents as a major constraint facing adaptation. For example, a small wooden greenhouse of 8m x 15m costs from Kenya shillings one hundred thousand to put up. This includes the green house structure, drip irrigation system and a tank to provide water. The cost of seedlings, maintenance costs that include payments to agronomists, supervisors and farm hands are not included. Majority of the small-scale farmers in Yatta District cannot afford this.

Another study by Tessema *et al.* (2013) in Ethiopia describes that very significant factor, which act as obstacle to effective climate change adaptation by the surveyed farmers, was lack of information about climate change and adaptation strategies. Which accounts 22.5%. This is account to various factors including lack of institutional support mechanisms and failure to mainstream the issue of climate change in the public extension system of the country. Other constrains being the lack of farm inputs including seed (20.7%), chemical fertilizer (3.6 %) and oxen (8.1%). Also, according to 17.1% of the sampled respondents, shortage of land plays a key role in weakening their likely potentiality to adapt to climate change. The surveyed farmers also mentioned lack of money (14.4 %) as another important climate change adaptation constrain. The other barriers stated by the farmers include: lack of water, lack of labor, insecure land tenure and lack of market access.

Ampaire *et al.* (2014) on their study titled institutional constraints to climate change adaptation: A case study on policy action gaps in Uganda uncover that the key constraints to successful policy implementation are different and cut across the policy development and implementation cycle. Policies are mainly formulated by central government agencies; other actors are insufficiently involved while local communities are excluded. It also revealed a communication disconnects between national, district, and community levels, coupled with limited technical capacity and finances, political interference, and absence of functional implementation structures across these levels.

Another study done by Antwi-Agyei *et al.*(2013) on barriers to climate change adaptation in sub-Saharan Africa: evidence from northeast Ghana revealed that households are constrained by a variety of obstacles, the most commonly mentioned constraint was the lack of financial resources 97% (131) of households cited a lack of financial resources as a severe barrier, about 65% (88) also perceived a lack of information on climate change characteristics, whilst 33% (45) reported that a lack of institutional capacity to facilitate agricultural adaptation served as barriers, about 26% (35) of the respondents described social-cultural barriers such as belief systems and local norms as serious obstacle, 28% (38) and 7% (9) of the households identified technological barriers and a lack of infrastructural development including ready markets. Households also reported unavailability of credit facilities to purchase farm inputs such as fertilizers, farm implements and pay laborers as additional constraints.

Researcher suggest that households must be supported through the provision of micro-credit schemes, community empowerment and extension plans directed at developing social networks within farming communities in order to reduce their vulnerability to the negative effects of climate change. The study further identified migration and changing the seasons of sowing as main climate change adaptation strategy in sub-Saharan Africa. The majority of households 90% (122) sampled in the three farming villages, reported that at least one member of their household had migrated over the period 2006–2011 as a strategy to cope with climate variability.

Furthermore Ampire *et al.* (2014) on their study conducted in Lushoto, Kilolo and Bagamoyo Tanzania identified climate change capacity and knowledge gaps, mainstreaming climate change concerns, budget allocation considerations and inadequate institutional coordination as key constraints to successful climate change adaptation.

2.2.6 Policies and legal framework for climate change adaptation strategies

Literatures acknowledges that policies need to provide a supportive environment that, not only guides development stakeholders in planning and executing climate change adaptation strategies but also enables farming communities to adapt to climate change (Berman *et al.*, 2015; Osberghaus, 2013; Ampaire *et al.*, 2017; Adger, *et al.*, 2007). In respect to this, various international and national frameworks were developed; the UN Framework Convention on Climate Change (UNFCCC) was formed in 1992 to facilitate broad national adaptation strategies.

Climate change is increasingly becoming one of the serious national, regional and global environment policy interests because of the projected impacts it causes on economic production and global nature (Aldy *et al.*, 2010, Adger *et al.*, 2007). According to Bezabih *et al.* (2010) understanding the economy wide impacts of climate change for a given country is important to planning national adaptation strategies and formulating effective global climate policy agreements to address them.

Tanzania signed and ratified the UNFCCC on 2nd June 1992 and on 17th April 1996 respectively and made the first national communication to the UNFCCC in 2003, which laid the basis for the preparation of the NAPA, that become operational in 2007. Tanzania NAPA was prepared as part of the overall integrated plans, policies, and programmes for sustainable development at the national level (NAPA, 2007). It prioritized fourteen adaptation projects: (a) Water efficiency in crop production irrigation to boost production and conserve water in all areas; (b) Alternative farming systems and water harvesting; (c) Develop alternative water storage programs and technology for communities; (d) Community based catchments conservation and management programs; (e) Explore and invest in alternative clean energy sources e.g. Wind, Solar, bio-diesel, etc. to compensate for lost hydro potential; (f) Promotion of application of cogeneration in the industry sector for lost hydro potential; (g) Forestation programmes in degraded lands using more adaptive and fast growing tree species; (h) Develop community forest fire prevention plans and programmes; (i) Establishing and

strengthening community awareness programmes on preventable major health hazards; (j) Implement sustainable tourism activities in the coastal areas and relocation of vulnerable communities from low-lying areas; (k) Enhance wildlife extension services and assistance to rural communities in managing wildlife resources; (l) Water harvesting and recycling, Construction of artificial structures, example, sea walls, artificially placing sand on the beaches and coastal drain beach management system; (m) Establish good land tenure system and; (n) facilitate sustainable human settlements (URT, 2007).

Although implementation of these projects has been criticized in some literatures for being insufficient (Adger *et al.*, 2007), Yanda *et al.* (2011) asserted that NAPA reflects the donor driven nature of climate change in Tanzania and is not a strategic government document from which adaptation activities are driven. Instead it provides a wish list of activities that are poorly quantified and it has not specified time boundary for its implementation.

Apart from ratification of international treaties, Tanzania has been developing several efforts towards addressing climate change in accordance with her national setting. The National Climate Change Strategy (2012) and the Zanzibar Climate Change Strategy (2014) comprehensively elaborate adaptation and mitigation actions. The strategies aim to, among others, enhance adaptive capacity to climate change thereby ensuring long term strength; flexibility of ecosystems to climate change; and enhanced participation in climate change mitigation activities to contribute to international efforts while ensuring sustainable development. The two climate change strategies and other national climate change and development will be the basis for the identification of adaptation priorities along with detailed consultations with key stakeholders within the entire communities of the selected study site.

Various policies, legislations, strategies, plans and programmes were analysed in the course of addressing climate change. Some of these are: the National Climate Change Communication Strategy (2015); the National Adaptation Programme of Action (2007);

the Zanzibar Environmental Policy (2014); the Renewable Energy Strategy (2014); the National Forestry Policy (1998); the Agriculture Sector Development Plan II (2013); the National Environmental Policy (1997); the Zanzibar Environmental Policy (2013); the National Environmental Action Plan (2012 – 2017); and the National Environment Management Act (2004). The list is not meant to be exhaustive. These policies form a base for analyzing policy gap in the study area on how they facilitate or constraint effective adaptation to climate change

2.3 Gaps in Literature

However, most of the empirical evidences are on semi-arid regions found at the central party of Tanzania, there is little empirical evidence of adaptation strategies in eastern party of Tanzania including Morogoro District Council. Given the high dependence on rain-fed agriculture for the most of the Morogoro district Council resident the area may be quite vulnerable to the current and future climatic changes.

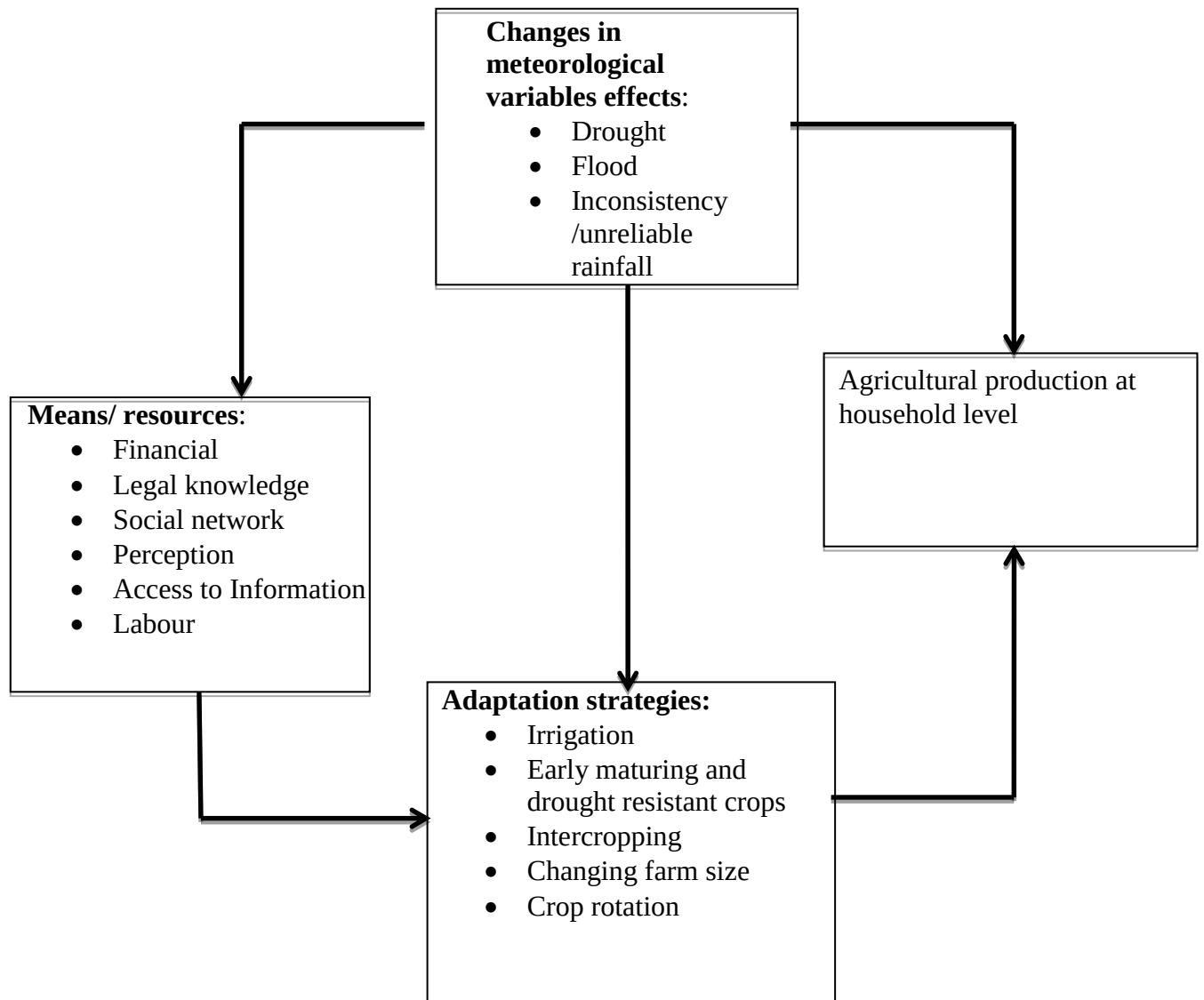
2.4 Conceptual framework

A conceptual framework constructed by the researcher after reviewing number of literature sources guided this study. It shows linkages among various means or resources, climate change, and climate change adaptation strategies, which influence agricultural production among small-scale farmers (Figure 1). Adaptations to climate change involve various actors whose relation is key in effective implementation and can be a source of constraints to adaptation, denoting that, adaptation is developed into means-end chains. Households respond to climate change differently depending on the possessed power such as capital, farm size, labour, financial, legal knowledge, social networks, perception and access to information, which collectively in this study referred to as means or resources to effective adaptation. Those means facilitate or constrain their interaction with the environment in order to secure food production. The cognitive resources that small-scale farmers gain through experiencing variation and changes in the environment such as inconsistency rainfall, drought and flood enables farmers to

notice changes in the climatic condition.

By using resource they have farmers respond to the climate change through employing different strategies such as irrigation, the use of early maturing and drought resistance crops, intercropping, grow pest or diseases tolerant variety, and increasing farm size. An adaptation requires actors' intention which is directed towards an impact of climate change and the use of resources as means to achieve the intended ends (improving agricultural production). Therefore, climate change adaptation strategy is shaped and might be constrained by resources that cannot be controlled by small-scale farmers. The focus of this study is on how the interactions between climates change, climate change adaptation strategies and means or resources possessed by farming household's impact on agricultural production at household level so as to determine constraints to effective implementation of climate change adaptation.

Figure 2.1 Conceptual framework



Source: Researcher construction, 2018

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter consists of the methodological part, which includes: the description of the study area, study design, study population, sample, sample size and sampling technique, tools of data collection, Method of collecting data, data processing, analysis and presentation.

3.1 Study area

This study was conducted in Morogoro District Council (MDC), which is among seven Districts of Morogoro Region in Eastern Tanzania. It was purposively selected because first, 82% of the population in MDC depends on rainfall agriculture and majority of them lives below the food poverty line. According to the planning, statistics and monitoring department (2011), the average individual annual income (Per Capital Income) for MDC is approximately US \$ 72 annually, (Tshs 250/= per day), Second, the District is prone to climate change effects and farmers have already faced some challenges in adapting to those changes, in year 2016, 8,869 cattle died from lack of pasture due to drought and three people were killed out of conflict between livestock keepers and crop growers.

3.2 Description of the Study Area

This district is located between 6° and 8° latitudes south of equator and between longitudes 36° and 38° to the east of the Greenwich Meridian. It has a total area of 11,731 square kilometer. That is 16.06% of the total area of Morogoro Region, which has 73,039 square kilometer. (NBS, 2013). It is bordered on north and east by Bagamoyo and Kisarawe (Pwani Region), on the south by Kilombero District to the southwest by the Kilosa District and to the west by the Mvomero and the Morogoro

Urban District. It is divided into six divisions: Mvuha, Ngerengere, Mikese, Matombo, Bwakira and Mkuyuni. Morogoro district council was established in the year 2005 after splitting of the then Morogoro District into Mvomero District and Morogoro District (Figure 1)

The district has the total population of 286,248, out of which 145,424 are females and 140,824 are males (NBS, 2013). The population density in this district is 32 people per square kilometer. The district has a total of 69,038 households (average 4.7 people per household) (ibid). The population distribution pattern is significantly caused by soil fertility, conducive climatic features which support crop production and livestock keeping as well as a strategic location of the district which favors commercial activities (example in Kisi). The dominant tribes in Morogoro District Council area: Luguru, Kutu, Zigua, and Kwere. The people who tend to concentrate in Mountainous areas are the Luguru, Kaguru and the Pogoro. The nature of the district attracts people from other tribe to settle in the district such as Masai, Mang'ati and Sukuma people.

According to the Morogoro District Council strategic plan of 2015/2016, 82% of the adult population earns their livelihood from agriculture mainly subsistence agriculture, 6% engages in commercial and trade activities such as selling goods in retail shops, selling of agricultural products (crops and livestock products), masonry, and handcraft, 6% in elementary occupations, 4% in office work (are employed in government such as teachers, health officers, police officers, extension officers, village executive officers and ward executive officers), and 2% in Livestock Keeping. Farming activities are done manually for which human labour (hand hoe) accounts for 64%, tractor 35%, and ox-cultivation 1%. Geographically, Morogoro District is divided into 3 areas as described in the next sections.

3.2.1 Mountainous areas

Mountainous areas form the large part of Mountain Uluguru; it takes 25% of the entire area of MDC. This zone receives the total average of 1000–3000mm rainfall per year.

The area is suitable for production of crops such as: beans, Cardamom, and Coffee, Black Pepper, Vegetables and horticulture.

3.2.2 Low mountainous zones

It is the Northern part of MDC which covers 20% of the whole area of Morogoro. The area is located on the highest zone ranging from 600m to 1200m from the sea level. It receives average total rainfall of 1000 – 2000mm per year. It comprises of sand type of soil, which is suitable for production of maize, Cassava, Finger and Millet. This zone is also suitable for livestock keeping.

3.2.3 Savannah zones

This area is covering the biggest part of the area; it forms fifty five percent of the entire MDC. This zone is located on the highest range between 600 to 800 m from the sea level. Savannah zone is characterized by persistent desiccating winds and low humidity, with temperatures ranging from 20°C to 30°C and precipitation varies from 600 mm to 1200 mm per year. Long rains are experienced from March to the end of May while short rains occur from October to December. The dry seasons are from August to October and January to March. The land is generally plain surrounded by the Uluguru Mountains, valley divided by rivers flow from Uluguru Mountains, namely Ruvu, wami, msongozi, mbulumi, Ngerengere, Mvuha, and Mgetakafa rivers. This zone is potentially good for maize and rice production. MDC comprises of diverse types of soils, which are; Sand type of the soils in places like Ngerengere and Kisihi. Clay type of soils in Kidugalo- Ngerengere, and Loam Soil in Matuli- Ngerengere

Morogoro district council is made up of 11,731 square kilometres, 11,036 square kilometres is suitable land for agriculture activities, 1864,937 square kilometres (21.05%) is used for crop production, 1093.192 square kilometres (12.34%) is used as livestock grazing land, 813.1 square kilometres (9.18%) is used as residential area, 1960.96 square kilometres (22.14%) comprises natural forest, 63.08 km (0.71%) is used as forest reserve area and 102.1 square kilometres (1.15%) is water logged area. From

these data, it can easily be concluded that, large part of the district land, which is suitable for various economic activities including agriculture, lies idle. The area under cultivation is relatively very small compared to the available suitable land for agricultural activities. This is mainly due to economic constraints, shortage of rainfall, inadequate supply of agricultural inputs and low agricultural technology.

3.3 Study Design

The research adopted a case study design. The design assisted a researcher to explore in depth information on constraints to effective implementation of climate change adaptation strategies employed by small-scale farmers. Therefore the suitability to the design based on it being relevant on answering why and how questions. In this study why there is no effective implementation of climate related policies in Morogoro District Council was determined.

3.4 Study Population

The study population was small scale-farmers and staff from MDC head quota such as heads of agriculture, environmental and planning departments, as well as WEO, VEOs, village chairpersons and extension officers in Mikese Ward, in Morogoro District Council. According to the Morogoro District Strategic Plan (2015/2016) there are 55,000 farming household who are entirely depend on rain-fed agriculture.

3.5 Sampling Techniques

The study used non-probability sampling techniques. The purposive sampling technique was used in this study.

3.5.1 Purposive sampling technique

The sampling unit was the households in the three (03) purposively selected villages namely Lubungo A, Fulwe and Mtego wa Simba in Mikese Ward. These villages were selected because they were reported to be among the villages affected by the climate

change (MDC agriculture department report 2016). Furthermore, purposive sampling was also employed to select key informants with key roles in the implementation of policies related to climate change. This was limited to; Ward Councilor (WC), Ward Executive Officer (WEO) and Village Executive Officers (VEO) of the respective villages. At the District level, they include, District Agricultural Irrigation and Cooperative Officer (DAICO) and District Livestock Officers (DLO) Environmental and Natural Resources Officer (ENRO), and District Planning and Statistical Officer (DPSO).

Researcher also used purposive sampling to select representatives from Non-Governmental Organizations (NGOs), who are implementing different projects related to climate change and environmental conservation in MDC. They were purposively selected basing on their positions and experience in their organization. Lastly the technique was also used to select 30 farming households from three villages this means in each village 10 small scale farmers were purposively selected basing on the required information on constraints that small-scale farmers face in adapting to climate changes effects.

3.6 Sample Size

The total of 44 respondents participated in this research, determined by the saturation of the information by the researcher, under the following classifications / categories: 30 small scale farmers household, 04 are staff from Morogoro District Council head quota, three (03) are staff from NGOs dealing with environmental conservation and agricultural activities in Morogoro, three (03) extension officers and one (01) VEO and one (01) WEO of Mikese Ward in Morogoro District Council.

Table 3.1 provide a summary of the sample size distribution.

Table 3.1 Sample size distribution

Participants from Morogoro District Council head quota			
S/N	Units of inquiry	No. Of staff	Sample size
1.	District chairperson	01	-
2.	District executive officer	01	-
3.	Agriculture and cooperatives department	15	01
4.	Livestock and fishing	09	01
5.	Environmental department	03	01
6.	Planning, statistics and monitoring	06	01
Sub total		35	04

Source: Researcher constructed, 2018

Non-governmental Organization (NGOs)			
NGO		No. of staff	Sample size
Morogoro Environmental and Development Foundation (MEDEFO)		06	01
Mtandao wa Vikundi vya Wakulima Tanzania (MVIWATA)		18	01
Ulugureu Mountains Agricultural Development Project (UMADEP)		06	01
Sub-total		30	03

Source: Researcher constructed, 2018

Participants from Mikese Ward			
S/N	Units of inquiry	No. of person	Sample size
1.	Ward council	01	01
2.	WEO	01	01
3.	VEO	03	01
4.	Village chairpersons	03	01
5.	Agricultural extension officers	04	03
6.	Farming household	55,000	30
Sub total		55,009	37

Source: Researcher constructed, 2018

3.7 Data Collection Methods

Data for this study were obtained from primary and secondary sources. Primary data was collected from study area through focused group discussions, semi structured interview and in-depth interview with key respondents. Secondary data was obtained from different sources after comprehensive systematic review of documents regarding the studied topic. Data about production trend in the study area was collected from

Morogoro District Council Agriculture Department and data on precipitation and temperature trend was collected from TMA. Statistical data were collected from Tanzania Bureau of Statistics (NBS)

3.7.1 Focused Group Discussions (FGDs)

Focused group discussions with small scale farmers were conducted so as to gather information about small-scale farmers awareness on the available climate change policies, to obtain data on the noticed changes in climatic condition and adaptation measures they employ to respond to those changes as well as constraints they encounter in adapting to climate change impacts and their recommendation on how to effectively adapt to climate change in order to improve agricultural production. Three FGDs in three villages were conducted. FGDs questions guide is attached in Appendix IV.

3.7.2 Semi-structured interviews

Semi structured interviews with extension officers in each village were carried out so as to obtain information on adaptation strategies, which they encourage and promote to be used by small scale farmers to improve their production. Also it was used to gain their insight on how policies are formulated and implemented in their respective areas, constraints to effective implementation of climate change related policies specifically the NCCS of 2012 and how to improve agricultural production. An interview guide is attached in Appendix V

3.7.3 Key informant interviews

Researcher also conducted in-depth interviews with key informants including officials from NGOs that deals with the climate change and environmental conservation activities, and staff from MDC head quota including the following: DAICO, Environmental and natural resource officer, Livestock officer, District Planning and Statistical officer, WEO, VEO and Mikese Ward Councillor so as to triangulate and

validate information pooled from focused Group Discussion and semi-structure interview. An interview guide questions is attached in Appendix VI

3.8 Data processing and analysis

Collected data were analyzed basing on their content and categorized under various created themes. Then they were coded in order to make meaningful information out of them (make sense). The researcher sequentially arranged and classified data basing on their themes as per specific research objectives. The computer software Atlas TI package was applied to analyze qualitative data since the software is useful for analyzing content of the text and quotations from the respondents after being transcribed.

CHAPTER FOUR

PRESENTATION OF FINDINGS

4.0 Introduction

Findings collected from the area of the study are presented in this chapter, in relation to the specific objectives and related research questions. Section 4.1 therefore, presents findings about constraints to effective implementation of NCCS (2012) in Morogoro District Council, section 4.2 assess small-scale farmers awareness on climate change related policies, 4.3 analyse adaptation strategies utilized by small-scale farmers in MDC and section 4.4 analyses policies which are in place to help them to effectively adapt to climate change effects

4.1 Constraints to effective implementation of NCCS of 2012

The study intended to examine reasons for ineffective implementation of NCCS of 2012. Findings reveled that constraints to effective implementation of NCCS includes lack of financial and human resources, poor inclusion of policy stakeholders in policy making, lack of working facilities, and infrastructure, limited awareness and lack of climate change information as well as political interference.

4.1.1 Budgetary constraints and lack of financial resources

The implementation of NCCS require funds to facilitate adaptation activities such as provision of trainings to farmers about climate change concepts, its effects and adaptation strategies which can be used to counter its effects. The findings from this study show that no fund that is allocated for implementation of the strategy, the MDC depends on its own sources of revenue and Other Charges (OC) to implement the strategy, which is not reliable. An environmental officer provided this fact during an interview by saying:

There is no fund that is allocated for implementation of the strategy, our council has failed to ensure effective implementation NCCS because the central government has failed to provide fund to the local government to implement it, and no way that prime minister or any minister somewhere else is implementing them not even a permanent secretary. Every year in the budget we request money for climate change management but we don't get, and this apply to all councils, if you see a council is implementing climate change project that project must have been funded by whites after writing a project proposal. (Environmental Officer at MDC, 16th May. 2018)

Response from environmental officer reveals that central government have forgotten the role of financing climate management activities but they keep on asking for the implementation reports, something that makes implementers copy and paste the previously work which has been implemented out of donor funded projects. One of the key respondents reported that “they only request implementation report, and to me when you request a report without fund for implementation I only copy and paste previously reports”. Additionally, interviewed agricultural officer revealed that the fund from central governments comes with directives and it is not easy to reallocate to finance climate change activities. As he reported that ‘it is not possible to use the budget allocated for other projects in order to implement NCCS as a result agricultural officers are forced to beg money from business men in the District incase of outbreak of hazards influenced by climate change such as flood and drought’.

Lack of financial resources hamper small scale farmers to use high technology in adapting to climate change so that to improve agricultural production as reported by ward extension officer stating that “Many farmers in this areas still use traditional seeds which are vulnerable to diseases and drought, and in case of diseases outbreak they use traditional means to treat crops such as the use of ashes in maize”.

It was also observed in one of the small scale farmer house where maize were preserved using traditional skills by placing them at the top of the kitchen with the believe that smoke will make them safe from insects and other grain pests. In the FGDs it was revealed that harvesting rainwater requires storage facilities like tanks and some of the

small scale farmers houses do not support them to harvest rain water since are made up by grasses.

4.1.2 Inadequate human resources

Effective implementation of NCCS depends on the availability of enough qualified human resources. This study revealed that the effective implementation of NCCS is constrained by inadequate number of staff. In MDC there are 03 environmental officers and one health officer who work as the environmental officer in Mikese ward, which comprises of 6 villages. There are no any environmental officers who have been employed direct from chief secretary as one of the key respondents explains.

The strategy is not effectively implemented because the government does not put efforts in employing environmental staff, if the government would have been serious to implement that strategy it could have employed enough staff so as to reach farmers in villages and provide them the required education, so being few we fail to deliver the climate change knowledge to the farmers in the villages and how to adapt to the negative effects resulting from those changes. (Agricultural officer at MDC, 22nd May. 2018)

The study reveals that, the one who works as environmental officers is a health officer by professional he carries out that role because they deal with human health with the assumption that they can also manage the environment in which is not right they do not have skills on climate change management

You have to know that many LGA's have no environmental officers, in many council those who are called environmental officers are by professional health officers, in very few council that employed environmental officer it was due to the efforts made by the former Prime Ministers in 2014, without him those who went to college like SUA, to study environmental courses or environmental science were merely employed to the industries. (Environmental Officer at MDC, 20th May. 2018)

4.1.3 Inadequate inclusion of policy key stakeholders in policy processes

Interviews conducted with key informants in MDC head quota revealed that officers at District level are poorly participating in policy formulation processes at the National

level. Normally policies at the National level use consultative workshops in which responsible Ministry invite representatives from district level to participate in those workshops with the assumption that before attending those workshops they will communicate with grassroots citizens so that to collect their opinions, and after workshop they will go back to tell them the resolution as well as train them on what needs to be implemented which is not practically done. One of the key respondents at district level stated that:

There is poor participation of experts in policy formulation, we are only participating in the implementation stage in this way we are denied a chance to provide our insight which is suitable and reflect to our environment and peoples needs, as a result most of policies formulated at national level are difficult to be implemented because they don't reflect local people needs. (Agricultural officer at MDC, 22nd May. 2018)

Key informants from ward, and village admitted that actually they are totally not participating in the policy formulation process and the representatives from district level do not consult them before attending policy making meeting and workshops which results to projects which are not easy to be implemented as one of the extension officer reported:

Without our participation there is a problem of formulating irrelevant policies, which do not reflect our situation. Some of reports are not well prepared because it is just a command from our bosses, which is a problem. Also in various projects the government brings crops to ask famers to grow them without giving them a room to decide what kind of crop they prefer to produce and their reason. I can give you an example we have the cottonseeds in our office have not been grown just because they were brought without our prior consultation. (Ward Extension officer at Mikese Ward, 19th May. 2018)

Moreover, none of the small-scale farmer reported being invited to policy formulation activities. Additionally the study finds out that and their representatives in the decision-making bodies do not visit them in order to know their opinions views and challenges that face them. An interviewed small-scale farmer as reported this:

Our member of parliament do attend national assembly meetings without prior visit to us whom we are their voters in their respective constituents, the same case to councilors, they attend council meeting and presents various challenges facing people without paying prior visit to us in order to know actual challenges we are facing and our opinion on what needs to be done. In that case do you except those meeting to come up with something to help us small-scale farmers in villages? (Small-scale farmer at Mikese Ward, 17th May. 2018)

4.1.4 Limited knowledge and lack of climate change information

District, ward and village official as well as NGOs representatives affirmed that they have little awareness of the NCCS the same has been reported by small-scale farmers. This have been contributed by absence of the document in all level also the language which was used to prepare the document is in English which is not friend to small scale Farmers. The findings revealed that none of the respondents has read the document. One respondent heard about it in seminar as reported below.

Myself I first heard about NCCS when I attended a seminar in Dodoma in 2017. However I have not read it and I have never met that document anywhere, even here at the council we don't have that document, even when you try to ask another environmental officer from another District Council you will receive the same answer. I have been in Mikumi District Council my fellow environmental officer there does not have it and are not aware of it, even me if not that seminar in Dodoma it could have been the first time to hear it from you despite being an environmental officer. (Environmental officer at MDC, 20th May. 2018)

4.1.5 Lack of working facilities

The study revealed that working facilities such as car to assist movement of experts to meet with farmers in the villages is not available. One of the key respondents at the district level revealed that.

We do not have enough working facilities such as car and motorcycle, imagine our department has no even a single car and as you know most of our work requires us to go field to meet with our clients who are farmers, with that situation it becomes difficult for us to go field at a require time hence farmers cannot receive our timely assistance to support them effectively adapt to negative impacts of changes in climate. We depend on cars from Council Director which

has no assurance you can ask for the transport to go field but you receive a negative response. (DAICO, 16th May. 2018)

Additionally the study revealed that due to lack of transport most of the small scale farmers interviewed had not received the services from extension officers, in this regards most of the reports produced by extension officer are the cooked reports since they don't visit farmers as one of village chairperson explained 'we normally see the extension officer writing the monthly report and we are wondering how are they producing those report while they don't visit farmers to collect the required data.' Also one of the small scale farmers explained since we are many those extension cannot reach all of us but at least they should organize a training seminar for famers in each of the farming season in order to train us on various technologies of adapting climate changes.

4.1.6 Political interference

It was revealed that governments at ward and village level are not free to implement their duties and responsibilities due to political interference as on of the ward councilor explained as follows:

It is very difficult for us to carry out our responsibilities if that duty requires changes of people's actions and practices, if you take action which is against their will or which require changes in their practices they say that they will pay back in the ballot box by not choosing you as their leader. Hesitating to annoy voter we are forced to use the experts and other public official to enforce law, policies and regulations, which was then our responsibility. (Councilor of Mikeke Ward, 19th May. 2018).

One among the ward extension officers interviewed stated having been threatened by a politician who forced him to provide cashew nuts seeds to a vendor out of the procurement guideline. After the extension officer had clarified the possible effects of ignoring the provided procedures and guidelines as well as the problem that might happen after farmers to know what happened the politician demanded for conversation among the extension officer and vendor. This illustrates how some policymakers or

politicians are willing to interference climate change adaptation initiatives for the purpose of safeguarding their political interests.

Additionally, political interference manifested by the policy maker to introduce projects, which have political benefits to them and not necessarily responding to the needs of community. Those projects are not reflecting the needs of farmers and do not observe the environmental management activities within a study area. Hence poor implementation as they don't receive positive response from farmer as interviewed Ward extension officer reported that:

That we have the cottonseeds in our office with the instruction that we are supposed to give those seeds to farmers, but as I'm speaking to you those seeds are still in the office we did nothing to them since that project was not the requirement of farmers and it came out of politician pressure without observing the climatic condition of our area. (Ward Extension officer at Mikese Ward, 20th May. 2018)

4.1.7 Lack of agricultural input and infrastructure

The study revealed that small-scale farmers are constrained by not having quality agricultural input to support them adapting to negative impacts of climate change. As one of small scale farmer explained:

Agricultural inputs is a problem, not necessary insecticides/pesticides but also quality seeds, in order to improve agriculture production you need to use quality seeds and sometimes you can buy those seeds or you can use the seeds provided by government official through vouchers but when we use them yet do not grow. (Small-scale farmer at Mikese Ward, 17th May. 2018)

Additionally, key respondent at the district, ward, and village levels as well as representatives from NGOs affirmed that agricultural inputs are expensive for small scale farmer to afford them and worse enough there is also fake input in the market that expose small scale farmer to more vulnerability to climate change. Agricultural officer reported that:

In year 2018 high breed seeds costs Tshs. 6000/=per kg, Open Pollinated Varieties (OPV) Tshs. 4000/= per kg and the government intention is for farmers to use high breed seeds but farmers cannot afford to buy those seeds as the results they use their traditional seeds. The same to fertilizers, the cost for Di-Ammonium Phosphate (DAP)is Tshs. 55,000/= per kg, UREA Tshs. 54,000/= per kg, insecticide and pesticides, of low cost is Tshs.10000/= depending on the quality. Additionally storage facility of high technology is too expensive for instance there are grains storage bags but too expensive for small-scale farmer to afford them costing Tshs. 5000/= per one bag. (Agricultural officer, at MDC, 22nd May. 2018)

In addition to the high cost of agricultural inputs, it was reported that those inputs have low quality and sometimes when used by farmers does not germinate.

The availability of fake agricultural inputs, which is the result of free market, puts small-scale farmers in more danger of being affected by climate change. For example maize seeds quality depreciate after seven months and it has to be taken back to the laboratory for quality verification but business people don't abide to that as the result they sell seeds with low quality to farmers as the result their production is affected and sometimes they don't germinate which is exploitation to them as they are forced to replant. (DAICO at MDC, 22nd May. 2018)

Also, lack of farming input is manifested by the reports from small-scale farmers who revealed that the agricultural inputs are not available during the cultivation season:

Availability of agricultural inputs especially seeds is not reliable; sometimes we receive seeds while the season for planting is over. For instance in 2018 we did not get the inputs in time and they were sold with high price, as a result many of us decided to use traditional seeds which consequently had very low yield as those seeds were affected by unknown diseases which turns the crops into yellow colour, those traditional seeds did not adapt too climate change. (Small-scale farmer at Mikese Ward, 23rd May. 2018)

On top of that it was also reported that lack of infrastructure constrains farmers to effectively respond to the new pattern caused by changes in climate, including lack of irrigation infrastructures, water wells, and market for selling their products.

4.2 Small-scale farmers' awareness on climate change adaptation related policies.

The study aimed to generate knowledge on whether small-scale farmers are aware of the available policies on climate change to facilitate adaptation process. The study revealed that there is limited awareness to climate change related policies to both small-scale farmers and government official at local level. Lack of extension services to small scale farmers play a great role in small scale farmer awareness about climate change related policies, since the awareness is related to availability and accessibility of information which can trigger their perception towards those policies.

The findings show that small-scale farmers are directly disturbed by ongoing effects of changes in climate however they are not aware of climate change related policies. This can be assessed by looking at two things; first the language that has been used to produce those policies, they are written in English while many farmers don't know that language, second is the availability of the documents, the government have failed to circulate policy documents to reach farmers in villages so that they can be aware of it. All small-scale farmers interviewed responded that they did not know if there are policies regarding climate change.

I am not aware of any policy about climate change and I can say that I'm not sure if there is such kind of policy at my age I have never seen any extension offer or environmental officer in my village educating people about presence of any policy relating to climate change and I am not sure if there is any farmer who will tell you anything different. (Small-scale farmer at Mikeke Ward, 19th May. 2018)

Responses from FGDs revealed that they have never received any extension services on existing policy to help them adapting climate change, but climate change as a concept they have heard it through media and experts from Sokoine University of Agriculture (SUA) and they perceive policies in relation to reforestation, and conservation of catchment areas as one of small scale farmers responded that.

I only know about the policy of tree planting and conserving the catchment areas, which can not help us to effectively adapt to negative effects of climate

change, because adapting to climate change require government commitment to empower farmers and put them in good position to undertake measures to address it. (Small-scale farmer at Mikeese Ward, 16th May. 2018)

Additionally all extension officers interviewed reported not to be aware of the NCCS of 2012. This manifests that there is poor coordination in policy formulation and implementation which results to national policy gap between policy makers and the implementers. When asked about the awareness on NCCS extension officer reported that:

It is new thing to me, we don't have that knowledge, servant from agriculture and livestock department we have not given that education or knowledge about that strategy may be staff from other departments. In my view there was no involvement of all stakeholders, participation was not properly done leaders at ward and village level did not participate and it has to be clear without proper participation and involvement of key stakeholders education will not reach to the required population. (Extension Officer at Mikeese Ward, 17th May. 2018)

4.3 Adaptation strategies utilized by respondents in MDC

Due to the absence of systematic implementation of NCCS of 2012 due to number of revealed constraints, researcher intention under this objective was to identify adaptation strategies employed by small-scale farmer to help them improve agricultural production. Small-scale farmers reported the following strategies as their reaction to the perceived negative effects of changes in climate to agriculture:

4.3.1 Planting drought resistant crops and short seeds

Results show that, some of the interviewed farmers planted crops which are resistant to drought like sorghum, millet, and cassava in order to respond to climate changes especially unreliable and insufficient rainfall also they use seeds which takes short time to mature. As one of the interviewed farmers responded:

We are forced to cope with the situation, if we don't receive rainfall on time I must opt for using short season seeds, which mature early unlike the traditional seeds that we were used to. Therefore I prepare my farms early so that as it rains I sow seeds but when you delay we might end by getting nothing at all.

(Small-scale farmer, in Mikese Ward, 17th May. 2018)

4.3.2 Intercropping

It is a farming system in which farmer grow more than one crop in a single plot, the study revealed that in MDC many farmers use this system to adapt effect of climate change “ I grow more than one crops in one plot like maize and sunflower, or cowpeas or beans and sunflower in one farm, however with the current climate even when you grow more than one crop still production is low”.

4.3.3 Crop rotation

The study revealed that small-scale farmers, who perceived climate change in relation to the outbreak of diseases and pests, adapt to those effects through crop rotation farming. As one of the interviewed farmer reported:

The problem of climate change has resulted to outbreak of unknown new diseases and pests and what I normally do is to consult agricultural experts for advice and they advice me to use crop rotation farming system, in the sense that if this year I planted maize in one of my plots the following year I grow leguminous crops, with the notion that pest and likely diseases will not affect crops. Small-scale farmer at Mikese Ward, 17th May. 2018)

4.3.4 Changing farm size and harvesting system

It was reported by some of the interviewed farmers that they have decided to change their farm size as well as harvesting system due to climate changes. Small-scale farmers reported to decide either to reduce or to increase the size of land for cultivation in order to respond to impacts of changes in climatic conditions in agricultural production. It is due to increasing needs of using inputs to overcome the impacts of climate change such as pests and diseases outbreak. As one of the farmers replied;

Horticulture require high inputs, you cannot harvest without using insecticides or pesticides. Neither watermelon nor tomato can be harvested without using pesticide; it was not the same in previous years currently there are outbreak of many new and unfamiliar diseases which forces farmer to use fertilizers and insecticides or pesticides as much as possible which adds to the cost of production. (Small scale- farmer at Mikese Ward, 17th May. 2018)

Additionally, one of the interviewed small-scale farmers reported that.

The cost for farming inputs is too high as a result I decided to reduce the size of the horticultural farm. Therefore that crop which require much pesticide or insecticides like water melon, I have decide to reduce the size of that farm and increase the size of the farm in which I grow crops that does not require a lot of pesticides or insecticides like maize. (Small-scale farmer at Mikese Ward, 17th May. 2018)

Additionally interviewed farmers reported that they have decided to change the harvesting system in order to have money to support farming activities. As one of small scale farmers reported:

I have changed the harvesting system. I harvest law maize and sell them in order to generate money, which will facilitate the production of the horticulture crops, which requires a lot of pesticides or insecticide. I do so because despite the fact that horticulture requires a lot of pesticides and fertilizers it has a nice market returns unlike maize. (Small-scale farmer at Mikese ward, 17th May. 2018)

4.3.5 Irrigation

Few farmers, those who dwell near water sources, use this strategy. Due to unreliable and insufficient rainfall one of the respondent reported to decide to shift to near water sources so that to engage in irrigation agriculture.

I have decided to look for farms located near to water sources so that to engage in irrigation agriculture because field located along water bodies hold water for a long period unlike those farms which are not located to near water sources, therefore even after the rain season I manage to produce, however mostly I grow vegetable crops. (Small-scale farmer at Mikese Ward, 17th May. 2018)

However, one of the respondents reported that “due to the potential and demand of those farms along water sources the cost to buy or lend them is high compare to farms located far from water bodies”.

4.4 climate change related policies in MDC

The study revealed that climate change adaptation policies in MDC are inadequate. Interviewed environmental officer reported that

There are no specific policies to guide climate change adaptation strategies in MDC also as a nation we are lacking a National policy for addressing climate change, which means that the government has failed to plan for climate change adaptation which would have guided LGAs in developing and implementing direct measures to support adaptation undertaken by small-scale crop producers who are exposed to negative impact of climate change to agricultural production. (Environmental Officer at MDC, 20th May. 2018)

Interviewed key informant showed their concern for the government to have a National Climate Change Policy and then to formulate a strategy with concrete actions to facilitate implementation of that policy. As key informant from MVIWATA reported:

Government formulated a strategy for climate change without having a clear climate change policy, in actual sense I expected to have a policy first then a strategy as an instrument for policy implementation, it is time now for government to formulate a National Climate Change Policy even if the impacts brought by climate change cut across different sectors the policy will mainstream activities undertaken by different affected sectors. (Key informant from MVIWATA, 22nd May. 2018)

The following were suggested to be considered in the policy: it should empower local government to incorporate the climate change issue in their strategic plan and allocate fund on their implementation, should stipulate concrete action plans which are implementable, establish an effective means to communicate and empower local community mostly, farmers by securing internal market for local products and establishing a financial system in which farmers will have an access to loan with low

interest, and capacity building to people who will effectively play a role of ensure that the policy is effectively implemented.

Small-scale farmers on the other hand had the view that there is a need of them to participate on the formulation process of those policies. They recommended for the policies, which reflects their needs and environment, policies to empower them to effectively adapt to effects of climate change and those policies must be channeled through their village assemblies and written in a friendly and simple way for them to read and get the required information. As one of small-scale farmers reported as follows:

It is time for government to focus on climate issues because changes in climate affects us a lot, farmers in our village are not happy because we depend on agriculture but production is becoming low day after day due climate change, no way for us to get out of poverty under the current situation. Only if I could meet with those who make policy I could tell them how badly we are affected so that they make a good policy to help us adapting to climate change impacts. (Small-scale farmer at Mikese Ward, 17th May. 2018)

Furthermore systematic document review revealed that the UNFCCC is core multilateral forum focused on addressing climate change and variability issues, having almost worldwide membership. On 12 June 1992 and 17 April 1996 Tanzania signed and ratified the UNFCCC respectively which become into force in 16 July 1996 also on 26 August 2002 ratified a Kyoto Protocol which came it to force in 16, February 2005 three years after the ratification of the Kyoto Protocol. UNFCCC call for all member countries to establish a long term goal of improving adaptive capacity, establishment of resilience plan and decreasing vulnerability to climate change impact by taking into consideration effects, mitigation efforts and adaptation needs.

The findings also shows that Tanzania has adopted and implemented various governance response with the aim to address climate change effects, some of the reviewed includes the NNCS (2012) The ZCCS, (2014), NAPA (2007), the Renewable Energy Strategy, National Forest Policy (1998), National Environmental Policy (1997), National Fisheries Policy (1998), National Agricultural Policy (2013), and the National Water Policy

(2002), However the findings shows that most of the policies reviewed acknowledges the challenges of climate change on various sectors, but, NCCS (2012) and ZCCS (2014) are the only documents, which comprehensively elaborate adaptation and mitigation actions and contain provisions on what needs to be done in different sector in adapting and mitigating effects of climate change. However, the actual cost and the source of fund for implementation of the strategies have not been determined by the strategy also no monitoring and evaluation framework in place.

Furthermore it was also revealed that climate change effects does not receive high attention or consideration by some of sectoral line policies, plans and strategies for example; The National Agricultural Policy (2013) outlined numbers of agricultural constraints and challenges which relates to low production but climate change is not mentioned as a challenge in the policy. Tanzania's energy strategy does not state climate change or explain the real plan in case of drought occurrences despite the fact that as a country we highly depends on Hydro-Electrical Power, National Water Policy acknowledge that effective water management can address climate change impacts but does no direct measure to address climate change has been addressed the same to wildlife Policy, National Forest Policy (1998), National Tourism Policy (1998), National Fisheries policies (1998). Also no specific fund has been allocated for the number of reviewed strategies, for example no climate change specific funding in the Medium Term Expenditure Framework, additionally adaptation not explicitly addressed in Village Land use plan.

CHAPTER FIVE

DISCUSSION OF THE FINDINGS

5.0 Introduction

Chapter five is about discussion of research results presented in chapter four. The discussion focuses on the linkage of research results to policy formulation and implementation process, in order to provide suggestions that can enable effective adaptation and hence improve the agricultural production in MDC

5.1 Constraints for effective implementation of NCCS of 2012 in MDC

The study revealed that the systematic implementation of NCCS is not happening in MDC. The effective implementation is constrained by various issues as discussed hereunder.

5.1.1 Limited awareness and lack information about climate change

The study revealed that there is limited knowledge and lack of information about climate change as well as appropriate reactive and proactive measures or plans required to addressing climate change effects to both small-scale farmers and extension officers which hamper the ability of small scale farmers to adapt to the effects of climate change effectively. Limited awareness results from lack of extension services contributed by their number and few available extension officers in the villages who are also constrained by lack of working facilities like car and motorcycle to facilitate their movement in delivering of services. Additionally it results from government failure to circulate policy documents to the LGA's. Government official reported to not receive the NCCS document despite the fact that the implementation plan of the NCCS proclaim to work with LGAs as stated in the document that Office of Prime minister Regional Administration and Local Government (PMO- RALG) will closely work with Local Government Authorities (LGAs) through their departments to implement the strategic

interventions at local level (URT, 2012). Poor dissemination of government plans and strategies result to most of national plans, policies and strategies remain unknown by the key policy implementer.

These findings are like findings presented by Siedenburger (2008), that many farmers in developing countries including Tanzania are not aware of climate change adaptation techniques at macro and micro level. This scholar argued that information and knowledge about climate change adaptation plays a very essential role to enable small-scale farmers to apply effective measure to climate change effects. These findings are also similar to what a study conducted by Nzeadibe *et al.* (2011) reported, that lack of knowledge and climate change information is a main constraints which hinder farmers in the Niger Delta to effectively adapt to climate change impacts.

The problem of limited awareness and lack of climate change information has been a problem that most of government initiatives aimed to address (NAPA, 2007, URT, 2012,). However, awareness creation has not been effectively done, limited awareness and lack of climate change information are still reported as constraints to effective implementation of climate change adaptation activities, this is because climate change issues have not been given the priority by our government and it is little bit addressed through various donor funded projects. Therefore calls for government commitment in implementing its plans, policies and strategies are unavoidable. Without political will and government commitment most of the good established plans, projects, policies and strategies they will remain unknown to the key policy implementers and neither changes will be observed, nor good result will come out of them.

Awareness on adaptation measures is important for enhancing farmers' ability to adapt to effects of climate change as well as improving agricultural production. Adequate climate change knowledge and availability of information on climate change conditions are crucial because effective adaptation to climate change impacts demands first farmers to observe that climate has changed, also to identify useful adaptations strategies which

are available and then apply them (Maddison 2006). Likely to what Antle (2009), reported that knowledgeable farmers are in good position of using suitable modifications to address climate change impacts for the purpose of improving their agricultural production. There is a positive link between information and knowledge in adaption. Education gives access to information, new technology and production methods and therefore increases the probability of adaption (Deressa *et. al.*, 2008). Information from outside the local system can come through extension service or Farmer Field Schools (Challionor *et. al.*, 2007). Extension service is believed to increase adaption (Maddison, 2007).

The problem of low agricultural production in the MDC is associated with limited understanding and unavailability of information about climate change condition to farmers, so that they could effectively adapt to climate change impacts hence improving agricultural yield. Farmers who know what to do in light to the effects of climate change can improve agricultural production by taking appropriate measures to experienced effects. This awareness can be channeled through radio, television, village meetings and seminars.

5.1.2 Budgetary constraints and lack of capital

Limited Governmental budget and individual lack of capital was reported to be a constraint for effective climate change adaptation activities, it accounts for low knowledge of adaptation technologies to small-scale farmers, because experts at district and ward level have failed to train small scale farmers on the available technologies that could help them to successful address climate change impacts through the use of demonstration farms. Budgetary constraints also hinder innovations in a way that experts cannot innovate adaptations plans to help small-scale farmers to effectively adapt to climate change impacts due to lack of fund.

Lack of capital to small-scale farmers is associated with poverty, as most of the dwellers in MDC live under food poverty line. According to the planning, statistics and monitoring department (2011), the average individual annual income (Per Capital Income) for Morogoro District Council is approximately US \$ 72 annually, (Tshs 250/= per day). Due to lack of capital small scale farmers have failed to use high technology to adapt to climate change such as green houses, harvesting rainwater, the use of high breed seeds and industrial fertilizer as it was revealed by key informant that due to climate change agricultural activities is currently expensive, as it is require the use of industrial fertilizers, industrial improved seeds as well as insecticide and pesticides due to the outbreak of diseases.

These findings correspond to the finding reported by a study conducted by Mburu (2015), in which financial constraint was reported to be the major limitation for small-scale farmers in Yatta District, Kenya, to adapt to effects of climate change. Small scale farmer low financial capability results from notion that farmers are not trusted to be given loans by financial institutions because their production is not predictable as they depend on rain-fed agriculture which is also not predictable also low price for the agricultural product which makes them earn little. The same was reported by Adger *et al*, (2003), that lower prices of agricultural prices which results from import competition, adds to climate change risks to farming communities in India.

These findings also correspond to what was reported by Antwi-Agyei *et al*. (2013) on barriers to climate change adaptation in sub- Saharan Africa: evidence from northeast Ghana, in which lack of financial resources was identified as a critical constraint to effective climate change adaptation.

NCCS states that climate change adaptation and mitigation in Tanzania will depend on financial support from international community to a large extent complemented by domestic funding from government budget, private sector, as well as individual contributions. (URT, 2012), however due to lack of technical capacity in the public

offices it is not easy to secure international fund. The international funds require environmental experts to write a well-established climate change proposal for them to fund those projects. As a result adaptation to climate change impacts is ineffective and results to low agricultural production.

5.1.3 Inadequate inclusion of key policy stakeholder policy formulation processes

Poor participation and limited inclusion of key policy stakeholders has resulted to the limited awareness of climate change related policies, and lack of sense of ownership of various governmental projects, hence poor implementation. It can also be said that inadequate inclusion of policy actors profound for policies which are not informed by research evidence which would help the identification of local people's needs and challenges that face them in order to be effectively addressed by policies.

These findings reflect those reported by Ampire *et al.* (2017) to be major institutional constraints for climate change adaptation in Uganda. According to them with the policies formulated with limited policy actors and scientific outputs, which are explained into a format that is not user-friendly to normal citizens who are not scientist then it is difficult for local people to effectively implement those policies. Therefore key actors participation in the formulation to governance response to climate change including small-scale farmers who are directly impacted by climate change is crucial so as to accommodate views and pinion of vulnerable and marginalized stakeholders. This is contrary to what Adger *et al.* (2007), argued that increased participation in decision making requires the inclusion of new social actors, which can lead to increasing complexity in the negotiation of objectives and pathways to achieve those objectives. Therefore inclusion should observe the complexity brought by climate changes it requires technical knowledge related to possible future consequences coupled with uncertainty nature of those changes.

5.1.4 Political interference

Political interference was reported to be among the constraint that hampers effective implementation of NCCS. The issue of political interference includes conflicts between politicians (policy decision makers) and street level bureaucrats at district and lower levels (policy implementers). Political interference, as stated by one of the key informants, expressed as conflict of interest where by politicians struggle to save votes by either ignoring implementation of policies, laws and regulations to avoid disappointing their voters or supporting actions that are damaging to the environment like allowing settlement in flood areas and conserved forest. Such tendencies developed doubt between citizens and government officials.

These finding are similar to what a study conducted by Ampaire *et al.* (2017) reported that political interference constraints the implementation of adaptation strategies in Rakai District in Uganda. To them political interference is mainly the outcome of inadequate decentralization, unclear division of responsibilities as well as absence of accountability (Ampaire *et al.*, 2017), also another study by Adger, *et al.* (2007) asserted that shared rights and responsibility for resource management and decentralization are best suited to promoting resilience. To them devolving responsibility for allocating resources and resolving conflicts among multiple parties enhances efficiency of decision making, increased trust in government, and increased capacity at the local scale to undertake, for example, monitoring and enforcement

Political interference results to poor implementation and enforcement of environmental policies and laws hence hamper the ability of small-scale farmers in MDC to effectively adapt to the effects of climate change. Experts in local areas cannot enforce the available rules, regulations and law due the fact that it depends on who those rule, regulations and laws are applied, as a result people mistrust government organs as they see them incapable of enforcing its own laws. In the study areas there are number of cases of illegal livestock migrants who move from one village to another without following

available rules and regulations, they do so after being assured protection by village political leaders as the result is resource conflict among crops grower and livestock keeper in the study area.

Additionally political interference in the study area also results from the introduction of agricultural projects, which do not reflect the needs of farmers but carries political interest to policy decision makers. These findings relates to what Adger *et al* (2007) stated that failure to acknowledge power imbalances among multiple policy actors basically changes adaptive governance toward supporting existing inequalities and the continuation of limited interests. However from this experience politicians could learn to play a role of information dissemination to the local people about various practices their effects to climate and how they can respond to negative effects of climate changes.

5.1.5 Lack of enough technical staff

It was revealed that there is lack of technical staff to support the implementation of adaptation strategy. Having limited number of technical staff resulted to failure in the provision of extension services to small-scale farmers as well as failure to access climate change funds from donor with technical their requirement on proposal writings. It was revealed that MDC have three environmental offices, to carry the responsibility of sensitization about climate change and adaptation strategies in the whole district, which becomes difficult to them. These findings are similar to what Antwi-Agyei *et al.* (2013) reported to be the constraints in Most Sub Saharan Africa that extension officers are overwhelmed by the numbers of communities they serve, making it practically impossible to attend to the needs of all farmers.

These findings are also similar to what another study conducted by Ampaire *et al.* (2016) which reported that lack of technical capacity limit adaptation to climate change in Uganda. They reported that without enough technical staff it is difficult to change governmental plans into actions as a result there is poor implementation of governmental plans and policies. Biagini *et al.* (2014) reported that capacity building is very important

in enabling adaptation at the local level. Additionally, lack of technical capacity in the public offices makes it difficult to secure international climate change funds, as a result climate change activities in the local community is not implemented and no innovation is done by available staff to assist small scale farmer to improve their production as result small farmers depends on their own awareness and knowledge to adapt to climate change does not help them to effectively adapt the impact of climate change.

4.1.6 Lack of working facilities

Key respondents at district, ward and village are not effectively engaged in climate change activities due to lack of working facilities, more important being lack of transport facilities such as car and motorcycle. The department of agriculture and environmental department in MDC have neither car nor motorcycle in turn it became difficult for officers at the district level to move in ward and villages so that to implement climate change activities including trainings on climate change and how farmers can adapt to the negative effects of climate change. Alternatively they assign those activities to extension officers in ward and village level whose technical capacity is low and are having no any means of transport to visit farmers in their different part of villages. As a result they report findings, which are not relevant as they fail to visit farmers so that to know the reality in case of production and challenges they face in carrying out their agriculture activities.

5.1.7 Lack of agricultural input, poor market and irrigation infrastructure

Due to climate change farmers are required to use high agricultural inputs in order to harvest, they require to use improved seeds which go in light to climate change, and use pesticides or insecticide to avoid diseases brought by changes in climate, lack of agricultural inputs accounts for high cost of agricultural inputs for small scale farmer to afford them, but also availability of fake agricultural inputs which adds the vulnerability of small scale farmers to climate change. On top of the high cost of production low price for the products discourage farmers to effectively adapt which is associated to lack of

storage facilities as a result farmer fails to determine when to sell and how much to sell. The same was reported by Antwi-Agyei *et al.* (2013) to be the constraints in most of sub-Saharan African countries. This is because most of them cannot store their produce and therefore accept whatever price they are offered

Furthermore lack of irrigation infrastructure makes the farmers to entirely depend on rain-fed agriculture. According to Komba and Mchaponwa (2015), irrigation is the dominant adaptation method that farmers would ideally want to use to respond to observed climate change but currently they are constrained by circumstances.

5.2 Small-scale awareness on National climate change Strategy.

The study revealed limited awareness of the NCCS and climate change related policies. Results from lack of extension services, which play a great role in awareness creation about the available policies and the climate provisions, stipulated in various policy documents. In relation to that the study revealed that availability and accessibility of information, which can trigger their perception towards those policies is lacking. Small-scale farmers who are directly affected by on doing climate change are not aware of climate change related policies. Lack of awareness is also associated with language that has been used to produce those policies, they are written in English language while many farmers don't know that language, second is the availability of the documents, it was found that none of the visited villages, and ward office had a copy of any policy document. The government has failed to circulate policy documents to reach farmers in villages so that they can be aware of it. All small-scale farmers interviewed responded that they don't know if there are policies regarding climate change.

Despite their number, unfortunately extension officers in the study area also reported not to be aware of any climate change policy including NCCS. This situation is the illustration of having policy, which are not informed by researches, lack of inclusion of key stakeholders and participation of local community in the policy process. As a result those policies lack ownership and they become difficult to be implemented. Tanzania

Climate Action Report (2015), reports that approximately 75-80% of Tanzanians earn their livelihood through smallholder agriculture, making it important to mainstream climate change adaptation measures within agricultural development strategies.

With the age of 7 years the NCCS, which is the only government with, provision that aim at climate change adaptation and mitigation, however it is not known by key policy implementers this is worse for a country whose economy depends on Agriculture.

5.3 Adaptation strategies employed by respondents in MDC

Adaptation refers to an adjustment in ecological, social, or economic systems in response to observed or expected changes in environmental stimuli and their effects and impacts in order to alleviate adverse impacts of those changes (Adger *et al.*, 2007). Adaptation to climate change involves changes in social and environmental processes, perceptions of climate risk, practices and functions to reduce potential damages or to realize new opportunities (*ibid*). Changes in agricultural management practices in response to changes in climate conditions often involves a combination of various individual responses at the farm- level (Mburu *et al.*, 2015) in doing so farmers are likely to reduce the effects of long-term changes in climate variables on agriculture. According to Burton *et al.* (2006), throughout human history, societies have adapted to natural climate variability by changing settlement and agricultural patterns and other aspects of their economies and lifestyles.

Despite the fact that there is no systematic implementation of the NCCS, the study recognized that small-scale farmers in MDC employ various strategies to adapt to climate change such as planting drought tolerant and early maturing crops, changing farming seasons so as to go with changes of rain season, intercropping, crop rotation, changing farm size and irrigation. These adaptation strategies were mainly self-directed adaptations where farmers changed their livelihoods in reaction to changing rainfall patterns. The residents use these types of adaptations basing on collected information and experiences over the years.

5.3.1 Planting Drought Tolerant and early maturing crops

Coping with the rainy season and choice of the type of crops are among appropriate climate change adaptation techniques since a small scale farmer who has experienced several droughts for many years, and expects drought occurrence in the future, may adjust certain crops production practices to manage drought risks and in case of unreliable rainfall can change the time for sowing crops. Drought tolerant crops withstand low water and high heat conditions while still maintaining their aesthetic and functional qualities (Borel, 2009). Few of the interviewed small-scale farmers reported that they opt to grow crops like cassava, millet and sorghum with the mentioned characteristic as alternative crops to maize, which cannot withstand drought. Others use short season seeds or early maturing crops in order to avoid the insufficient rain consequences. According to Komba and Mchaponwa, (2015) farmers use short-season crops when temperatures increase. An increase in the average annual temperature has an impact on farmers' adaptation to climate change using short-season crops. A study conducted in Kilimanjaro by Mwakalila, (2010) shows that, about 11% of farmers are using modern short season seeds as adaptation strategy to cope with short season rains

However it was observed that in the study most of dwellers prefer to grow maize as main crops, which are vulnerable to drought, and this results to insufficient production and the mentioned drought crops are only produced as the alternative crop as they offer an alternative to suffering from hunger through seasons due to crop failure results from insufficient rainfall. This results from lack of education on how to improve agricultural production. These findings are similar to what a study conducted by Komba and Mchaponwa (2015) reported that Farmers who are more educated and those households with more highly educated members tend to use drought-resistant crops more often.

Therefore, lack of knowledge on how to effectively adapt to effects of climate change renders small-scale farmers growing maize, which is vulnerable to climate change, and they grow cassava, millet and sorghum as alternative so secure availability of food.

According to (Kurukulasuriya and Mendelsohn, 2006) poor crops selection of crops among small-scale farmers is due to lack of awareness. To them, crop selection is important in the light of rainfall variability and unpredictability. Wrong election of crops results to poor production because small-scale farmers entirely depend on rain-fed agriculture.

The government has a campaign of motivating small-scale farmers to grow cashew nuts, which also withstand drought, and in this campaign small-scale farmers are provided with free seeds so that they grow them. The government's intention is for small-scale farmer to have an alternative cash crop and not to sell their food crop. In the study area farmers used to sell most of their maize to get money so with this it will help them to have an alternative cash crop and save maize for household consumption.

However logistic issues hamper these efforts, as farmers in the study area reported that free drought tolerant seeds are always issued after the beginning of rains and lack of sense of ownership to that campaign as one of the extension officer reported farmers who received free seeds used them differently, some ate or sold them, after detecting that problem they use deceptive mechanism to tell them that those seeds have poisons so when they eat or sell to people they can cause death.

5.3.2 Intercropping

It is a system of farming in which farmers grow more than one crop in field. It is an old strategy, used mostly by farmers, as a risk management in case of one crop failure then the other one will secure the family needs. However, some expert perceive intercropping as an outdated farming practice to them the best agriculture is monocrop, which is farming practice in which farmers grow one crop in a field, therefore those who mix crops as a means to adapt climate change but also as a means to manage crop risks in case of one crop failure they end up by producing low. However this farming system is common in Tanzania. In the discussion with farmers it was noted that farmers are aware of the benefits of mixing crops where many mix maize which is cereal crop with beans

or groundnuts legumes and nuts crops. Others mix maize with sunflower so that to meet different needs maize for food and sunflower for cash. The same results were reported, farmers diversify crop types as a way of spreading risks on the farm (Orindi and Eriksen 2005; Adger *et al.*, 2003, Mary and Majule, 2009). Crop diversification can serve as insurance against rainfall variability. According to Shayo, (2006), it is common to find more than five different crops being grown in a piece of land in the common drought-prone areas.

5.3.3 Crop rotation

It is a farming system in which farmers change crops production in one plot, that is if this year a farmer grow maize then next year will grow different plant in that plot. It was observed that farmer use this system of farming to adapt to the effect of climate change such outbreak of pests and diseases also they do crop rotation as a traditional mechanism to manage soil fertility. A farmer who uses crop rotation as an adaptation strategy still is vulnerable to climate change in case of insufficient and unreliable rainfall.

5.3.4 Changing farm size and harvesting system

It was revealed that due to the increase of cost in agriculture activities caused by climate change farmers were forced to either reduce their farms or increase them. Farmers reduced the farm size for the crops, which require the use of high inputs such as too much fertilizers and pesticides or insecticides, and increase the farm size for the crops, which require little use of the farming inputs. Also farmers decide to harvest their maize crops before they are dry in order to sell and earn money, which will assist them to carry other agricultural activities by facilitating the production of another crop

5.3.5 Irrigation

The Tanzania Agriculture Policy encourages the need for the country to use irrigation farming as an important aspect of agricultural development strategy, which can help the nation to achieve three major objectives: improvement of food security; increasing

farmer's productivity and income; and production of higher value crops such as vegetables and flowers (URT, 2013) the study revealed that few farmers those who dwells along the water sources managed to engage in irrigation agriculture, cultivating vegetables, using traditional irrigation schemes. According to Mwakalinga, (2010) traditional irrigation schemes are characterized by poorly constructed and temporary infrastructures that are usually associated with significant water losses and low crop productivity.

In the discussion with farmers it was noted that it was not easy to engage in irrigation activities because of lack of irrigation infrastructure and those farms located near to water sources are difficult to secure as a results many farmer depend only on the rain-fed agriculture. According to the District agricultural officer 82% of farmers depend on rain-fed agriculture, which adds their vulnerability to climate change. Findings from this study are similar with those presented by Makundi (1996) who stated that many farmers in Tanzania depend on rain-fed agriculture which makes them more vulnerable to climate change (drought), weather changes, especially uneven distribution of rainfall and hence these farmers attain low agricultural production. Over-dependence on rains has been a major constraint to higher production. According to Komba and Mchaponwa (2015), irrigation is the dominant adaptation method that farmers would ideally want to use to respond to observed climate change but currently they are constrained by circumstances.

5.4 Policy and legal framework for climate change adaptation

The government of Tanzania has undertaken various international and national reactions regarding addressing the impacts of climate change in various sectors. However, policies to address climate change effects and helping small-scale farmers in MDC to adapt to the adverse effects of climate change are inadequate and not effectively implemented as a result low production and low-income generation. Agricultural policy for instance aim to develop an efficient, competitive and profitable agricultural industry that contributes

to the improvement of the livelihoods of Tanzanians and attainment of broad based economic growth and poverty alleviation (URT, 2013)

Most of the reviewed policies were formulated in 1990s and early 2000s when the issue of climate change was not given a serious attention by the government. They includes National land policy (1997), National forest policy (1998), National fisheries policy (1998) National environmental policy (1997) those policies acknowledges that climate is changing but do not have a clear statement or provisions on how to address climate change. Additionally climate change adaptation planning is not well incorporated by available policies. In regard to this, there is a need for adaptation planning the review and amendment of those policies so that they can accommodate the needs of addressing climate change effects and lays a ground to support small-scale farmers to effectively adapt to those effects.

Presently the matter of climate changes is under taken care with regards to the National Environmental policy of 1997 and EMA of 2004. Section 75 of EMA gives power to Ministry of State in the Vice President's Office for Union Affairs and Environment to take needed measures to address issues concerning climate change. This involve a detachment from Ministry of Agriculture, which is the most vulnerable sector affecting the livelihoods of 80% of Tanzanians. In 2012 the government launched the NCCS after the rising concern of the negative impacts of climate change. According to Ampire *et al.* (2016), it is the key strategic document that guarantees successful employment of climate change adaptation measures in Tanzania and also acts as a guide to other sectors strategies. However the strategy is yet to develop a separate monitoring and evaluation framework and therefore depends on the present government standard monitoring and evaluation processes and procedures.

CHAPTER SIX

SUMMARY, CONCLUSION, RECOMMENDATIONS AND POLICY IMPLICATIONS

6.0 Summary

The study established that MDC experiences variability and changes in rain season, rain seasons that were previously predictable are no longer predictable, farmers in the district had a tendency of cultivating twice within a year during short rainy season which experienced from October to December and long rainy season experienced from March to the end of May but currently short rainy season is no longer experienced and long rainy season is also unreliable. This climate changes have an account to low agricultural production in MDC as farming activities have been negatively affected by drought, and outbreak of pests and diseases. Additionally, due to climate change agricultural activities demands the use of high technological inputs, which will work out in light to outbreak of pests and disease as well as drought and insufficient precipitation.

The study established that small-scale farmers in MDC are ineffectively adapt to climate change effects due to the infective implementation of NCCS of 2012, which faces a number of constraints including, inadequate human and financial resources, lack of working facility, inadequate inclusion of key policy stakeholders in policy formulation process, limited awareness and lack of climate change information, lack of agricultural inputs and poor infrastructure and political interference. Awareness to climate change related policies by small-scale farmers in MDC is generally low, this account for inadequate inclusion into policy formulation process, lack of extension services, the use of unfriendly language in writing policies and failure of the government to circulate policy documents to lower level organ of government such as village government.

Furthermore, Small-scale farmers in Morogoro District Council were found to engage in various self-directed adaptation strategies to the effects of climate change such as plant

drought tolerant and early maturing crops, intercropping, crop rotation, changing of farm size and harvesting system and irrigation. In adapting to the effects of climate change the following were mentioned to constrain small scale farmers to effectively adapt: lack of capital, and limited technological awareness on how to effectively adapt to climate change, lack of irrigation infrastructure and market, lack of farming inputs, as well as lack of climate change policy to guide the adaptation activities. Policies to address adaptation to climate change and to help small-scale farmers to effectively adapt to negative effects of climate change are insufficient.

6.1 Conclusion

From those findings, the following can be concluded: The findings indicated that crop yield has been declining in MDC over years. Government response in addressing climate change through the establishment of the NCCS has faced a number of constraints, which leads to ineffective systematic implementation of adaptation of the strategies as stipulated in the strategy. The constraints to employing effective adaptation strategies reported were lack of finances and human resources, limited awareness and information on climate change, lack of agricultural inputs, lack of irrigation infrastructure and market, inadequate inclusion of key policy implementation actors, and political interference.

Awareness of climate change related policies by small scale farmers is generally low as a result there is ineffective implementation of those policies since farmers do not consider the formulation of those policies to be of their advantages. Low awareness of policies is contributed by inadequate inclusion of key policy actors in the process of policy formulation and implementation, the language which has been used to write the policies is English and many farmers in MDC fluently in Swahili language, absence of policy document at local level, lack of extension services and having policies which are not informed by researches.

Small-scale farmers in MDC have developed self-directed adaptation strategies to climate change, which are basically used, as a means to manage crop risks in case of one crop failure then there is another to meet the household needs. Changes in agricultural practices reported to be employed includes growing drought tolerant and early maturing crops, intercropping, crop rotation, changing of planting seasons and harvesting system and few of them use irrigation. Some of those adaptation strategies are more effective than others. However, knowledge of climate change adaptation strategies and small-scale farmers' perception on the impact of climate change influenced a choice of these adaptation strategies.

Policies to address adaptation to climate change and to help small-scale farmers to effectively adapt to negative effects of climate change are insufficient. This situation is worse when considering that small-scale farmers are highly dependent on climate to secure their livelihood. The only governmental document that has significant climate change provisions is National Climate Change Strategy, which has not been implemented in the study area as none of the interviewed respondent reported to have knowledge of that document. This was also observed by the fact that document is written in English and it was not circulated in the LGAs as none of the key respondents at the district and ward level reported to have seen that document in their office.

6.2 Recommendations

The study recommends that rain-fed agriculture needs to be complemented with water harvesting techniques and development of small-scale irrigation scheme in order to help small-scale farmers to irrigate their crops in case of unreliable and inadequate rainfall. In the case of lack of funds, the Tanzanian government should assist the farmers who are not yet in the SACOS and/or VICOBA credit organizations by forming groups so that they can be considered for low-interest agricultural loans, which will assist them in adapting to climate change impacts by applying new technologies of farming inputs.

To diminish the problem, lack of farming inputs, the Ministry of Agriculture should ensure that agricultural officers and agents provides appropriate amount of required subsidized inputs at the appropriate time, on top of that, severe punishment should be given to those agents who sales fake agricultural inputs. To address the issue of market of agricultural products the national policies should secure the internal market to assist farmer in increasing the price for their products, also there is a need of the government to prepare a training program to educate farmers on how to improve the quality of their products by applying high technologies in production in order to get market outside the country.

Ineffective implementation of climate change related policy and the NCCS resulted from insufficient inclusion of policy actors, which account for limited awareness policy and lack of ownership of those policies, financial constraints, lack of enough human resources, lack of working facilities and political interference. It is recommended that government should formulate a National climate change policy in order to create conducive environment for development stakeholders to plan and implement adaptation measures, also the policy will guide climate change adaptation activities, and enables small-scale farmers to adapt to the effects of climate change. The formulation process, should ensure participation of all key policy stakeholders in order to accommodate views and opinions from diverse groups, and to create sense of ownership, which will ensure effective implementation of the policy.

It was found that most of the available policies were formulated in the 1990s when the issue of climate change was not given high recognition and those policies does not have a clear statement or provision on how community can adapt to the climate change effects. There is a need of reviewing them to reflect the current magnitude of climate change effects, which has been manifested in different sectors including affecting agricultural production. Formulated or amended policies should observe the indigenous knowledge on adapting to the impacts of climate change to create sense of ownership.

The government should ensure that policy documents are written in a friendly language to non-scientific community and are circulated to the lower governmental organs, which are accessible by the local communities so that to ensure accessibility of those policy and it will enable local communities to be aware to those policies hence facilitate effective implementation. Additionally, to ensure effective implementation of policy there is a need for the government to allocate budget for climate change adaptation activities, invest on developing staff to carry the implementation activities and who will be able to write technical proposals to secure international donor fund, and last the government should ensure accountability in public office and practical implement the decentralization policy to collect the issue of political interference

6.4 Policy implications

Government has an essential role to play in establishing the policy and regulatory frameworks in order to support adaptation by individuals, households and private sector. As observed, formulating good policies does not guarantee effective implementation and successful adaptation at household level. The MDC case illustrate that ineffective implementation of NCCS at district level, hinders small-scale farmers to effectively adapt to negative effects of climate change on their agricultural activities, hence there is low production since farmers have failed to effectively adapt. The policies addressing climate change must acknowledge role of local communities who are the key actors in the implementation process, and who are directly affected by climate change. The consultative workshop used by responsible ministries in developing policies conducted for the purpose of collecting stakeholder's views in the formulation of NCCS for instance was not enough to ensure inclusiveness and more participation of local people, which resulted to unknown strategy hence no systematic implementation of that strategy in MDC.

6.5 Area for further study

The study suggests further studies to be conducted on impacts of climate change adaptation strategies employed by small-scale farmers on environment in MDC. The reason for suggesting that is to generate knowledge on whether the climate change adaptations strategies employed by small-scale farmers contribute to the occurrence of climate change.

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APPENDEXIES

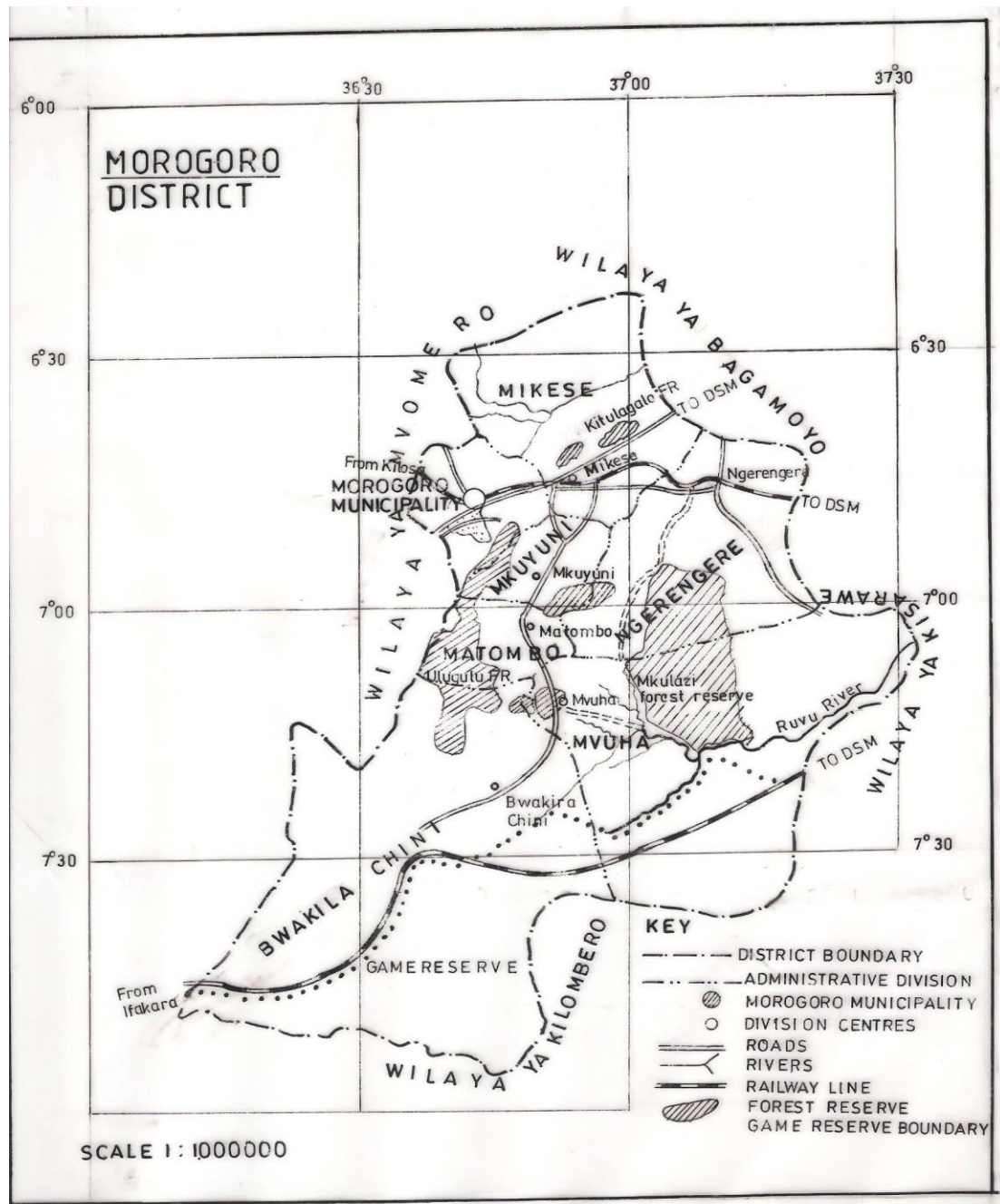
Appendix I Research Process Running Order

The time plan for the study will be as follows:

Time	2018					
Activity	January	March	April	May	June	July
Study Designing /Concept Note Paper Preparation						
Research Proposal writing						
Field Data Collection&Report writing						
Report presentation & Dissertation production						

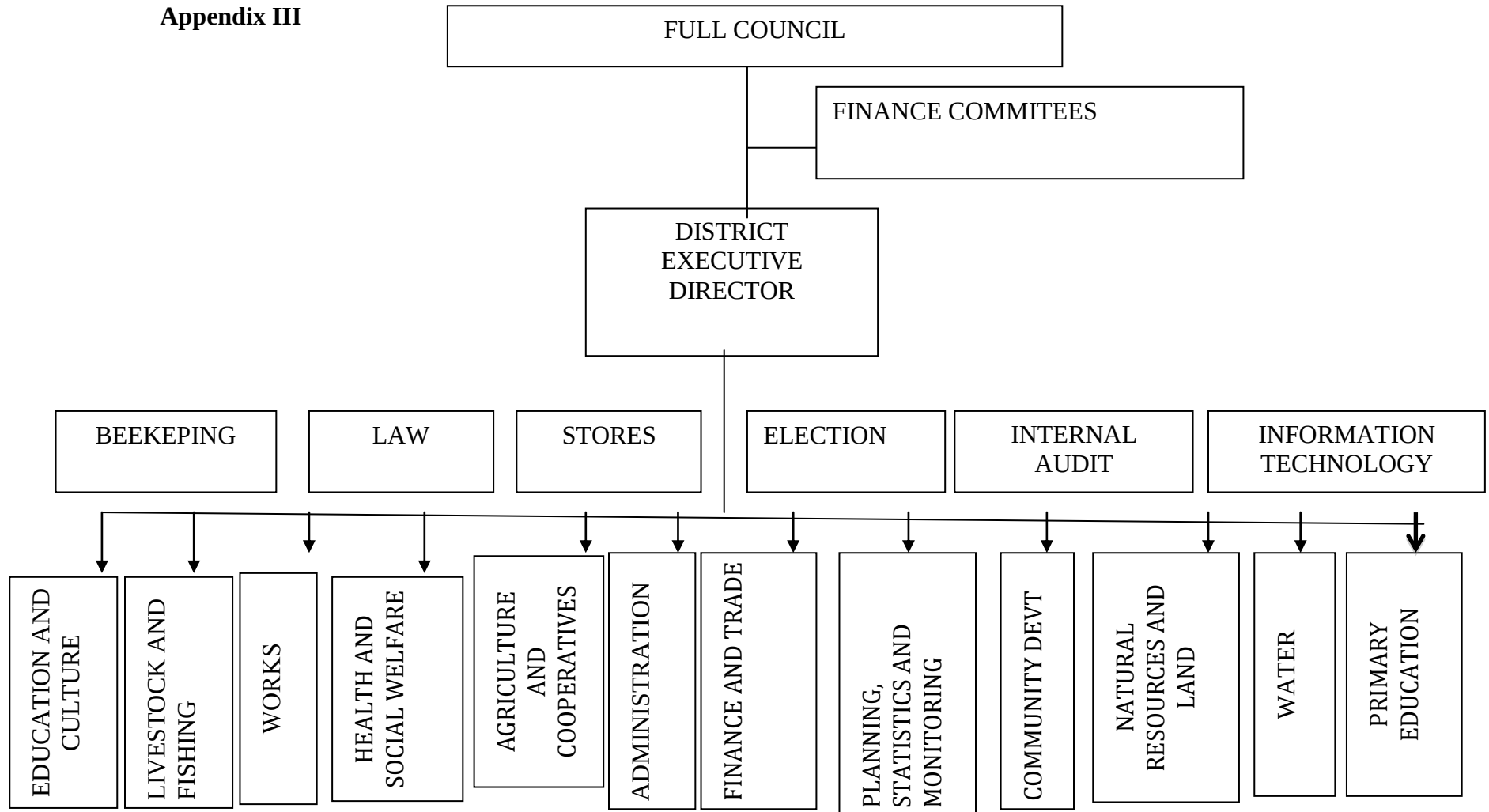
Source: researcher, 2018

Appendix II Map of Morogoro District Council



Source: Morogoro District Council Social Economic Profile, 2012

Appendix III



Source: Morogoro district council strategic plan 2011-2016

Appendix IV

Interview guide for key informants

1. What do you understand about the NCCS of 2012?
2. How is NCCS implemented in your district?
3. Which adaptation strategies have you witnessed being employed by small-scale farmers in Morogoro district to counter the effects of climate change?
4. How do those strategies related to NCCS?
5. How does your organization / office play role in the implementation of NCCS?
6. What are the constraints for effective implementation of NCCS?
7. Which policies can be put in place to facilitate adaptation strategies employed by small-scale farmers and helps them to improve food production?

Appendix V

Interview guide to small-scale farmers

1. How is climate change affecting agriculture in your village?
2. What strategies do you undertake to adapt to those impacts?
3. What are constraints facing you in employing adaptation strategies?
4. How district / government support you to adapt to climate change impacts?
5. How frequently have you been visited by an agricultural extension officer?
6. What kind of support is required/needed to withstand the climate change impacts in your area?
7. Are you aware of the policy, laws and regulations governing climate change in your area? If yes, what are they?
8. Does the government promote and practice the existing policy, laws and regulations towards better agricultural activities? If yes how it has been useful to your side?
9. If they are not effectively what are your suggestions to improve the situation?
10. What any general comment you have about climate change, agriculture and poverty alleviation?

Appendix VI FGDs Questions

F G Ds questions for small scale farmers, staff from Morogoro district council and extension officers

1. What do you know about climate change?
2. How do small-scale farmers adapt to negative effects of climate change?
3. Does Morogoro District Council have any policy, which guides adaptation strategies? If yes can you explain it?
4. How does the council organize itself to make sure that small-scale farmers are effectively implementing adaptation strategies?
5. What do you suggest on improving the implementation of NCCS?