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National Adaptation Strategies to Climate Change Impacts.

A Case Study of Mozambique.

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NATIONAL ADAPTATION STRATEGIES TO CLIMATE CHANGE IMPACTS
A CASE STUDY OF MOZAMBIQUE

By Albertina Bambaige

1.0 Introduction

Climate Change projections indicate that the world temperature is increasing continuously. According to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2001), the global average temperature will increase by 1.4° C to 5.8° C between 1990 and 2100 if the levels of emissions are not reduced. This is largely attributed to the anthropogenic activities especially the use of fossil fuels in the developed world. Developing countries are considered to be the ones suffering more from the effects of climate change and African countries are even more vulnerable due to their dependence on natural resources.

Although Africa's contribution of greenhouse gas emissions to global warming is low, it carries the greatest burden of the impacts of climate change, mainly due to lack of ability to cope with and adapt to this phenomena. The impacts of climate change in Africa are generally manifested in human health and in the agricultural sector worsening the existing levels of poverty and undermining all development efforts in this continent (ILRI, 2006).

The effects of extreme weather events associated with climate change are devastating to the poor populations. Mozambique is vulnerable to climate change and the frequency of natural disasters such as floods, droughts and tropical cyclones is increasing. Some of the major floods which have occurred in Mozambique include the 1984- Umbeluzi River, the 1976 –Incomati River, the 1977 – Limpopo River, the 1973 – Buzi River, the 1974- Save River and the famous 2000 floods in the Central and Southern regions of the country. These floods were considered the worst in 50 years, directly affecting 2 million people and forced them to leave their homes. About 700 people died. The damages were estimated in 600.000.000 USD and led to a decrease in the country's economic growth from 10% to 4% (INGC, 2002).

This study demonstrates the risks and vulnerabilities due to climate - related disasters and climate change. It also analyses the existing government policies to enhance resilience and adaptive capacity for the more vulnerable sectors and population in Mozambique. Financial and institutional constraints of the government strategies and the role of international cooperation in reducing the constraints are also a focus of this report.

2.0 Background information to Mozambique

Mozambique is located in South-Eastern Africa, bordering the Mozambique Channel, between South Africa and Tanzania. The geographic coordinates are between 10°27' and 26°52'at South Latitude and 30°12' and 40° 51' East Longitude. The territory covers a surface area of 799 380 km^2, with 786 380 km^2 constituting the land and the remaining 13 000 km^2 consisting of water bodies. It has a terrestrial border of 4.445 km long and a coastal line length of 2 515 km.

The country emerged from nearly 500 years of colonial era and became independent in 1975. Mozambique is one of the poorest countries in the world. Socialist mismanagement and subsequent civil war for about 16 years exacerbated the situation. In 1987, the government

embarked on a series of macroeconomic reforms to stabilize the economy. Since the peace agreement in 1992, Mozambique has been working hard to rebuild the country implementing a number of market-based policies combined with donor assistance and with the good political environment since the multi-party elections. All these factors have led to an increase in the country's economy with a Gross Domestic Product (GDP)-real growth rate of 7,2% in 2005 (The World Fact book-Mozambique, CIA, 2006) and a reduction in the inflation rate of 7,8% in 2005.

Although Mozambique's is considered one of the world's highest economic growth rates, it is still one of the poorest countries in the world with a Human Development Index (HDI) of 168th, according to the UNDP Human Development Report, 2005. Mozambique depends strongly on foreign aid for part of its annual budget and the majority of the population (70%) still live below poverty line. The population of the country is of 19,686,505 inhabitants with 81% in the subsistence agricultural sector. The industry sector contributes with 41,2% for the GDP, followed by services with 34,6% and agriculture with 24,2%.

The long civil war in the country resulted in increased migration of the population to urban areas, with adverse impacts on the environment and 35.6% of the population living in the cities. Poor infrastructure combined with lack of access to basic services such as water and sanitation has led to a number of health problems including malaria, diarrhoeal diseases and cholera. HIV-AIDS is also one of the major threats to the country's economy with 12.2% of the adult population aged from 15 to 49 years old infected.

Figure 1: Map of Mozambique showing its Location

2.1 Climate Change / Variability in Mozambique

Mozambique is particularly vulnerable to climate change due to its poor infrastructure and geographical location (along Indian Ocean Coast with some areas below sea level). About 55% of the country is considered to be vulnerable to climate change. The extreme weather events affecting Mozambique include Floods, Droughts and Cyclones and occur throughout the country. Droughts are more common in the southern region of Mozambique, while floods are frequent in the central and northern region and tropical cyclones can hit all of the country.

The agro ecologic zones can be characterized as follows: 25% of the area is semi-arid and 28% is humid–dry, 40% is sub–humid and only 5% is classified as humid areas. Since about 80% of the population depend directly on land and natural resources in Mozambique, the effects of climate change and variability are likely to have a great influence on the communities and in the economy in general. The main sectors likely to be impacted by climate change according to Mozambique's Initial Communication to UNFCCC include: Agriculture and food security, water resources, costal resources, biodiversity, human health and infrastructure.

The table below summarizes the expected major climate change effects as identified in the Initial National Communication and National Adaptation Plan for Action (NAPA):

Table 1: Climate change related adverse effects and its impacts by sector

CLIMATE RELATED ADVERSE EFFECT	SECTOR/AREA IMPACTED	IMPACTS
Floods	Agriculture, forest, water resources, health, livestock, coastal resources, tourism, ecosystems, infrastructure, flood plains of main rivers basin such as Limpopo, Incomati, Pungue, Save, Zambezi, Umbeluzi, Maputo and Buzi.	Loss of life, crops, ecosystems, property, human and animal habitats, outbreaks of pests and diseases, displacement of people, movement of land mines, destruction of infrastructure (communication network, schools, hospitals, houses, etc.), erosion, land degradation, etc.
Droughts	Agriculture, water resources, ecosystems, health, food security, livestock and low lying areas.	Crop failures, water scarcity, drying of water reservoirs (dams, fish pond, lake, rivers), famine, loss of human and animal lives, stresses in the marine living organisms, loss of biodiversity, environment degradation, salt intrusion, erosion.
Tropical cyclones	Country wide, particularly along the coastal area, during rain season.	Loss of life from collapsing structures. Damage to structures (rural community houses, school blocks, hospitals, etc) due to sub-standard constructions. Destruction of crops, forest plantations & natural trees. Bush fire enhancement in the dry season.
Sea level rise	Coastal area, river water resources	Loss of land and infrastructures, increased erosion, salt intrusion,

According to the Mozambican Initial Communication to the UNFCCC the effects of climate change are as follows:

- Increase of the mean air temperature by between 1.8 and 3.2 ºC;
- Reduction of rainfall by 2 to 9%;
- Increase of the solar radiation from 2 to 3%, and;
- Increase of the evapo-transpiration by between 9 to 13%.

Computer simulations already indicate that the coastal area resources, water resources, agriculture and forests could be negatively impacted. Pastures seem to be the only sector where it would be possible to observe an increase of the foliage, but conversely, the reduction of the nutritional capacity due to the weak absorption of nitrogen, would counterbalance, in a negative way, the predicted increase in pastures.

Various sectors of the Mozambican economy are vulnerable to the effects of climate change, therefore there is a need to adopt measures in order to lessen the impacts of climate change. Adaptation to climate change is the only option for countries like Mozambique. The response of the community to the climate change/variability has become known as their capacity to adapt and this should be supported by national policies. The Government of Mozambique has recognized the problems that can arise from changes in climate and has shown its commitment to stabilize the greenhouse gases and ratified the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol.

3.0 Main Institutions involved in the process

A number of government and non governmental agencies are working in areas related to climate change/variability with a focus on disaster management. Studies to assess the future impacts of climate change on the frequency and severity of disasters, demonstrating options of risk reduction and disaster preparedness and the implications on humanitarian response and the relation with climate change are in place. These studies have shown that climate change increases the urgency of integrating risk management into development intervention (DFID, 2006, IFRDRCC, 2003).

3.1. Ministry for Coordination of Environmental Affairs (MICOA)

MICOA is the main government institution dealing with the issue of climate change and is engaged in a number of activities and measures to tackle the problem. These include awareness raising workshops on the UNFCCC to meet the country's commitment to the convention. The elaboration of NAPA, capacity building programme for the implementation of the Clean Development Mechanism (CDM) sponsored by the Dutch Government, the preparation of the First National Communication and currently the Second National Communication are MICOA tasks including elaboration of Green House Gases inventory for 1990 and 1994. The Ministry has worked with The Netherlands Climate Change Assistance Programme on Vulnerability assessment for maize in the Chokwé district, for the water resources for the main river basins of Mozambique, for the coastal zones in Beira and for forestry and pasture for the Chokwé District. The main role of MICOA is to coordinate the implementation of the Environmental Strategy for the Mozambique Sustainable Development in order to reduce absolute poverty, promote sustainable use of natural resources and improve the quality of the general environment, economic growth and social well being (MICOA, 2003) .

MICOA is the responsible institution for the coordination of the implementation of the UNFCCC. Therefore, to comply with the objectives of the convention, a multidisciplinary group was created, encompassing different sectors: agriculture, water, energy, planning and finance, health, forestry, disaster management, science and technology, Academia, NGOs and civil society. These institutions are directly related to the convention's objectives.

There are two groups: the Vulnerability and Adaptation Group, and the Inventory Group. The first one is responsible for assessing the vulnerability of the country in terms of adverse effects of climate change and draw out adaptation measures through analysis of the following climate change parameters: temperature, precipitation, wind, cloudiness and sunshine hours.

The vulnerability and adaptation group also identify the data needs, the availability and suitability of data and establish datasets baselines for the assessment, and review the vulnerability assessment of the following sectors: agriculture, water resources, natural ecosystems, forestry, and human health. Based on the results of the vulnerability assessment studies, the group evaluates the feasibility of available adaptation measures to meet their specific needs and concerns arising from the adverse effects from climate change.

The elaboration of the National Adaptation Action Plan (NAPA) to implement those measures has been one of the highest priorities in order to have a clear distinction of responsibilities among the relevant stakeholders, timeframe for fulfilment of the recommended measures, financial resources issues and identification of possible barriers, constraints and risks to implement the adaptation measures.

The group is also working on the chapter on "Programs containing measures to facilitate adequate adaptation to climate change," in accordance with the UNFCCC guidelines.

Yet the inventory group is responsible for the elaboration of the Green House Gases Inventory and suggests mitigation measures for the main emission sectors. The main activities are as follows: undertake national Green House Gases (GHG) inventories according to the National Communications' Guideline, including information on the other non-direct GHGs such HFCs, PFCs and SF_6 as well as CO, NO_x, SO_x and NMVOCs.

The inventory group also collects the available data from national sources to fill inventory data gaps, identifies and develops methods to overcome inventory data gaps and identifies barriers for obtain existing data for key emission sources. Additionally, the work group calculates emissions for all sectors and describes procedures to collect and archive data for the preparation of national GHG inventories and ensure the continuity of this process including information gathering and coordination among the sectors and their role in the process.

3.1.1 An Overview of the NAPA process in Mozambique

Following the objectives of the convention, Mozambique has initiated in August, 2003, its National Adaptation Program of Action (NAPA) and this document is expected to be concluded by April

2007. MICOA has established a multidisciplinary group, the so called NAPA team. Its task is to coordinate the activities and elaboration of the NAPA document. Participatory evaluation was undertaken in 31 districts of the 10 provinces of Mozambique. The total of 621 people were interviewed at national level and from them 37% are from the provinces located above the Zambeze river, namely Niassa, Cabo Delgado, Nampula and Zambézia, 24% are from the central part of the country (Tete, Manica and Sofala) and 39% in the south of Mozambique (Inhambane, Gaza and Maputo). Twenty eight percent (28%) of those interviewed are professionals from the government institutions and NGOs, 29% are community leaders and 43% are community members.

The NAPA document focuses on the following main adaptation issues:

- Strengthening the early warning system,
- Strengthening the capacity of the local communities who mostly depend on agriculture to deal with the effects of climate change,
- Reducing the impacts of climate change such as coastal zones erosion and water resources management to respond to the effects of climate change.

Project costs for the urgent adaptation needs identified in the NAPA are divided into four phases. From the first phase until the last one the following amount of money will be used: 1500,000 USD, 2500,000 USD, 2000,000 USD and 2000,000 USD respectively.

Institutional framework for the implementation of NAPA has been carried out by MICOA, where they have already identified the relevant institutions to be involved in the process. However, MICOA has not yet defined the responsibilities of these institutions.

NAPA can be seen as one of the strongest ways for mainstreaming adaptation into National Policies and strategies; however, the process should be as participatory as possible. The involvement of all relevant sectors is crucial for the success of NAPA projects. Additional capacity building regarding climate change and adaptation should be undertaken along with the implementation of NAPA projects. NAPA can be a starting point for a clear definition of an adaptation policy in Mozambique, if adaptation to climate change is incorporated into the development agenda and poverty reduction strategies.

3.2 National Disaster Management Institute (NDMI)

This Institute is a government agency and was created to manage and prepare for the natural disasters in the country. The Disaster management policy (INGC, 1999) has defined as its main strategies to reduce the risks and vulnerabilities the following:

- Civil Society involvement in planning and programme designing for prevention, response measures and rehabilitation of the affected areas
- Integration of the prevention actions in other sectors and development planning
- Development of plans by sector according to types of disasters; for example fire management plans, epidemic plans, industrial accident plans.
- Implementation of the community based projects and promotion of appropriate technologies.

- Education and awareness campaigns for the vulnerable communities in terms of risks, disaster management practices, preventive actions, response measures, working closely with the media and alerts in local languages.
- Encouraging the use of insurance risk.
- Institutional training, mobilise financial resources and adequate equipment for prevention and rescue operations during disasters.
- Organizing financial and material resources to allocate to the already identified more vulnerable areas.
- Promote saving policies to be used during disasters periods.

The NDMI has created a multidisciplinary board designated Technical Council for Disaster Management, managed by the NDMI director, who is responsible for all emergency activities. The board should be managed taking into account different sectors and emergency actions. All Ministers representatives are members of the referred council (INGC, 1999).

In 2006 the National Disaster Management Institute has elaborated the Master Plan to guide the activities in terms of disaster management including disaster preparedness and response, given the frequency of disasters in the country.

The NDMI was initially created with the main objective to respond to disasters in case of emergencies; however the focus has changed to disaster preparedness.

A number of strategies to respond to and prevent the natural disasters are included in the Master Plan (Plano Director de Prevenção e Mitigação das Calamidades Naturais- INGC, 2006). These strategies were defined for a period of 10 years and also focus on the vulnerability reduction of the local communities. The master plan was prepared under the Poverty Reduction Strategy Paper and of the Five Year Programme of the Mozambican Government.

The strategies defined in the Master Plan for prevention and mitigation of natural disasters should be treated both as cross cutting issues in all government sectors and as specific complementary actions directed to specific regions which are considered vulnerable and need special attention (MPPMND: 2006).

The fact that the master plan for the prevention and mitigation of natural disaster is part of National policy can make the implementation of the designed strategies difficult. Although the long term disaster preparedness can be considered as adaptation to climate change, these adaptation measures should be translated into local levels in order to have the desired results on the ground.

The Master Plan for the Prevention and Mitigation of Natural Disasters has introduced the concept of Resource Centre and Multiple Use to tackle a number of issues defined as disaster prevention and mitigation. The centre has started to develop some activities, where the NDMI's technicians are working closely with local communities. Based on field experiments they are implementing water logging practices to reduce the impacts of droughts. They are constructing small dams, for multiple use which can be used for irrigation, fish farming and if possible for recreation and eco-tourism, however, the main objective of the dams is water supply for agriculture, livestock and

human consumption. The Department of Treasury has allocated some money for the implementation of these activities.

The Resource Centre and Multiple Use is also involved in promotion of drought tolerant crops and low circle life crops, creation of food reservoirs for the shortage periods, introduction of new crops, conservation agriculture and alternative sources of income in the communities.

The benefits of the transition from the response approach to preparedness can be felt in the country. The 2007 floods can be used as an example, as the impacts are considered less that the 2000 floods. It is important to mention that these two floods dimensions were not the same in terms of amount of rainfall received in the affected regions.

3.2.1 An overview of 2000 floods and 2007 floods

In February 2000, Mozambique suffered its worst flooding in almost 50 years. Approximately seven hundred people died and hundreds of thousands were displaced. Over 49 countries and 30 international non-governmental organisations provided humanitarian assistance. Coordination of disaster assistance is critical for effective humanitarian aid operations, but limited attention has been directed towards evaluating the system-wide structure of inter-organisational coordination during humanitarian operations (More, S, et all, 2003)

In the beginning of 2007, weeks of heavy rain from December 2006 to March 2007 have triggered floods along the Zambeze River and its tributaries, washing away homes, bridges, livestock and crops in four central provinces (Tete, Manica, Sofala and Zambezia). According to the Natural Disaster Management Institute, an estimated 285,000 people have been affected by the floods, of which 163,000 people have been displaced.

People affected by the floods were sheltered in the accommodation centres created for this end, however some people in the 2000/2001 floods found accommodation in centres established during the emergency phase. This constitutes an advantage in terms of existing accommodation for the 2007 displaced people. The 2000/2001 floods experience was used in the 2007 floods in terms of disaster management.

On the 22 of February 2007, a tropical cyclone named ‘Favio’ hit Vilankulo District in the Inhambane Province and continued through the Sofala and Manica Provinces. According to the NDMI, the cyclone killed 9 people and affected 160,000 people, destroying crops, and threatening local food security. Both the floods and cyclones have affected approximately 500,000 people and caused about $71 million in damages to local infrastructure and destroyed 227,000 hectares of crops

It is important to mention that the coordination among the Mozambican government represented by the NDMI and the partner organizations has improved during the emergency period. Different government agencies and Non Governmental Organizations, UN agencies were involved in emergency operations. The NDMI prepared the population with an early warning system, emergency aid centres and coordination channels which can be considered effective during flood periods. The role of NGOs and other government partners was crucial in the success of the disaster management. For example GTZ (Gesellschaft für Technische Zusammenarbeit – German Technical Cooperation) provides the institute with relevant advisory services.

A rapid flow of information is the essence of disaster prevention. The first communication centre was established by Télécoms Sans Frontiéres (TSF) at the NDMI office in Caia District on 15th February. This centre was used by the different organisations working in the area such as Oxfam, World Vision, Red Cross, WFP, UNICEF.

The Red Cross, USAID and other organisations have worked hard in distributing basic commodities, foods and medical assistance during the emergency period. However, according to the American Red Cross another $16.9 million is needed to assist 117,000 people for the next six months. This organisation has already contributed $200,000 in emergency assistance.

3.3 National Meteorological Institute (INAM)

Among others, the main activities of the National Meteorological Institute (INAM) which can be used to reduce the risk of climate related events include:

- Plan, install and ensure that all meteorological stations are working properly
- Plan, install and ensure that all meteorological stations for monitoring air quality are adequate. This is done in collaboration with the environmental authorities
- Research and gather information with meteorological international institutions
- Collect climate data and make it public
- Climate and meteorological oriented research
- Participate in Environmental Impact Assessment Studies in coordination with MICOA

Although INAM's responsibilities are defined in the institution policy and as can be seen above, there are a number of limitations and constraints faced by this government institution:

- Lack of financial resources for investments in equipment
- Lack of financial resources for the operations and maintenance of the existing equipment
- Poor planning of its activities and responsibilities
- Lack of qualified personnel and technical skills
- Lack of capacity for analysis of climate and meteorological data
- Insufficient capacity to identify and forecast climate alterations situations
- Lack of meteorological and climate data in time
- Low quality of information and low ability for meteorological forecast in time

In order to overcome the existing limitations INAM and the relevant institutions working with climate related issues, such as the Ministry of Environment, should develop a data needs assessment and identify priorities for data collection, analysis and interpretation. A clear definition of the INAM role and responsibility should be designed and made available to the public.

3.4 National Directorate of Water (DNA)

The National Directorate of Water is a government institution working under the Minister of Infrastructure and Housing. The water sector is critically affected by the effects of climate change/variability in Mozambique. The frequency of floods in the country makes this sector very vulnerable, thus its involvement in the disaster management strategies is important.

The sector has developed a number of initiatives to deal with the disasters (DNA, 1999), these include:

- Policy design and planning of the water resources management.
- Inventory of the national and regional needs.
- Alert system to floods consisting of information gathering about water levels of the main rivers, dam discharges and precipitation.
- Data interpretation and prevision of floods.
- Data collection is carried out by the operational agencies of the sector, which is the Regional Authority of Water (ARA) operating in the Northern and Southern parts of the country.
- Management of the Limpopo and Buzi river and floods control through construction of dikes and small dams.
- In coordination with the Natural Disaster Management Institute and Agriculture department, the sector is involved in construction of small irrigation schemes in areas vulnerable to droughts.

3.5 Technical Secretariat for Food Security and Nutrition (SETSAM)

This institution was established to coordinate all the activities concerning food security and nutrition for both government and non government agencies in the country. It promotes food security and nutrition through initiatives designed to improve the availability of information about vulnerable areas and their levels of food security and nutrition. SETSAM is working towards poverty alleviation and reduction of food insecurity and encouraging agriculture with crop variety.

3.6 Ministry of Agriculture (MINAG)

Among various actions in the national program of action for reduction of the impacts of droughts, MINAG is developing the following activities:

- Expansion of areas for perennial crops, through distribution of this type of crops
- Intensive agriculture for vegetables and crops diversification throughout the year
- Promotion of crops which are resistant to droughts (sweet potatoes and cassava) and replacement of crops which are vulnerable to diseases
- Production and multiplication of seeds
- Seeds markets promotion
- Distribution of equipment to prevent and combat pests
- Water resource management practices including construction of irrigation schemes such as pedestrians pumps to encourage sustainable agriculture

3.7 Red Cross-Mozambique (CVM)

The Red Cross – Mozambique plays an important role in disaster management and prevention, supporting the poor most vulnerable to disasters. Red Cross is working in coordination with government agencies including Ministry of Agriculture, Ministry of Health, Ministry of Social Affairs and the National Disaster Management Institute. The main objective of the Red Cross is to reduce the vulnerability through disasters preparedness and risk reduction practices. Red Cross Mozambique also provides aid in terms of food and water supply during and after disasters and health care.

Red Cross – Mozambique on its Strategic Plan has defined the area of Disaster Preparedness and Disaster Response as one of the priorities (Mozambique: Appeal, 2006-2007), with the following objective: Strengthening the capacity of the most vulnerable populations by supporting their development particularly regarding protection of their health and improvement of their social conditions so as to be better prepared to cope with disasters. To achieve the objectives mentioned in its disaster management policy, the Red Cross Mozambique stresses:

- The design and implementation of Community Based Disaster Preparedness Projects
- The training and consolidation of the Red Cross Mozambique local structures in order to strengthen the capacity of the institution in disaster response and help the communities to deal with disasters
- Assess the existing resources in the country

Red Cross- Mozambique has incorporated climate change into its activities, through implementation of the so called Mozambican Red Cross (MRC) climate change program. The project was to be implemented in Gaza Province, Chokwe district, community of Chiguidela.

The most important features of the project according to the Mission report prepared by Pablo Suarez in 2005, include:

- Use climate change (CC) to strengthen (MRC) capacity to reduce vulnerability in Mozambique, rather than using MRC to force long-term climate adaptation.
- Incorporate CC aspects through all levels of MRC, hiring not just a National Project Manager but also a provincial one, and getting 20 volunteers at the community level directly engaged with this initiative.
- Develop a community-level pilot project in Chokwe district (vulnerable to severe floods and droughts)
- Incorporate rigorous assessment of the impacts of interventions to learn from the field and support the case for a subsequent phase.

4. Key sectors to increase resilience and sustain adaptation measures

There are in Mozambique key sectors which are considered critical in terms of vulnerability to climate change. As such, to strengthen the resilience and promote adaptation measures in these sectors is crucial.

4.1 Agriculture Sector

Agriculture supports 80% of the population in Mozambique and contributes to 45% of Gross Domestic Product (GDP). The Ministry of Agriculture in Mozambique has defined a number of strategies which can be considered in adaptation to climate change: increase in seeds varieties, development of a national industry of seeds, development and research of new and alternative technologies and low cost technologies, adoption of community based knowledge, open new research centres at local level, promote conservation practices, invest in technologies to deal with droughts.

The above mentioned strategies should be translated into local practice at the community level. A study undertaken by Siri Eriksen (2006) has shown that the communities in Matidze district in Gaza province, a drought prone area, are already adjusting their practices and life style to increase resilience and adapt to climate. For example they are implementing coping strategies such as food storage, horticulture, informal trade, charcoal production, casual labour to adapt to climate

change/variability. Other farmers in Mozambique, should adopt these practices and others to cope with the changes in climate since the land will be strongly affected by increase or decrease in precipitation.

The agriculture department is also working in order to improve soil fertility through rehabilitation of some irrigation schemes in the Zambezia province. In Nicoadala district, for example, 22 hectares of land are now using an irrigation system. In Ninthulo district, Zambezia province, 45 hectares of land will benefit from the rehabilitation of an irrigation scheme and a small dam in the Lotiwa River is also being repaired.

4.2 Water Sector

Water is considered as a good with economic and social value. In Mozambique the largest water consumer is the irrigation, following by the supply to the urban areas, industries and last the rural areas (Direcção Nacional de Águas, 1999).

One of causes to extensive floods in Mozambique is due to poor dam management in the region as the main river bodies start in the neighbouring countries. The water sector in the country has defined as a priority the establishment of agreements on shared courses of river basins in more critical situations, like Incomati, Limpopo, Save and Pungue. In the medium and long term the Mozambican Government through the National Directorate of Water (DNA), is in process of elaboration of a national strategy of water resources. In this strategy the component of the institutional capacity building will be very important.

Dam construction to increase the production of hydropower and for irrigation purposes are some of the efforts undertaken by the water resources authorities in Mozambique. It is expected that a new hydropower dam will be built in the near future in the Zambeze River (Mepanda Uncua) upstream of Cahora Bassa Dam. Additionally, there is the prospect of building new dams in the following rivers:

- Moamba in Incomati river, for irrigation and water supply to Maputo city;
- Bue Maria in Pungue river, for irrigation and water supply to Beira city;
- Mapai in Limpopo river, for irrigation;
- Alto Malema in Malema river; for production of electric energy;
- Monapo in Monapo River, for irrigation and water supply to Nampula city.

According to the Annual Government Assessment Report of the Economic and Social Plan for the year 2005 (PES,2005), around 2,514 new water irrigation schemes were built in the Gaza, Niassa and Nampula provinces. Eighteen small irrigation schemes and 45 public systems for rain water logging were implemented throughout the country.

The total of 1189 water sources were built or rehabilitated in the rural areas. From this number 95 are new wells and 570 boreholes. These water sources are being used for approximately 6,500 families, increasing the access to potable water in the country for 42.1%.

4.3 Energy Sector

In Mozambique the most used source of energy is biomass and charcoal with 80% of annual consumption. This sector stresses the importance and the role of renewable energy such as solar

power and wind power for the country's economy and social wellbeing. The energy sector also defines as strategy the improvement in the forest management practices including reforestation programs. To increase the access to energy for the rural and urban population and promote environmental sound practices in the use of biomass are part of the energy policies.

The sector seeks to be involved in the use of substitute fuels like petroleum and liquid gas and capacity building for the communities in order to promote the use of renewable energies. There is need for energy sector staff training to install, monitor and maintain the equipment. To promote the use of the natural gas for energy supply in areas which are close to the production centre and implementation at low cost a national program of electrification to the districts which have no access to the electricity.

Under the Energy Sector, there is a National Energy Fund (FUNAE), which is a public institution, with its own autonomy with the objective of development, production and use of different forms of low cost energies and promotion of the conservation and rational and sustainable management of energy resources. The National Energy Fund provides technical and financial support for implementation of renewable energies in rural areas.

There are a number of projects being implemented and some already completed by FUNAE, for example the Guara Guara Project in the Sofala province located 168 Km from the Provincial Capital Beira. The project consisted in the implementation of 16 Photovoltaic systems in Guara Guara. One of the photovoltaic systems was installed at the local women's organization, the so-called "Círculo e Interesse". This group of women undertake various income generation activities, besides adult literacy. The installation of a photovoltaic system at the "Círculo de Interesse" will increase the literacy level, as it will allow for the introduction of evening courses. Currently, more than 400 families are interested in benefiting from the system.

Another project implemented by FUNAE is the Savane Project, located in the Administrative Area of Savane, in the Dondo District in Sofala province, which consists in financing for the acquisition of improved technologies for charcoal production. With the implementation of this Project, the environmental balance can be ensured by means of the improvement of the biomass and will promote the employment and development in the Administrative Area of Savane

The Michumwa project, located in the Administrative area of Metangula, Lago District of the Niassa Province, 109Km from the Provincial Capital Lichinga, also benefiting from a project implemented by FUNAE which consisted in the financing for the acquisition of a 60KVA generator and the installation of a Low Tension distribution network along 1km of line in the village. The project benefited 12 residences, one primary school, one health post, a church, the start up of cereal mill and an electric pump.

4.4 Health Sector

Climate and disaster related vulnerabilities are manifested through health problems in Mozambique. These include the outbreak of diseases such as malaria and cholera during floods periods. The Ministry of Health has defined some strategies to respond to occurrence of these phenomena. The Ministry of Health is carrying out a Roll Back Programme on Malaria which aims at reduction of malaria cases in the country, promoting the use of mosquito-nets and other prevention methods. The health sector is working in close relation with the Water Authorities

concerning water provision to prevent the outbreak of cholera. Awareness campaigns are also carried out by the Health Ministry on the water and sanitation aspects.

5. The Role of International Organizations

There are a number of international organizations working in Mozambique in the area of disaster management, vulnerability and risk reduction.

5.1 World Food Program (WFP)

World Food Program assesses the vulnerability state of the population in different regions in the country in terms of food security. The main role of this agency is food distribution for the most vulnerable poor. They also focus on the children, pregnant women and implementation of emergency programs taking into account the HIV – AIDS.

5.2 UNDP – United Nations Development Programme

The UNDP agency in Mozambique is working in the area of emergency and a number of activities are being carried out in the country including:

- Preparation of the national disaster plan and the establishment of an aid network to help NGOs and local authorities to strengthen the communities with disaster reduction practices
- Fund raising to support local communities to deal with natural disasters
- Improvement of the information system, public participation in disaster reduction and vulnerability reduction
- Improvement of the geographic and population information in the risk areas

UNDP is also involved in the capacity building programmes in the following areas:

- National Plans for reduction risks through financial support for training local communities
- Training in alert systems and awareness raising for the local communities
- Strengthen the capacity of institutions, through staff training at government level and other institution such as institute for disaster management
- Operationalisation of the disaster management through coordination with the technical council for disaster management based on the contingency plan
- Awareness campaigns and creation of information centres
- Regional coordination centre in southern Africa for implementation of regional programs

5.3 Famine Early Warning System Network Mozambique Integrated Information Network for Decision-Making (FEWS Net Mind)

There are six main objectives guiding the FEWS Net Mind activities in Mozambique:

- Improvement of early warning systems
- Improvement of the access and utilization of information relating to early warnings for disasters risk management
- Identification and improvement of constrains on issues relating to information about vulnerability
- Support to the contingency plans for pre disasters management and response
- Availability of information and analysis of disasters aiming for good planning of emergency strategy.

6. Considerations/Conclusions and Recommendations

The risks faced by Mozambique due to climate change and disaster related phenomena do not differ from other countries located in the tropical region. However, the Mozambican level of poverty, and therefore the capacity of the country to deal with the effects of climate change/vulnerability, makes the country more vulnerable. Lack of infrastructure such as hospitals, roads and low income houses worsen the situation leading to prolonged problems in health (spread of diseases) and food insecurity.

Although the Government of Mozambique has some policies to enhance resilience of the poor populations and in the various vulnerable sectors, mainly in the area of disaster management, these policies are not tackling directly the issue of climate change. These are pieces of policies which are not implemented efficiently due to lack of coordination among the involved sectors. There is need for harmonisation of the existing policies, improving the information circulation and movement from emergency actions to preventive plans and of great importance is to mainstream adaptation to climate change into key sectors.

The agriculture sector policies already being mentioned in the study on the implementation of drought tolerant crops, seed distribution and small dam construction should be encouraged and expanded to all vulnerable regions in the country, given that most of the time this is undertaken during emergency periods. Another adaptation option is to encourage the families to cultivate both in high fields and lowlands. While the lowland can produce good crops of rice, vegetables and potatoes, which can be destroyed during floods, highland areas can produce good crops of maize and cassava during flood years. However, the above mentioned practice can be difficult, especially for the women, who are major players in the agriculture, due to other social constraints in the rural areas such as long distances for the water sources, school of the children who also help in the fields.

Regarding the energy sector, Mozambique still has a big potential to implement renewable energies to expand electricity in the rural areas. Only a small part of the total population has access to electricity. There is room for introduction of clean technologies which promote sustainable development for power supply. Government policies mention the use of renewable energies for domestic purposes. This practice should be transferred to other provinces and districts in order to reduce the effects of climate change derived from deforestation, as trees are the main source of energy in the country.

The National Disaster Management Institute (NDMI) is a well recognised government agency dealing with natural disasters, especially in the case of floods, droughts and cyclones and it should play an active role in the area of climate change. In coordination with the Ministry of Environmental Affairs (MICOA), an institutional capacity on climate change adaptation for the NDMI staff would be appropriate in Mozambique. Additionally, the Ministry of Environmental Affairs should play the leadership in the coordination, implementation and monitoring of the climate change adaptation measures.

The main institutions involved in the area of disaster and climate related issues in Mozambique are lacking financial, technical and human resources to implement their actions. Most of the organizations do not have people who understand climate change issues. The actions undertaken by these organisations can be considered adaptation. However, they are not clearly designed as

such. In some cases, the existing financial resources are not utilised adequately due to poor planning, poor management and sometimes corruption problems. Training and awareness campaigns should be promoted among these institutions as well as to the civil society and private sector.

In Mozambique various Non Governmental Organisation and UN Agencies are working with humanitarian, social, economic issues and disaster management issues. They play an important role in assisting the local communities to deal with the risks and vulnerability to the effects of climate change. However, only some organisations like Red Cross are starting to work directly and clearly with the climate change issues. In terms of financial and institutional capacity they are working directly with the government in terms of definition of priorities although coordination can still be considered poor.

Coordination at national level, particularly among the most vulnerable sectors of the economy, including the capacity of sharing information is crucial to increase the resilience. Approaches which can demonstrate that sustainable development, proper natural resource management and long term disaster mitigation are equivalent to adaptation to climate change should be strengthened and brought into national policies and translated to local level.

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