Republic of Mozambique

Report of Action Plan and Project Ideas for Agriculture Sector Adaptation to Climate Change

By Rogério Marcos Chiulele

April 25th, 2018

UN environment

gef GLOBAL ENVIRONMENT FACILITY INVESTING IN OUR PLANET

UNEP DTU PARTNERSHIP

ERC ENERGY RESEARCH CENTRE University of Cape Town

Disclaimer

Table of Contents

List of tables

List of Abreviations

Acronym	Long Name
AT	Autotidade Tributária de Moçambique
CA	Conservation Agriculture
CARE	American Organization
CLUSA	Cooperative League of the United States of America
FAO	Food and Agriculture Organization
DARIDAS	Direcção das zonas Àridas e semi-áridas
DARN	Direcção da Agricultura e Recursos Naturais
DINAS	Direcção Nacional de Agricultura e Silvicultura
DNEA	Direcção Nacional de Extensão Agrária
DNRH	Direcção Nacional dos Recursos Hídricos
DPCI	Direção Nacional de Planificação e Cooperação Internacional
FAEF	Faculdade de Agronomia e Engenharia Florestal
IHE	Institutions of High Education
IIAM	Instituto de Investigação Agrária de Moçambique
INE	Instituto Nacional de Estatística
INGC	Instituto Nacional de Gestão de Calamidades
INIR	Instituto Nacional de Irrigação
MASA	Ministério da Agricultura e Segurança Alimentar
MEF	Ministério de Economia e Finanças
MIC	Ministério da Indústria e Comércio
MICOA	Ministério para a Coordenação da Acção Ambiental
MINAG	Ministério da Agricultura
MOPHRH	Ministério das obras Públicas, Habitação e Recursos Hídricos
NGO	Non- Governamental Organization
PEDSA	Plano Estratégico para o Desenvolvimento do sector Agrário
PROMAC	Promoção da Agricultura de conservação
RWHC	Rainwater harvesting and conservation
SDAE	Serviços Distritais das Actividades Económicas
TNA	Technology Need Assessment
UEM	Universidade Eduardo Mondlane

Executive Summary

Mozambique as signatory of the United Nations Framework Convention on Climate Change and developing country is implementing the Technology Need Assessment Project (TNA). The implementation of this project aims to answer the Convention and fill the gaps of lack of climate change technologies identified in the National Adaptation Strategy for Climate Change Adaptation and Mitigation. The TNA project was implemented in three stages, namely, prioritizing technologies; barrier analysis and identification of enabling framework; and design of Action Plan design for priority technologies and identification of Project Ideias.

For first step of the project, 3 priority technologies were identified, which are: conservation agriculture, rainwater harvesting and conservation and seed production and promotion of low-cost improved storage systems of grain and seed. In the second step, the barriers hampering the transfer and dissemination of priority technologies were identified and analysed and the measures to remove the barriers and enabling environment identified.The 3rd step of the project consisted in designing the Action Plan for successful transfer and dissemination of the priority technologies and identification of project ideias. This report presents the Action Plan and Project Ideas identified.

The actions that should be implemented for successful transfer and dissemination of conservation agriculture are: (1) Strenghten collaboration among teams of local experts; (2) Strenghten institutional capacity (financial, technical and in means); (3) Improve research capacity for CA and (4) Create awareness of farmers and society about CA. The actions to be implemented for successful transfer of rainwater harvesting and conservation are: (1) Map potential areas for implementation of RWHC; (2) Mobilization of funding for construction of RWHC systems, (3) Create tax incentives to promote private investment; (4) Create awareness of the society about RWHC by inclusion of the topic curricula of the different education systems and (5) Improve coordination and collaboration among stakeholders. For seed production and promotion of low-cost improved storage systems of grain and seed, five (5) actions should be implemented, which are: (1) Improve seed quality control and certification through increase in number of laboratories and qualified personnel; (2) Improve funding for the development of improved varieties, (3) Create farmers awareness about improved seed and promote the massification of community seed production; (4) Create incentives for local production of super bag, metal and poliethylene silos and (5) Promote the use of the super bag, metal silo and polyethylene silo for storage.

The project ideas identified and proposed for funding for (1) conservation agriculture, (2) rainwater harvesting and conbservation and (3) seed production and promotion of low-cost improved storage systems for grain and seed are, respectively, (1) Increase awareness and promotion of CA in Mozambique through demonstration plots and provision of audio-visual information, (2) Mapping potential areas for implementing RWHC systems and, (3) Massification of seed production through capacity building of farmers and extension officers. These 3 project ideias were selected based on the perception of the technology working groups that they have high potential to ensure successful transfer and dissemination of the technology in the country.

Chapter 1: Action Plan of three (3) Agriculture Technologies

1.1 Overview of the Agriculture Sector

Agriculture is the main socio-economic activity of the population in Mozambique. Agriculture employs over 80% of the country active workforce

and is an important source of income for over 70% of the population, most of whom are smallholder farmers (MINAG, 2010). Agriculture contributes to poverty reduction and economic growth through provision of food and income for families and through its contribution to the gross domestic product (GDP) estimated at around 23% (INE, 2011) and to exports estimated at about 20% (FAO, 2011). Agricultural activity is essentially done by smallholder farmers, involving about 3.7 million rural households, which contribute about 95% of total agricultural production (MINAG, 2010). The contribution of production made by small farmers to GDP generated by agriculture is about 95% (FAO, 2011), which makes this one of the most important sector for the the country economic development.

Agriculture in Mozambique is characterizada by low productivity; low use of improved technologies such as machinery and improved inputs (improved seeds, fertilizers and pesticides); dependence on rainfall and poor access to market. As result, it is very vulnerable to climate change manifested mainly in the form of extreme weather events such as droughts, floods and cyclones. The vulnerability of the sector to climate change is due to the fact that most of the actors are poor and do not have the financial resources to respond efficiently and effectively to the challenges imposed by climate change. In addition, these actors have little capacity to cope and adapt to climate change. These factors make the sector to be characterized by low levels of production and productivity.

Future projections about climate change in Mozambique show that their impact will be more severe, especially in the agricultural sector. INGC (2009) predicted that the impact of climate change will result in reduction of crop yields due to increased temperature, reduction in the average annual rainfall and its high variability and also due to the increased ozone concentration (Brito and Holman, 2012 ; MICOA, 2013). The yield reduction will also occur due to rapid multiplication of pests and diseases, as well as the appearance of aggressive species of pests and diseases with strong impact on reducing the production of crops and animals. In addition, climate change will also have severe impact on pastures given that the dry season will be longer, causing shortages of food and water for livestock watering due to the reduction of the river water flow and drying of natural water sources. These impacts will result in the reduction of livestock production due to increased livestock mortality and reduced average weight gain and milk production, exacerbating food shortages and food insecurity in rural communities whose economy is dependent on livestock production.

Under these circumstances, it becomes important to develop measures to help smallholder farmers to increase their productivity, to strengthen their resilience to climate change and contribute to the reduction of Greenhouse Gas Emissions (GHGs). In That context, the country through the Ministry of Land, Environment and Rural Development (acronym in Portuguese MITADER) and Ministry of Agriculture and Food Security (acronym in Portuguese MASA) have been developing policies that create an enabling environment for increasing agricultural productivity, improving resilience and reducing greenhouse gases. Examples of policies include the Strategic Plan for the Agriculture Sector Development (acronym in portuguese PEDSA); the National Investment Plan (acronym in portuguese PNISA); The National Strategy for Adaptation and Mitigation of Climate Change (acronym in portuguese ENAMMC), the Gender and Environment Strategy, the Strategy for Reduction of Emissions from Deforestation and Forest Degradation (acronym in portuguese REDD+), the National Action Plan for REDD+ and Action Plan for Agricultural Adaptation to Climate change (MASA, 2015).

In the perspective of increased agricultural productivity and strengthening of resilience of populations to climate change, the country through the Ministry of Land, Environment and Rural Development (acronym in portuguese MITADER) is implementing the Technological Needs Assessment Project which aims to identify priority technologies for agriculture sector adaptation to climate change; identify and analyse the barriers that hinder the transfer and diffusion of priority technologies and identify measures and enabling environment to overcome barriers; and the development of action plan for the transfer of priority technologies. From that process three (3) priority technologies were identified from a set of 14 initially identified (Government of Mozambique, 2017). The three (3) priority technologies are: (1) conservation agriculture; (2) Rainwater harvesting and conservation; and (3) seed production and promotion of low-cost improved storage systems of grain and seed.

These technologies were subjected to analysis of barriers that hinders their transfer and diffusion in the country followed by the analysis of measures that can contribute to the removal of barriers and the identification of an enabling environment for the transfer and diffusion. This report presents the process of developing Action Plan for transfer and diffusion of the three priority technologies. The three priority technologies in question have already been introduced in the country, being in a testing and promotion phase or in an initial phase of upscaling. The Action Plan for Conservation agriculture aims to scale-up the technology to smallholder farmers who are in semi-arid and arid

regions of the country. The action plan of rainwater harvesting and conservation aims to promote the technology in areas where the technology is not yet established and scale-up where it has been introduced. The action plan for seed production and promotion of low-cost improved storage systems aims to scale-up seed production and adoption of storage systems across the country.

1.2 Action Plan for Conservation Agriculture

1.2.1 Introduction

Conservation agriculture (CA) is an agricultural system that seeks to conserve soil and water; the concept refers to the conservation of soil organic matter, increased soil water retention and reduced soil erosion and pollution. CA combines three principles: minimum soil disturbance, permanent soil cover (cover crops or cover with residues) and crop rotation or intercropping.

The CA is a technology suitable for arid and semi-arid areas where soils are low in organic matter and are prone to desertification. The technology leads to reduced use of machinery and fuel and time savings in operations. However, CA requires specialized machinery for sowing, large areas for crop rotation and maintenance of the residues in the field to maintain fertility.

Conservation agriculture contributes significantly to resilience to drought but it can also contribute to the resilience to flooding. This can be done by reducing evaporation, increase the retention of moisture and organic matter in the soil. CA also contributes to the reduction of greenhouse gases because the soil is not disturbed. CA contributes to the reduction of flooding by improving water retention and reducing runoff. CA also contributes to increased nutrient use efficiency, increased biodiversity of the soil and reducing desertification. CA provides an opportunity to improve the welfare of people in arid and semi-arid regions of Mozambique. Conservation agriculture is not a market technology.

1.2.2 Ambition of the action plan for conservation agriculture

This action plan aims to scale-up conservation agriculture to the smallholder farmers in arid and semi-arid areas of Mozambique given that farmers in these areas are cyclically affected by drought, flood and erosion and as a result they

cyclically face food insecurity due to low production and productivity caused by these phenomena. The action plan is targeting to cover at least 75% of smallholder farmers living in arid and semi-arid areas of the provinces of Gaza, Inhambane, Manica, Zambezia, Tete and Nampula. The massification of the technology in these areas will contribute to improve the resilience of smallholder farmers to drought and floods making them food and nutritional secure contributing to improve their well being.

1.2.3 Actions and activities to be included in the action plan for conservation agriculture

The actions to improve the transfer and diffusion of conservation agriculture were obtained converting the measures for the removal of barriers to transfer and diffusion of the technology into actions. Before presenting the measures, the barriers to transfer and diffusion of the technology are presented followed by the measures and actions and activities.

1.2.3.1 Barriers to transfer and diffusion of conservation agriculture

The barriers that hinder the transfer and diffusion of conservation agriculture are related to high initial costs for farmers due to the cost of implements (rippers and planters) associated to their lack of financial capacity; limited information and awareness due to limited researcah and demonstrations and inadequate extension support; and lack of collaboration due to lack of strong coordinating institution or lack of awareness of effectiveness of collective action. These barriers are categorized into economic and financial and nonfinancial barriers as detailed below.

A. economic and financial barriers for conservation agriculture

The key economic and financial barriers to transfer and diffusion of conservation agriculture are related to the cost of technology implementation and limited financial capacity of government to invest in research and promotion of technology to farmers. The initial cost of implementing CA is high because farmers have to purchase implements such as rippers and planters which are costly. That is exhacerbated by their lack of financial capacity which is further complicated by their lack of access to credit due to lack of collaterals and high interest rates.

The lack of financial capacity by the government limits investment in research to identify techniques and practices appropriate for different farming contexts, for conducting socio economic studies to assess perceptions and preferences

of techniques and practices, for hiring and training extension sfatt and for conducting demonstrations of the technology and assistance to farmers.

B. Noneconomic barriers of conservation agriculture

Nonfinancial barriers are categorized into political and regulatory, lack of human capabilities, market failures, lack of information and awareness, institutional and organizational capacity, socio-cultural and technical.

a) Human capacities

The barriers of human capacities are related to limited number of technical staff to conduct research, to demonstrate and assist farmers in the process of transfer and diffusion of CA. Due to limited government and international donnors investiment in agriculture sector, the number of technical staff is limited to ensure adequate research, technology demonstration and appropriate assistance of farmers. In addition, the existing technical staff (agronomists and extension officers) lacks technical and communication skills to ensure research and promotion of CA in the country. Training is a mechanism to improve human capacity. However, the courses being offered in most agricultural training institutions still don't include contents of conservation agriculture. Non-degree training is generally undertaken to extension staff by different institutions promoting CA but this training generally does not include practical lessons. As a result, extension workers lack practical skills and experience on how to conduct demonstration plots for promoting CA.

b) Market

The reduced demand of implements used in CA due to limited number of adopters of CA results in reduced suppliers of implements used for CA. On the other hand, the promotion of non-food cover crops limits interest in seed companies to produce seed of these crops. That is exacerbated by the fact that most of cover crops are not widely cultivated in the country.

c) Information and awareness

Farmers in most cases are not aware about CA. The lack of awareness is due to limited research on appropriate techniques and practices for different farmers' contexts and lack of demonstrations of techniques and practices identified as well as lack of communication of research results to potential beneficiaries. In case the research is conducted, there is no involvement of potential beneficiaries of the technology. Therefore, few farmers are informed and aware about technology and its potential benefits.

d) Institutional and organizational capacity

The coordination of research activities, technology dissemination, establishment of linkage between research, extension and producers and the overall coordination of actions conducted by different stakeholder in the country on conservation agriculture should be led by the Ministry of Agriculture and Food Security (MASA) in Mozambique. This institution lacks capacity in financial and human resources and skills to ensure coordination of transfer and diffusion of the technology. MASA has also limited capacity to lead the coordination and establishment of linkages between research, extension and producers, as a result the extension doesn't make full use of the research results and consequently, the producers doesn't make use of results generated by the research and there is no coordination of who does what, where and when (different institutions working on CA are not coordinated and there is no information on what they are doing, where and when). The limited financial and technical capacity of MASA limits the capacity to provide continuous technical support to producers.

Other barriers to transfer and diffusion of CA is the lack of full integration of Local Adaptation Plans (where promotion of CA activities should be planned) in the District Development Plan. This has been due to lack of lack of continuous technical support

e) Social and cultural

Due to lack of awareness because of weak linkages between research, extension and farmers and lack of involvement of farmers in research process, farmers do not realize the advantages of using CA. Another barriers to CA adoption by farmers is related to the fact that some CA practices are labour intensive (e.g. transportation of crop residues from one place to another site for implementing CA) and farmers still don't perceive the advantage of CA over conventional agriculture due to the fact that the yields obtained using CA in first 3 years are lower than those obtained using conventional agriculture. For permanent soil cover, there has been a promotion of crop residues use; the

competition for the crop residues between application of conservation agriculture and livestock feeding is another barrier to adoption of CA.

f) Technical

Yield performance under CA in first 3 years is low compared to conventional agriculture which makes people not to appreciate CA. The promotion of techniques and practices not suitable to farmer's needs and conditions has been blocking the transfer and adoption of CA. This has been due to lack of socio-economic analysis of the process of technology promotion. For instances, the use of mulching has been a problems in sites with termites. On other hand, the use of non-food cover crops has led to lack of interest by the farmers and seed companies on seed production of these crops.

1.2.3.2 Measures to overcome barriers for conservation agriculture

Like the barriers, the measures were categorized into economic and financial and non-financial.

A. Economic and financial measures of conservation agriculture

To enhance the transfer and diffusion of CA there should be substantial investments in research for identifying techniques and practices appropriate for different farming contexts, demonstration of techniques and practices that work well, investment for hiring and training technical staff that will conduct research, demonstration and assist farmers. The investment will also be directed to support the extension services, training of producers and awareness of farmers and society about the CA through introduction of CA in syllabus. Parallel to investment, there should be incentives to farmers through creating subsidized loans to acquire implements and to companies importing the implements or raw materials and spare parts to make implements through tax breaks. Another measure to help enhance transfer and diffusion of CA can be through allocation of a proportion of the total institutional budget to target CA activities (for implementation, coordination and monitoring of activities).

B. Nonfinancial measures of conservation agriculture

Nonfinancial measures were categorized into political and regulatory, development of research capacities, research and participatory training of farmers, education, training and knowledge transfer, institutional collaboration and communication and awareness.

a) Political and regulatory

The use of cover crop for permanent soil cover seems more feasible than using crop residues because of termites in certain locations, competition with animal feeding in others and labour intensiveness of transporting crop residues from one place to another. Hence, it is recommended to use as cover crop the one can have multi-purpose (more purposes than being only cover crop) and there should be incentives to promote seed production of the cover crop to ensure its availability and accessibility. These incentives can be through the granting subsidized loans, facilitating the importation of inputs at free taxes.

Another measure can enhance transfer and diffusion of CA is through integration of CA in national policies (environmental policy, agricultural extension policy, land policy and education policy) to promote the adoption and ensure sustainable agriculture development.

b) Research capacity development

Given the limited human and technical capacities for development and promotion of CA, there is a need to develop a capacity building program for human resources to strengthen and improve scientific and technical competences to create local experts in CA who will be involved in research for assessing perceptions about technologies and practices appropriate for each context and testing of these techniques and practices for adaptability to the farmers context. For that to happen there should be a continuous investment to support research. The research should also include the identification and promotion of cover crops for multiple use, production of evidence of the advantages of CA over the conventional agriculture and development of technological packages of CA.

The CA is a public good; however, the private sector should be encouraged to invest in capacity building as well as in research and development (R & D) to identify techniques and practices appropriate to the local context, identification of best cover crops and in seed production of the cover crops.

c) Research and participatory training of farmers

Since research is driven by farmer's needs, there is a need to use the research and participatory training approach to bridge the gap between research and implementation of CA by farmers. The participatory research and training approach enables to promote methods that integrate traditional and scientific knowledge and enhances the perception of the ecological and economic principles to enable farmers to develop the ability to make informed decisions. With this approach farmers are involved in all phases of the process of defining the research agenda and experimental treatments, in conducting observations and in discussion and interpretation of results. Thus, farmers improve their knowledge in relation to ecological principles and become partners of research and extension institutions. This approach allows researchers to assess the knowledge of farmers in relation to ecological principles of crop management and thereby improve their perception of how to address the social and behavioural obstacles CA adoption.

d) Education, training and knowledge transfer

Researchers and extension agents should receive appropriate training to improve their knowledge in technical and ecological principles of CA in order to make informed decisions about how to do research and transfer of techniques and practices looking at each context. Extension services should adopt appropriate technology transfer approaches for each context involving participatory methods. This participation should include research institutions, NGOs and farmers organized in associations or not. The participatory approach should allow all stakeholders to participate in the decision making process, analysing problems and generating solutions. Hence the need to have an expert extension agent closely linked to farmers through CA demonstration projects and adult participatory learning methods to improve knowledge about the technology and CA techniques to increase farmers' confidence about the technology.

Increased awareness of the producers and the public on climate change can help overcome personal attitudes and misconceptions related to the barriers of CA adoption. Furthermore, collaboration between public research institutions, universities, private sector, extension services, farmers and experts should be promoted and strengthened to improve the transfer and diffusion of technology and knowledge. Education and capacity building should also include the development of curricula in secondary education, technical and in High Education Institutions that teach agriculture.

e) Institutional colaboration

The CA platform should be institutionalized and strengthened to ensure coordination, liaison and collaboration between all stakeholders involved in agricultural development for the successful implementation of CA. The stakeholders include the Ministry of Agriculture and Food Security, The Agrarian Research Institute of Mozambique, The High Education Institutions working on CA, the NGOs (CARE, CLUSA-PROMAC, etc), the National Institute for Disaster Management, FAO, farmers organizations (UNAC).

f) Communication and awareness

There is a need to develop effective dissemination programs with clear messages and more objective content using demonstration plots (CDRs), farmer field school (FFS) approaches and integrated program of agricultural technology transfer, including the development of manuals, technical notes. There is also a need to design programs and strategies CA upscaling throughout the country.

1.2.3.3 Actions selected to be included in the action plan for conservation agriculture

For successful transfer and diffusion of conservation agriculture, it is proposed to conduct five (5) actions, which are:

Action 1: Strenghten collaboration among teams of local experts

Strengtening collaboration among tems of local experts will strenghten the capacity of conducting research, promotion of technology, sensitization of farmers and society about the technology by ensuring joint discussion and identification of appropriate methods and approaches for conducting activities to address the limited adoption. Effectiveness of this action will be enhanced when the expert team members are informed on what, when, who, where and how CA activities are conducted. Presently, there are institutions working on CA but there is lack of information on who is doing what, where, when and how and country coverage by these actions and activities is still too small and some times there are geographic and topic overlaps.

Action 2: Strenghten institutional capacity (financial, technical and in means). Institutional capacity development will improve the effectiveness of transfer and diffusion of CA by making financial resources more available through mobilization of funds which will enable hiring and training technical staff and acquiring means to ensure conducting research, demonstrations, training and

provision of information and sensitization of farmers and society. This action has strong potential to ensure transfer and diffusion of CA.

Action 3: Improve research capacity for CA

Improved investment in research will enable identification of techniques and practices appropriate to each socio-economic and edaphic-climatic contexts. The potential impact of of the investiment in reasearch to enhance the transfer and diffusion will be enhanced by involving farmers in identification of the techniques and practices that sweet their needs and farming conditions.

Action 4: Create awareness of farmers and society about CA

Appropriate demonstrations of CA practices and techniques and provision of information will ensure sucessful transfer and diffusion of CA by enabling farmers to see which and how some of the practices and techniques are performin on their own environment. The provision of audio-visual information (Radio, TV, brochures, pamphlets and manuals) will raise awareness about the techniques and practices. This action has strong potential to enhance adoption of CA.

1.2.3.4 Identification and discription of activities per action

Action 1: Strenghten collaboration among local teams of experts through mapping institutions working on CA and bringing them to share their work, creating teams to work together (researchers, participatory learning, sensitization of farmers and society, communication); training; creating a plataform for dialogue; and mobilization of funds.

Activity 1.1 Map institutions and experts working in AC.
Activity 1.2 Create teams of experts in research, extension, communication.
Activity 1.3 Identify the training needs of actors and or experts.
Activity 1.4 Conduct training to improve the technical capacity.
Activity 1.5 Create a dialogue platform and instituicionalize the group.
Activity 1.6 Mobilization of funds.

Action 2: Strenghten instituicional capacity through mobilization of funds to improve financial capacity, hiring new staff and training to improve technical capacity and acquisition and provision of work means.
Activity 2.1 Identification of needs and budgeting.
Activity 2.2 Mobilization of funds for covering the realization od activities.
Activity 2.3 Hiring new technical staff.
Activity 2.4 Conducting training of extension staff.
Activity 2.5 Acquiring work means for extension staff.

Action 3: Improve research capacity for CA through provision of funds for research. That will be achieved through mobilization of funds, training of reserachers in proposal design, research design and implementation.
Activity 3.1 Mobilization of funds.
Activity 3.2 Training reserachers in project proposal writing.
Activity 3.3 Preparation of research proposals by breeders.
Activity 3.4 training reserachers in research design and implementation.

Action 4: Create awareness of farmers and society about CA
Activity 4.1 Sensitization of farmers groups to host demonstration plots.
Activity 4.2 Conducting demonstration plots.
Activity 4.3 Organize field days to share results.
Activity 4.4 Preparation of communication materials.
Activity 4.5 Dissemination of results

1.2.4 Stakeholders for implementing the TAP

The stakeholders for implementing the TAP include the National Directorate for Planning and International Cooperation (DPCI), the National Directorate for Agricultural Extension (DNEA), the Institute for Agricultural Research of Mozambique (IIAM), the National Instute for Disaster Management (INGC), the Private Sector, the Civil Society (NGOs), the Development Partners and farmers groups.

Table 1: Stakeholder for implenting the TAP for CA

Action	Resposible institutions	Beneficiary	Focal point
Action 1: Strenghten collaboration among local teams of experts	MASA/DNEA; NGOs (Clusa; PROMAC; CARE); NGC; Development partners; Farmers associations	All stakeholders	DNEA
Action 2: Strenghten instituicional capacity	MEF; MASA/DPCI; MASA/DNEA; IIAM; Development partners	MASA/DNEA	DPCI
Action 3: Improve research capacity for CA	MEF; IIAM; UEM/FAEF; Development partners;	IIAM; UEM/FAEF	IIAM
Action 4: Create awareness of farmers and society about CA	MASA/DNEA; NGOs; Development partners	Farmers associations	DNEA

1.2.5 Planning and sequencing of activities

The sequency and duration of activities is shown in Table 2. The implementation of activities of the action 1, 2 and 3 will start in January 2010 while the action 4 will be implemented after the action 2 and 3 have been completed. The implementation of the entire action plan for conservation agriculture will take 6 years.

Table 2: Sequency and duration of activities

Action	Activity	Duration of activities
Action 1: Strenghten collaboration among local teams of experts	1.1 Map institutions and experts working in AC	Year 1(3 months)
	1.2 Create teams of experts	Year 1 (3 months)
	1.3 Identify the training needs of actors and or experts	Year 1 (3 months)
	1.4 Conduct training to improve the technical capacity	Year 1 (3 months)
	1.5 Create and institucionalize the platform of dialogue	Year 2 (6 months)
	1.6 Mobilization of funds	Year 2 (6 months)
Action 2: Strenghten instituicional capacity	2.1 Identification of needs and budgeting	Year 1 (3 months)
	2.2 Mobilization of funds	Year 1 (8 months)
	2.3 Hiring new technical staff	Year 2 (6 months)
	2.4 Conducting training	Year 2 (4 months)
	2.5 Acquiring work means.	Year 2 and 3 (8 months)
Action 3: Improve research capacity for CA	3.1 Mobilization of funds	Year 1 (8 months)
	3.2 Training in project proposal writing	Year 2 (6 months)
	3.3 Preparation of research proposals	Year 2 (3 months)
	3.4 Training in research design and implementation	Year 2 (3 months)
Action 4: Create awareness of farmers and society about CA	4.1 Sensitization of farmers groups to host demonstration plots	Year 3 (3 months)
	4.2 Conducting demonstration plots	Year 4 and 5 (18 months)
	4.3 Organize field days to share results	Year 4 and 5 (2 months)
	4.4 Preparation of communication materials	Year 5 (9 months)
	4.5 Dissemination of results	Year 6 (6 months)

1.2.6 Capacity needs abnd estimated resources required for implementing the TAP

1.2.6.1 Capacity needs for implementing TAP

Capacity needs for Action 1

There will be a need to conduct a training of trainers to implement the activity 1.4 and training on proposal design and implementation and procurement process according to the donor requirements for activity 1.6. To implement activities 1.1, 1.2, and 1.3 there will be a need to hire consultant.

Capacity needs for Action 2

To implement the activity 2.2 there will be a need to conduct training on project design, management, reporing and monitoring and evaluation. To conduct that training there will be a need to hire a consultant.

To implement the activity 2.4 there will be a need to conduct a training of trainers. For that to take place there will be a need to hire a consultant to conduct such training.

To implement the activity 2.6 there is a need to conduct training on procurement process.

Capacity need for Action 3

To implement activities 3.1, 3.2 and 3.4 there will be a need to hire a consultant. For activity 3.1 there will be a need to conduct training on project design and management which will be done by the consultant.

Capacity needs for Action 4

For activity 4.4 there will be a need to hire a consultant that will conduct training on how to prepare audio-visual information.

Hiring a consultant will also e necessary to conduct training on writing research papers for activity 4.5.

1.2.6.2 Cost estimates for activities of TAP

The total cost for implementing the action plan for conservation agriculture is estimated at 8,4 million USD. The cost per action are the following: 140,000USD for action 1; 4,3 million USD for action 2; 2,1 million for action 3 and 750,000 USD for action 4. In addition, there are are aditional costs for the management of the plan which are estimated at 10% of the total budget at contigencies which are estimated at 5% of the total cost of the project.

Table 3: Cost estimation for activities of the TAP for CA

Action	Activity	Cost estimates
Action 1: Strenghten collaboration among local teams of experts	1.1 Map institutions and experts working in AC	10,000
	1.2 Create teams of experts	10,000
	1.3 Identify the training needs of actors and or experts	10,000
	1.4 Conduct training to improve the technical capacity	60,000
	1.5 Create and institucionalize the platform of dialogue	40,000
	1.6 Mobilization of funds	10,000
Subtotal		**140,000**
Action 2: Strenghten instituicional capacity	2.1 Identification of needs and budgeting	8,000
	2.2 Mobilization of funds	10,000
	2.3 Hiring new technical staff (for salaries during 1st 5 years)	2,110,000
	2.4 Conducting training	150,000
	2.5 Acquiring work means.	2,000,000
Sub-Total		**4,278,000**
Action 3: Improve research capacity for CA	3.1 Mobilization of funds	10,000
	3.2 Provision of funds for researchers (competitive grant)	2,000,000
	3.2 Training in project proposal writing	40,000
	3.3 Preparation of research proposals	50,000
	3.4 Training in research design and implementation	50,000
Sub- total		**2,100,000**
Action 4: Create awareness of farmers and society about CA	4.1 Sensitization of farmers groups to host demonstration plots	50,000
	4.2 Conducting demonstration plots	400,000
	4.3 Organize field days to share results	150,000
	4.4 Preparation of communication materials	100,000
	4.5 Dissemination of results	50,000
Subtotal		**750,000**
Total		**7,268,000**
Management of the Action Plan	10% of the total	726,800
Contigencies	5% of the total	363,400
Grand-Total		8,358,200

1.2.7 Management planning

1.2.7.1 Risks and contigency planning

The foreseen risks to implementation of the TAP are more related to cost and performance.

Cost risks: during discussion, the group foresee cost risks for activities 1.4, 2.4, 2.5, 4.2 and 4.4. These risks arise for the fact that the costs calculated for the activity are lower in relation to the cost during the implementation of the activity. As contigency action it was decides to add a percentage of about 20% to the costs currently calculated to cover such risks during implementation just in case it takes place.

Activities scheduling risks: there is a risk of activities 1.4, 2.5 and 4.4 taking longer than expected because these activities will involve putting annoucement in national newspaper to hire a consultant, selecting a consultant and then to start the actual activity. The contingy action will involve having a monitor and evaluation specialist to minitor closely the progress of activity to ensure correction of any delays that may take place. However, given that I some case it will not be possible to complete the activity within the planned time it is proposed to add 10% to the inicial cost of the activity.

Performing risk: The activities 1.1, 1.2, 1.3, 1.4, 2.4, 3.2 and 4.4 will involve hiring a consultant or firm to provide services. The consultants may have low performance in conducting the activities. The contince action will involve having a monitoring and evaluation working closely to the consultant to verify the performance and on case of under performance the contract will be cancelled and a new consultant hired. Because that may lead to some delays and have additional costs, it is proposed to add about 5% to the initially estimated budget.

1.2.7.2 Next steps

For the successful implementation of the plan it is recommended to appoint an individual at MASA to be based at the National Directorate for Planning and International Cooperation who will have the responsibility of establishing the implementation processes. The costs associated with his activities will to be supported by the Government budget before get funding to cover the costs for the TAP. To that end it is required that financial resources and means are made available to enable him to conduct the work.

Table 4: Summary for the action plan for CA

sector: Agriculture								
Technology: Conservation agriculture								
Ambition: The action plan aims to upscale the use of conservation agriculture in semi-arid and arid areas of Mozambique to cover about 75% of the population living in these areas								
Benefits: the benefits of using CA include increased resilience to drought by reducing evaporation, increase the retention of moisture and organic matter in the soil, reducing erosion by reducing the flow and wind; increasing the efficiency of nutrient use, increasing soil biodiversity and reduce desertification.								
Actions	**Activities**	**Funding source**	**Responsible institution and focal point**	**Duration**	**Risk**	**Success Criteria**	**Indicators for monitoring the implementation**	**Budget per activity**
Action 1: Strenghten collaboration among local teams of experts	1.1 Map institutions and experts working in AC	Government budget/Development partners	MASA / DNEA	3 months	unavailability of financial resources to the activity	After 2 years, at least 40% of the target population should e using the technology	Number of mapped institutions	10,000
	1.2 Create teams of experts	Government budget/Development partners	MASA/ DNEA	3 months	Lack of cooperation of experts and institutions		List of training needs in different sectors	10,000
	1.3 Identify the training needs of actors and or experts	Government budget/Development partners	MASA/ DNEA EMU //	3 months	Lack of financial resources		Number of people trained	10,000
	1.4 Conduct training to improve the technical capacity	Government budget/Development partners	MASA / DPCI	3 months	Lack of financial resources		Established and functional platform	60,000
	1.5 Create and institucionalize the platform of dialogue	Government budget/Development partners	MASA / DNEA MEF //	6 months	Lack of participation		project proposal submitted	40,000
	1.6 Mobilization of funds	Development partners	MASA/DNEA//MEF	6 months	Lack of interest in financing			10,000
Action 2: Strenghten instituicional capacity	2.1 Identification of needs and budgeting	Government budget/Development partners	MASA / DNEA / DPCI	3 months	Lack of a clear picture of the needs	After 2 years, At least	list of needs and budget	8,000
	2.2 Mobilization of funds	Government budget/Development partners	MASA / DNEA / DPCI // MEF	8 months	Lack of interest by lenders infinance		Project proposal submitted	10,000
	2.3 Hiring new technical staff (for salaries during 1st 5 years)	Government budget/Development partners	MASA / DNEA / DPCI MEF //	6 months	Lack of financial resources		Number of staff hired	2,110,000
	2.4 Conducting training	Government budget/Development partners	MASA / DNEA / DPCI	4 months	Disorganizatio n /		Number training conducted/Number of participants in trainings	150,000

	2.5 Acquiring work means.	Government budget/Development partners	MASA / DNEA / DPCI // MEF	8 months			Number of means acquired per category	2,000,000
Action 3: Improve research capacity for CA	3.1 Mobilization of funds	Government budget	MASA / IIAM UEMI // // MEF	8 months	Lack of interest in financing by financiers	After 3 years at least 60% of the target of the population should be aware about the technology	project proposal submitted /report of the negotiating process	10,000
	3.2 Provision of funds for researchers (competitive grant)	Government budget	MASA / IIAM UEMI // // MEF	6 months	Lack of skills		Research proposal submitted	2,000,000
	3.2 Training in project proposal writing	Development Partners	MASA / IIAM // IES	3 months	Lack funds		Number of participants	40,000
	3.3 Preparation of research proposals	Government budget	IIAM//UEM/FAEF	3 months	Lack of funds		Number of proposal written	50,000
Action 4: Create awareness of farmers and society about CA	4.1 Sensitization of farmers groups to host demonstration plots	Government budget/Development partners	MASA / DNEA	3 months	Lack of capacity / funding	After 6 years, at least 80% of the target population should be using the technology	demonstration fields established	50,000
	4.2 Conducting demonstration plots	Government budget/Development partners	MASA / DNEA	18 months	Lack of funds		Subscribers / seminars report	400,000
	4.3 Organize field days to share results	Government budget/Development partners	MASA / DNEA	2 months	Lack of funds / skills		Listmaterials produced	150,000
	4.4 Preparation of communication materials	Government budget/Development partners	MASA / DNEA / IIAM	9 months	Lack of analysis capabilities data		documents / Subscribers	100,000
	4.5 Dissemination of results	Government budget/Development partners	MASA / DNEA / DPCI	6 months	Lack of police production capacity / Reserach brifs		Police / research briefs produced	50,000

1.3 Action Plan for Rainwater Harvesting and Conservation (RWHC)

1.3.1 Introduction

Rainwater harvesting is a method for collecting, storing and conserving water from roof top and surface runoff for household consumption and agriculture in arid and semi-arid regions. The storage system or reservoirs can be of medium to large size when for community use and small size when for individual farmer use. RWHC can play a major role in improving the resilience of smallholder farmers to drought by providing water for crop irrigation and for livestock watering during dry season or in areas with little rainfall or in areas with irregular rains. To a small extent, rainwater harvesting and conservation can contribute to resilience to floods because it will help reduce the runoff of water from excessive rainfall. The implementation of this technology will contribute to increased production and productivity, diversification of crop production and therefore to improving food and nutritional security, increasing family income and improving the well-being of populations, especially those living in areas prone to drought. The technology can also contribute to reducing the risks of erosion and replenishment of aquifers.

1.3.2 Ambition for the Action Plan for Rainwater Harvesting and Conservation

Rainwater harvesting and conservation is a technology that already exists in the country but it needs to be introduced and promoted in some areas and massified in others. The massification RWHC will contribute to resilience to drought of families and communities living in arid and semi-arid areas of Mozambique which have been cyclically affected by drought through provision of water for human consumption, agricultural production and livestock watering. This plan aims to test and promote the techniques and practices of rainwater harvesting and conservation in areas where the technology does not exist and to massify it in areas where their practice is already known but less adopted. The focus of the massification of technology will be the smallholder farmers living in arid and semi-arid areas of the provinces of Maputo, Gaza, Inhambane, Manica and Tete Provinces which have been hit by drough. The plan is tergeted to cover at least 60% of smallholder farmers living in arid and semi-arid areas of the 5 provinces.

1.3.3 Actions and activities to be included in the Action Plan for Rainwater Harvesting and Conservation

The actions to improve the transfer and diffusion of rainwater harvesting and conservation were obtained converting measures into actions. Before presenting the measures, the barriers hindering the diffusion of the technology are presented and then the measures followed by the actions and their activities.

1.3.3.1 Barriers that hinder the transfer and diffusion of Raiwater Harvesting and Conservation

The barriers that hinder the transfer, diffusion and adoption of rainwater harvesting and conservation are related to high costs of preparation, construction and maintenance; limited information and awareness due to limited promotion, research and demonstration; inadequate technical capacity to promote RWHC due to limited training and training institutions and reduced number of technical staff; and weak collaboration. The barriers are categorized into economic and financial and nonfinancial as detailed below.

A. Economic and financial barriers for RWHC

The transfer and diffusion of RWHC is generally done by government and in most cases in collaboration with development agencies particularly for large RWHC systems such as dams. For small systems such as small reservoirs farmers can cover his costs of construction and maintenance. The barriers limiting the transfer and diffusion of large RWHC are related to the high costs of preparation, installation and maintenance while for small systems are related to high costs of installation and maintenance. The high costs associated to the limited financial capacity of government to promote the transfer and diffusion as well as of farmers to implement the systems hinders the transfer of RWHC. The cost of installation and maintenance of tarpaulins, sheets, and cement in some cases, taps and piping pipes, panels for pumping water can be high for farmers limiting the adoption of the technology by farmers. The government in most cases depends on development agencies to conduct mapping, construction and maintenance for the large systems which also depend of the objectives and interest of the development agencies. The limited olviment of private sector in this technology is also a major contributing barrier to limited adoption by farmers.

B. Nonfinancial barriers of RWHC

a) Political and regulatory

Lack of incentives for private investment in RWHC.

b) human capacities

To conduct mapping, construction and maintenance of large RWHC systems requires highly skilled and qualified people which are not presently available in the country. The limited number of skilled human resources is due to the fact that very few national institutions are offering training containing these skills. In addition, at the implementation sites there are no skilled personnel for management and maintenance of these systems. Even for construction and maintenance of small RWHC, there are still limited human resources skilled.

c) information and awareness

In Mozambique, awareness campaigns about climate change and possible solutions to address climate change have been limited to floods and tropical cyclones. Hence, different groups and farmers are not well informed or aware about the RWHC as possible solution to adapt to drought. Other reason leading to lack of information and awareness has been the lack of community involvement in decision-making. In addition, the involvement of mass media in dissemination of this type of technologies is another reason for the lack of information and awareness of RWHC technology.

d) Institutional collaboration and organizational capacity

The construction of medium to large RWHC systems is generally planned at central level and sometimes with less involvement and coordination with districts and province. In some cases the plan is made at MASA with less involvement of MOPHRH and vice-versa. The lack of joint planning and community involvement has been limiting the adoption of this type of technology. The lack of community involvement limits the community's appropriation of technology. The other barrier that hinders the transfer and diffusion of this technology in Mozambique is limited investment by the private sector.

1.3.3.2 Measures for overcoming barriers to transfer and diffusion RWHC

The measures necessary to remove barriers to transfer, diffusion and adoption of RWHC are categorized into economic and financial and nonfinancial. In each category, the measures were identified.

A. Economic and financial measures

The government should invest and or negotiate with development and funding agencies to fund actions of mapping of potential areas for implementation of RWHC, construction and maintenance of RWHC systems as well as for obtaining cheap bank loans to support the construction and maintenance of small RWHC systems by farmers. Similarly, the government should encourage private investment in RWHC through establishing infraestruture to encourage private sector penetration in rural areas to provide all necessary equipments for construction of small and medium RWHC systems. Government should also negociate with financial institution to provide cheap loans to farmers for constructing small RWHC systems.

B. Nonfinancial measures

a) Political and regulatory

Creating incentives for private investment in RWHC such as tax incentives to importers of hydraulic components and local production of some components

b) Capacity building

There is need to empowering the society through inclusion the RHWC issues in curricula at different levels of education as drought resilience adaptation. The implementation of the training program should include practical lessons of how to build some RWHC systems. In addition, farmers and communities should be trained on construction, management and maintenance of RWHC systems.

c) Collaboration

There is need to improve the coordination and collaboration among the institutions involved in the transfer and diffusion of RWHC (MASA, MOPHRH, INGC) at local, provincial and central levels

d) Communication and awareness

Design and implement awareness campaigns related to climate change impacts and adaptation strategies. The implementation of these campaigns should involve mass media in its diffusion.

1.3.3.3 Actions selected to be included in TAP for RWHC

Action 1: Mapping potential areas for implementation of RWHC. This action will allow the identification of areas where the rainwater harvesting and conservation systems can be constructed. The action is key to determine the dimension of the RWHC system to be constructed, the potential impact in terms of number of beneficiaries to cover.

Action 2: Mobilization of international funding for construction of RWHC. This action is key given that government budget is generally not enough particularly for implementing large RWHC systems.

Action 3: Provide tax incentives for private investment in RWHC. Private investment can enhance adoption particularly of small-scale RWHC systems by manufacturing or importing spare necessary for that purpose such as waterproofing sheeting, the taps, solar panels, etc.

Action 4: Create awareness of society by including RWHC in the curricula at different levels. The inclusion of RWHC in curricula will create awareness to people about its potential to contribute for resilience to drought and will ensure the adoption of technology. In addition, this action will contribute to generating different types of skills including for construction, maintenance and creation of small businesses in RWHC.

Action 5: Improve coordination and collaboration among stakeholders. Improving coordination among stakeholders has strong potential to improve the transfer and diffusion of technology and im particular for widespred distribution of the technology because with coordination and colaboration different partners can work in different geographyc areas or different dimension of systems ensuring wide coverage.

1.3.3.4 Proposed activities for each action.

Action 1: Map potential areas for implementation of RWHC

Activity 1.1 Identify and negociate with potential funding institutions
Activity 1.2 Hiring company for conducting mapping
Activity 1.3 Mapping potential areas

Action 2: Mobilization of international funding for construction of RWHC systems

Activity 2.1 Mobilization of funds
Activity 2.2 Preparation of projects
Activity 2.3 Hiring a construction company
Activity 2.4 Construction of RWHC systems

Action 3: Create tax incentives to promote private investment

Activity 3.1 establishment of working group to review the law
Activity 3.2 Revision of legislation of importation of goods and agricultural equipment
Activity 3.3 Publication of the legislation

Action 4: Create awareness of the society by inclusion of RWHC in the curricula of the different levels

Activity 4.1 Negotiate with Ministries of Eduaction, Vocational Training and of Workers
Activity 4.2 Currucula review to include RWHC contents
Activity 4.3 Implementation of curricula

Action 5: Improve coordination and collaboration among stakeholders

Activity 5.1 Identify coordinating institution
Activity 5.2 Produce a a memorandum of understanding
Activity 5.3 Identify the focal point's
Activity 5.4 Organize meeting for agreeing on terms and conditions for collaboration

1.3.4 Stakeholders and beneficiaries of TAP implementation

For the identification of stakeholders, the institutions responsible for the entire process and beneficiaries were identified. The responsible and beneficiary institutions for the implementation of the different actions included the MASA through INIR, DPCI and DNSV, MOPHRH through the DHRH and ARAs, the Ministry of Finances, The Ministry of Eduacation and Human Development, The Ministry of Hig Education, Technology and Vocational Training, The National Institute for Disater Management, The National Institute for Agricultural Research, Academia, and Local communities. To lead the implementation of the action, a focal point was proposed. For each specific action, the table below shows the institutions responsible, beneficiaries and focal point.

Table 5: stakeholder for implementing TAP of RWHC

Action	Resposible institutions	Beneficiary	Focal point
Action 1: Map potential areas for implementation of RWHC	MASA/INIR; MOPHRH/(DNRH, ARAs), INGC, IIAM, DNSV	MASA/INIR; MOPHRH/(ARAs, DNRH); Local communities	DNRH
Action 2: Mobilization of international funding for construction of RWHC systems	MEF; MASA/INIR; MOPHRH/(DNRH, ARAs), INGC, IIAM,	Central Government; MASA/INIR; MOPHRH/(ARAs, DNRH); Local communities	MEF
Action 3: Create tax incentives to promote private investment	MEF; MIC; AT; MJACR; MASA; MOPHRH, Private sector	Private sector, Local communities	MEF/MASA (DPCI)
Action 4: Create awareness of society about RWHC through training at different levels	MEDH; MESTP; MASA; MOPHRH; Academia	MASA; MOPHRH; Local communities	MASA/ MOPHRH
Action 5: Improve coordination and collaboration among stakeholders	MASA/INIR; MOPHRH/(DNRH, ARAs), INGC, IIAM, DNSV, Academia	MASA/INIR; MOPHRH/(DNRH, ARAs), Local communities	DNRH/INIR

1.3.5 Schedule and sequency of activities

The sequencing of the activities ollow the numbering used to identify the activities and certain activity can be performed only after the completion of the previous activity. The predicted implementation time and the sequencing of the implementation of the activities are presented in the table below 5 below. The implementation of action plan for RWHC will cover 10 years.

Table 6: Sequency and duration of activities for RWHC

Action	Activity	Duration of activity
Action 1: Map potential areas for implementation of RWHC	Activity 1.1 Identify and negociate with potential funding institutions	Year 1(10 months)
	Activity 1.2 Contracting a company for Mapping	Year 2 (24 months)
	Activity 1.3 Mapping potential areas	Year 3 and 4 (24 months)
Action 2: Mobilization of international funding for construction of RWHC systems	Activity 2.1 Mobilization of funds	Year 5 (12 months)
	Activity 2.2 Preparation of projects	Year 6 (12 months)
	Activity 2.3 Hiring construction company	Year 7 (12 months)
	Activity 2.4 Construction of RWHC systems	Year 8, 9 and 10 (36 months)
Action 3: Create tax incentives to promote private investment	Activity 3.1 establishment of working group to review the law	Year 1 (2 months)
	Activity 3.2 Revision of legislation of importation of goods and agricultural equipment	Year 1 (8 months)
	Activity 3.3 Publication of the legislation	Year 2 (3 months)
Action 4: Create awareness of society about RWHC through training at different levels	Activity 4.1 Negotiate with Ministries of Eduaction, Vocational Training and of Workers	Year 1(6 months)
	Activity 4.2 Currucula Review to include RWHC contents	Year 1 and 2 (12 months)
	Activity 4.3 Starting implementation of curricula in pilot institutions	Year 3 (12 months)
Action 5: Improve coordination and collaboration among stakeholders	Activity 5.1 Identify and agree on coordinating institution	Year 1 (1 month)
	Activity 5.2 Produce a memorandum of understanding	Year 1 (3 months)
	Activity 5.3 Identify the focal point	Year 1 (1 month)
	Activity 5.4 Organize meeting for agreeing on terms and conditions for collaboration	Year 1 (3 months)

1.3.6 Capacity need and estimated cost of activities

1.3.6.1 Capacity needs

There will be a need fro consucting a short-term training on procurement process in ordert o implement activities 1.2, 1.3. 2.3 and 2.4. Similarly, there will be a need for conducting short term training for conducting a training of trainers for implementing activity 4.3 where instructors at different levels of the pilot institution will have to receive training.

There is also a need to hire a construction company that will prepare the RWHC projects (activity 2.2), hire a loyer that will help in revision of the legislation (activity 3.2) and a training of trainers' consultant (activity 4.3)

1.3.6.2 Estimated costs of activities

The cost for implementing the TAP of RWHC is estimated at 135 million USD. The action 1 will cost about 6,5 million USD; the action 2 about 110 million USD; the action 3 about 70 thousand USD, the action 4 about 300 thousand USD and the action 5 about 17 thousand USD. The cost estimates of the different activities can be seen in Table 6 below.

Table 7: Cost estimates for activities of RWHC

Actions	Activities	Cost Estimates
Action 1: Map potential areas for implementation of RWHC	Activity 1.1 Identify and negociate with potential funding institutions	20,000
	Activity 1.2 Contracting a company for Mapping	1,500,000
	Activity 1.3 Mapping potential areas	5,000,000
Subtotal		**6,520,000**
Action 2: Mobilization of international funding for construction	Activity 2.1 Mobilization of funds	10,000
	Activity 2.2 Preparation of projects	200,000
	Activity 2.3 Hiring a constructing company	10,000,000
	Activity 2.4 Construction of RWHC systems	100,000,000
Subtotal		**110,210,000**
Action 3: Create tax incentives to promote private investment	Activity 3.1 Establishment of working group to review the law	30,000
	Activity 3.2 Revision of legislation of importation of goods and agricultural equipment	30,000
	Activity 3.3 Publication of the legislation	10,000
Subtotal		**70,000**
Action 4: Create awareness of society about RWHC through training at different levels	Activity 4.1 Negotiate with Ministries of Eduaction, Vocational Training and of Workers	10,000
	Activity 4.2 Currucula Review to include RWHC contents	100,000
	Activity 4.3 Implementation of curricula in pilot institutions	200,000
Subtotal		**310,000**
Action 5: Improve coordination and collaboration among stakeholders	Activity 5.1 Identify and agree on coordinating institution	1,000
	Activity 5.2 Produce a memorandum of understanding	10,000
	Activity 5.3 Identify the focal point	1,000
	Activity 5.4 Organize meeting for agreeing on terms and conditions for collaboration	5,000
Subtotal		**17,000**
Total		**117,127,000**
Management of implementation	10%	11,712,700
Contigency	5%	5,856,350
Grand-Total		**134,696,050**

1.3.7 Management planning

1.3.7.1 Risks and contigency planning

The risks foreseen for the implementation of RWHC action plan are associated to cost and scheduling.

Cost of Risk: estimating costs of activities 1.2, 1.3, 2.3. and 2.4 is somehow complex. Hence, there is possibility that the estimated costs are lower in relation to the costs that the hired companies will require or that the mapping and construction will require. AS a contingency, the technology working group decided to add a percentage of about 20% to the costs of the activities to cover the risk of underestimation.

Activities scheduling risks: Given the complexity of mapping and construction of RWHC infra-estrutures, the technology working group indicated that there is a possibility that the acticity 1.3 and 2.4 may take longer than expected. As contingency planning, it was proposed that to add a percentage of 10% relative to the initially calculated value to cover the costs incurred with extension of activity.

1.3.7.2 Next Steps

There will be a need to create a management team before the funding of the plan has been been submitted for funding. This team will also e responsible for designing proposals for funding and for managing the implementation of the plan after funding. Before funding, the operations of the management team will be supported by the government budget. This team should be based at the MOPHRH.

Table 8: Summary table for the action plan of RWHC

sector Agriculture

Technology: Rainwater harvesting and conservation

Ambition: This action plan aims to upscale the use of technology in the sector family that lives in arid and semi-arid areas of the provinces of Maputo, Gaza, Inhambane, Manica and Southern Tete Province that has been affected by cyclical drought. It is hoped that the plan cover about 75% of people living in arid and semi-arid regions of 5 provinces

Benefits: RWHC contributes to the resilience to drought through the provision of water for crop irrigation, livestock watering and human consumption during the time of lack of rain or in areas with low rainfall and or areas that record irregular rainfall. In small extent, RWHC can contribute to resilience to flood because it will contribute to reducing runoff of excess water from the rain.

Actions	Activities	Funding source	Responsible institution and focal point	Duration	Risk	Success Criteria	Indicators for monitoring the implementation	Budget per activity
Action 1: Map potential areas for implementation of RWHC	1.1 Identify and negociate with potential funding institutions	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	10 months	Potential funders not interested in financing	After 5 years, at least 75% of the potential areas mapped	List of potencial funders identified	20,000
	1.2 Contracting company for Mapping	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	24 months	Lack of funds		Mapping company contracted	1,500,000
	1.3 Mapping potential areas	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	24 months	Lack of funds		Potencial areas mapped	5,000,000
Action 2: Mobilization of international funding for construction	2.1 Mobilization of funds	Government budget	MASA / INIR // MOPHRH / DNRH	12 months	Lack of interest in funding by pontecial funders	After 6 years, at least 75% of the technology diploid in the tarhet areas	Funds mobilized	10,000
	2.2 Preparation of projects	Government budget	MASA / INIR // MOPHRH / DNRH	12 months	Lack of skills		Projects prepared	200,000
	2.3 Hiring a constructing company	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	12 months	lack of funds / Lack of interest of beneficiaries		Constrauction company hired	10,000,000
	2.4 Construction of RWHC systems	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	36 months	Lack of funds for construction		RHWC systems constructed	100,000,000

Action 3: Create tax incentives to promote private investment	3.1 Establishment of working group to review the law	Government budget	MASA / INIR // MOPHRH / DNRH	2 months	Lack of interest by potential participants	After 5 years, at least 50% of the target area receiving private investment	Working groups created	30,000
	3.2 Revision of legislation of importation of goods and agricultural equipment	Government budget	MASA / INIR // MOPHRH / DNRH	8 months	Lack of political will		Legislation revised	30,000
	3.3 Publication of the legislation	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	3 months	Lack of funds		Legislation published	10,000
Action 4: Create awareness of society about RWHC through training at different	4.1 Negotiate with Ministries of Eduaction, Vocational Training and of Workers	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	6 months	Lack of interest by the Ministries	After 5 years, at least 50% of the target population is aware about RWHC systems	Curricula reviewed	10,000
	4.2 Curucula Review to include RWHC contents	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	12 months	Lack on interest in reviewing the curricula		Contents of RWHC included in the curricula	100,000
	4.3 Implementation of curricula in pilot institutions	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	12 months	Lack capacity to implement new curricula		Reviewed curricula implemented	200,000
Action 5: Improve coordination and collaboration among stakeholders	5.1 Identify and agree on coordinating institution	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	1 month	Lack of interest by participating institutions	After 5 years, at least 75% of the population are implementing RWHC systems in their production system	Coordinating institutions identified and agreed	1,000
	5.2 Produce a memorandum of understanding	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	3 months	Lack of interest by participating institutions		MoU produced	10,000
	5.3 Identify the focal point	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	1 month	Lack of interest by participating institutions		Focal point identified	1,000
	5.4 Organize meeting for agreeing on terms and conditions for collaboration	Government budget /Development partners	MASA / INIR // MOPHRH / DNRH	3 months	Lack of funds / lack of interest in participating		Meeting organized	5,000

1.4 Action Plan for Seed Production and Promotion of low-cost improved storage systems

1.4.1 Introduction

Seed production is a process of producing high-quality seed to ensure achieving crop yield potential. In seed production, quality control and certification are key aspects to ensure genetic and phycal purity and disease control. Seed production can contribute to resilience of smallholder farmers and their families to drought, floods and cyclones by ensuring quick recover and restart of crop production after these events have taken place. Good quality seed has vigor that allows it to withstand some level of stresses caused by limited water availability and high temperatures in addition to resisting the attack of pests and diseases.

Low-cost improved storage systems is referred to the systems consisting of super bags, metal and polyethylene silos which were investigated and found to be appropriate for grain and seed storage in Mozambique. Low-cost improved storage systems can contribute to resilience of smallholder farmers to climate change by ensuring food availability soon after extreme events have taken place and through rapid recovery and restart of agricultural production using seed stored in low-cost improved systems.

1.4.2 Ambition of seed production and promotion of low-cost improved storage systems

The present action plan aims to upscale seed production and promotion of low-cost improved storage systems in the country. The targets for seed production are both seed companies and farmers organized in groups or associations while for low-cost improved storage systems are smallholder farmers. The transfer and difussion of seed production and improved low-cost storage systems is aimed to cover at least 75% of smallholder farmers in entire country to make Mozambique resiliente to climate change.

1.4.3 Actions and activities to be included in seed production and promotion of low-cost improved storage systems

The barriers, the measures as well as the actions to ensure sucessful transfer and diffusion of seed production and promotion of low-cost improved storage systems are discussed below.

1.4.3.1 Barriers hindering the transfer and diffusion of seed production and promotion of low cost improved storage systems

The barriers that hinder the transfer and diffusion of seed production are highly related high production and transation costs due to high inefficiency of seed companies; lack of financial capacity by seed companies and farmers to limited access to credit; lack of awareness of the value or advantage of using improved seed by farmers and malfunctioning of the seed value chain due to market distortion by the government and lack of technical and financial capacity to coordinate, monitor and promote the development of seed sector development by MASA as well as lack of capacity to conduct quality control and seed certifications.

The barriers hindering the transfer of low-cost improved storage systems are associated to lack of financial capacity pf farmers to acquire storage systems; exhacerbated by the lack of markets for agriculture production which can give incentives for farmers to store and sell the production when the price is attractive and low production and productivities which which in most of cases does not justify for acquiring storage systems; and lack of awareness about the improved storage systems due to lack of demonstrations and promotion. These barriers are categorized into economic and financial and nonfinancial as indicated below.

A. Economic and financial barriers for seed production and promotion of lowcost storage systems

The economic and financial barriers hindering the transfer and diffusion of seed production are associated to high production and transation costs due to high inefficiency resulting to lack of skills and lack of financial capacity of seed companies. Other is related to lack of financial capacity of farmes to acquire improved seed due to the fact that they depend on agriculture to generate income and they generally have low production and productivity, lack access to market and credit due to lack of collaterals and high interest rates.

Similarly to the seed production, the transfer and diffusion of low-cost improved storage systems is hindered mostly by the lack of financial capacity by farmers to acquire storage systems. The low production and productivity is one of the major disincentives for adoptions of improved systems because in most cases the low production doenst need storage system. The lack of market for agricultural produce to create incentive for storing the production to sell when the price is attractive is another barrier for adoption of improved storage systems. The lack of access to credit is another barrier to adoption of improved storage systems.

B. Nonfinancial barriers for seed production and promotion of low cost improved storage system

a) Political and regulatory

In Mozambique there is still no apropriate seed policy and legislative intruments that could address many of the gaps in the seed value chain. The design and implementation of seed police and regulation will contribute to improve the effectiveness of MASA conduct seed quality control and certification and to promote, coordinate and monitor the development of the seed sub-sector.

b) Socio-cultural

FAO implemented a project to promote Gorongosa silo but the adoption has been very low. The cost for constructing the silo (cost with cement and wires) and the fact that it enables to store only one commodity at a time and low crop productivity are among the caused for low adoption. Given that farmers produce multiple crops, they prefer storage system that enables storing different commodities at same time and not single crop storage as the case of Gorongosa silo. The size of the storage system in situation where productivity are very low limit the adoption. Gorongosa silo is designed to store up to 1,000kg which most farmers do not produce.

c) information and awareness

In Mozambique the use of improved seed still at 10% for Maize and 1.8% for rice and for other crops is still very low. The lack of awareness about the benefits of using improved seed is a major barrier because there have been less demonstration of advantage of improved seed over the recycled seed currently being used for crop production. With regard the storage systems, farmers still not informed and aware about some of the storage systems such as the super bag and its advantages over the storage systems currently being used by farmers. The promotion of these technologies (seed and storage

systems) should be anticipated by the demonstration of their best performance over the systems currently being used.

d) Institutional and organizational capacity

The major barriers hindering the seed production is the malfunctioning of the seed value chain due to market distortion caused by Government seed distribution programs and lack of technical and financial capacity of MASA to coordinate, monitor and promote the development of seed sector development as well as to conduct quality control and certification. Presently, there are three laboratories conducting seed quality control, one in North, one in central and one in South. These laboratories have difficult to respond to the demand on seed quality control for the entire country on time. The limited staff in number and quality to perform seed inspection and certification further complicates the production of good quality seed.

Other barriers that hinder transfer and adoption of seed production is the fact that there is still little opening for guaranteed seed production. The weak support mechanisms to producers to increase production and areas to promote the search for seed and storage systems is another blocking barrier to seed production and adoption of storage systems. Associated to these barriers, there is lack of systematic extension approaches to promotion and dissemination storage technologies and lack of systematic performance evaluation of the storage technologies to inform the needs for technology improvements to respond to farmers need and preferences.

f) market

The poor distribution network is one of the market barriers that limits the transfer and diffusion of seed production. The weak market development for agricultural products is another barrier hindering seed production because with well-developed market for agriculture products farmers will need to increase their production and for that they will need improved seed. The market barriers for promotion of storage systems are related to unavailability of materials for the construction of metal silos and lack of suppliers for super bag in the country.

g) Technical

The basic seed used to produce certified seed is generally of low quality. That results in low quality of certified seed produced leading to low production and productivity of marketed seed. The low availability of improved varieties for some crops is also another barrier that hinders seed production

1.4.3.2 Measures for removing barriers to the diffusion and transfer of seed production and promotion of lowcost storage systems

The measures to overcome the barriers of seed production and promotion of lowcost improved storage systems are detailed below. They are categorized into economic and financial and nonfinancial.

A. Economic and financial measures

Given that the barriers hindering the transfer and diffusion of seed production and promotion of low-cost storage systems are associated to the cost and lack of financial capacity it is recommended to:

- Liaise with financial institutions to provide cheap loans to: seed companies to cover the costs for transportation, processing and administrative which are very high; community and farmers to conduct seed production particularly of food security crops where seed companies generally doesn't have interest in seed production
- Provide Tax incentives through reducing or eliminating taxes in importation of raw materials for manufacturing storage systems
- Create an enabling environment for local artisans to have access to loans cheap loans for them to manufacture low-cost storage systems at local level.

B. Nonfinancial measures

a) Political, legal and regulatory

The seed policy and legislation should be created to help improve the development of the seed sub-sector by improving the seed business environment through supporting MASA institutions to be more effective in promoting, coordinating and monitoring the development of the seed sub-sector, in implementing the seed legislation and in delivering services to the seed industry and also to assist MASA and seed sub-sector stakeholders in monitoring the implementation of seed policies and legislation. Some of the aims of the seed police and legislation should be to help create sustainable seed maket by removing market distortion cause by Governments subsidy programmes

b) Socio-cultural

The social and cultural barriers hindering the adoption of improved seed production and storage systems can be addressed through enhanced access to improved inputs in order to increase production. With enhanced production farmers will demand for storage systems o store production as well as for improved seed to maintain high production. Other measures should be to manufacture small sizes of storage systems to enable storage of small quantities of different crops that they produce.

c) Technical

To ensure increased seed production, there is a need to expand and increase seed inspection in the field and the quality control of the seed after processing. The effective realization of seed inspection and quality control will contribute to raise awareness about the value or advantage of the use of improved seed because improved seed will have better performance than recycled seed and will lead to increased production and productivity. That in turn this will contribute to increased demand for improved seed and hence increased seed production. On the other hand, increased seed production will contribute to seed affordability given that increased production leads to increased availability.

One of the factors contributing to low adoption of improved storage systems is low production and productivity. Increased production and productivity will also contribute to increased demand for storage systems once the market for agricultural production has been established. Other measure to be considered is to make available storage systems of different sizes to suit different types of farmers and levels of production and productivity, where small size of the same type of storage system will be appropriate for farmers producing small quantities of grain or seed.

d) Information and awareness

Very few farmers are aware of the value or advantage of using improved. Therefore, there should intensification of demonstration plots for demonstrating the performance of improved seed compared to recycled seed to enable farmers to seed the advantage of improved seed. These demonstrations should be conducted using different approaches including the farmer field schools to ensure covering large number of farmers.

e) Institutional and organizational capacity

There a set of measures on institutional and organizational capacity that needs to be taken in consideration to enhance seed production in Mozambique. These include:

- Improve extension network, their skills and in means for more effective assistance to farmers on community seed production or on agricultural production
- Improve the entire production chain in order to encourage producers to increase production which will contribute to increase the demand for improved seed and storage systems to store the increased production.
- Improve or expand the network of inspectors and seed laboratories to ensure availability of improved seed and increase awareness about improved seed.
- Institutionalize and strengthen the quality control services at various levels
- Improve local infrastructure for entire seed supply chain
- Improve coordination between seed production and inspection institutions and streamline the inspection process or remove bureaucracy.

f) Market

Market for agricultural production can be a major drive for adoption of seed production as well as for storage systems. Market availability can contribute for increased production because farmers will be sure to sell all production that can make. On the other hand, increase production can contribute to acquisition of storage systems to ensure storing the production for the time the price for agricultural production is high. To ensure market establishment and development, there is a need improve roads and create associations to aggregate production and facilitate its transport and or attract potential buyers. On the buyers' side, there is a need to create incentives to ensure Economic agents to improve the network of seed distribution of seeds. These incentives can be access to cheap loans to get involved in commercialization.

g) Human capacities

To increase seed production it is necessary to train extension officers and farmers on seed production, handling and conservation. That will enable farmers to get involved in seed production in contract farming with seed companies or conduct their own production individually on in groups. Training extension officers will ensure availability of expertise to assist farmers on seed production.

On the other hand to promote low-cost storage systems, there is a need to train local artisans if manufacturing some of the storage systems such as metal silos.

1.4.3.3 Actions selected to be included in the TAP of seed production and promotion of low-cost improved storage systems

Action 1: Improve seed quality control and certification through increase in number of laboratories and qualified personnel

One of the factors limiting the availability of good quality seed and therefore, seed production in Mozambique is the limited capacity of quality control caused by the limited number of laboratories and limited number of qualified personnel for seed quality control and certification. The implementation of this action will aim to increase the number of laboratories and qualified personell through building new laboratories and hiring and trainng personell. This action is very important to ensure seed production in Mozambique and its impact is direct because once quality control of seed is assured seed producers will provide seed of good quality making farmers to realize the value of using good quality seed in the agricultural production process.

Action 2: Improve funding for the development of improved varieties

Other factor limiting seed production in Mozambique is limited availability of improved varieties caused by reduced and low robustness of breeding programs. This reduced and lack of robustness of improvements programs are motivated by the limited funding to breeding programs and by the limited number of breeders in the country. The mobilization of funding focused for breeeding will contribute to the availability of improved varieties to the market and therefore to improve the seed produção.

Action 3: Create farmers awareness about improved seed and promotion the massification of community seed production

The availability of improved seed in Mozambique is very limited particularly of the food security crops which private seed companies generally do not have interest in seed production. As a result, farmers generally use recycled seed. The promotion of community-based seed production system, can contribute to resilience to climate change because it will contribute to wide availability of improved seed that can be used to restart production after an climate event has ocorred. The promotion and massification of seed production will be done through training of communities and extension officers in seed production and management.

Action 4: Promote local production of super bag and metal silos through tax incentives to companies producing /importing raw materials

Presently, super bags and raw materials used to produce metal silos are imported. Local production can contribute to increased their availability and accessibility and hence contribute to enhanced adoption. To promote local production, incentives should be provided through tax exemptions or dute relaxation. The promotion of local production will contribute to resilience through enhancing their availability and accessibility which in turn will contribute to reduce postharvest losses on seed and grain.

Action 5: Promote the use of the super bag, metal silo and polyethylene for storage

These technologies have been found to be appropriate for grain storage in Mozambique. The promotion of their use will contribute for resilience by reducing post-harvest losses which are amongst the highest in Africa.

1.4.3.4 Proposed activities for implementing the TAP

The proposed activities for im+plementing the TAP of the five actions are detailed below.

Action 1: Improve seed quality control and certification through increase in number of laboratories and qualified personnel

Activity 1.1 Mobilization of funds for construction and equipping laboratories
Activity 1.2 Building laboratories in various parts of the country
Activity 1.3 Hiring lab and certification staff
Activity 1.4 Train hired staff

Action 2: Improve funding for the development of improved varieties

Activity 2.1 Identify potential institutions to finance the development of varieties
Activity 2.2 Negotiate funding dedicated to development of improved varieties
Activity 2.3 Train plant breeders in design and management of funds and the breeding program
Activity 2.4 Improve the system of variety release and registration

Action 3: Create farmers awareness about improved seed and promotion the massification of community seed production

Activity 3.1 Create farmer field schools (FFS) for improved eed production and promotion
Activity 3.2 Training farmer from FFS in seed production techniques and handling
Activity 3.3 Identify personel to carry out internal seed quality control and train them
Activity 3.4 Develop a manual for a system of internal quality control
Activity 3.5 Establish demonstration plots of improved and non-improved seed
Activity 3.6 Develop audio-visual information materials to popularize the use of improved seed
Activity 3.7 Negociate loans to fund community seed production and handling
Activity 3.8 Train communities in seed business plan and management
Activity 3.9 Implementation of seed production by communities

Action 4: Create incentives for local production of super bag, metal and poliethylene silos

Activity 4.1 Create a group to negociate tax incentives for importation of raw materials for making super bags, metal and polyethylene silos
Activity 4.2 Produce a list of negociation points
Activity 4.3 Submission of negociation points to government (MEF, AT, MIC) for analysis
Activity 4.4 Propose negociation forum and dates

Action 5: Promote the use of the super bag, metal silo and polyethylene for storage

Activity 5.1 Test the effectiveness of these technologies for seed and grain storage with FFS farmers
Activity 5.2 Data recording and analysis
Activity 5.3 Disseminate the results of effectiveness through audio-visual materials

1.4.4 Stakeholders of implementation of TAP

For implementing the TAP for seed production and promotion of low cost storage systems, the institutions responsible for implementation and beneficiaries as well as the focal points were identified. The responsible institutions included the National Diretorate for Agriculture and Silviculture of the Ministry of Agriculture and Food Security, The National Directorate for International Cooperation of the ministry of Agricultulture and Food security, The National Directorate for Agricultural Extension of MASA, The Nationa Institute for Agriculture Research, Some NGOs involved in seed production or promotion of storage systems such as Helvetas, The Faculty of Agronomy and Forestry Engineering of the Eduardo Mondlane University, The Platform for Dialogue in Seed (APROSE), The Development partners (USAID, World Bank, FAO), The Ministry of Finance, The Ministry of Comerce and Industry, The National Renevue Authority (AT), the private sector represented by CTA. The beneficiaries include farmers associations and communities, The research Institutions, the Authorities for seed release and certification (Seed Department), CTA and some NGOs. The Focal poit include APROSE, IIAM, CTA and DNEA.

Table 9: Institutions responsible and beneficiary of TAP implementation and focal point

Action	Resposible institutions	Beneficiary	Focal point
Action 1: Improve seed quality control and certification through increase in number of laboratories and qualified personnel	MASA/DINAS; MASA/DPCI; IIAM, NGOs; APROSE	MASA/DINAS; APROSE; Communities; Seed Companies	APROSE
Action 2: Improve funding for the development of improved varieties	MEF; IIAM; Development partners (FAO; WB; USAID) UEM/FAEF	IIAM and UEM/FAEF	IIAM
Action 3: Create farmers awareness about improved seed and promotion the massification of community seed production	MASA/DNEA; MASA/DINAS; APROSE	Communities	MASA/DNEA
Action 4: Create incentives for local production of super bag, metal and poliethylene silos	MASA/DPCI; MEF; MIC; AT, Private sector (CTA)	CTA	CTA
Action 5: Promote the use of the super bag, metal silo and polyethylene for storage	MASA/DNEA; NGOs (Helvetas); Farmers associations	Helvetas; Farmers associations	DNEA

1.4.5 Scheduling and sequencing of activities

The sequency and duration of activities for implementing the TAP is indicated in Table 10 below. The four activities for implementing the action 1 will cover 4 years starting from year 1. The four activities for implanting the action 2 will cover 3 years starting from year 1. The nine activities for implementing the action 3 will cover 6 years starting from year 2. The 4 activities for implementing the action 4 will cover only one year. The 3 activities of the action 5 will cover 3 year starting from year 1.

Table 10: Sequency and duration of activities of TAP for seed production

Action	Activity	Duration (months)
Action 1: Improve seed quality control and certification through increase in number of laboratories and qualified personnel	Activity 1.1 Mobilization of funds for construction and equipping laboratories	Year 1 (12 months)
	Activity 1.2 Building laboratories in various parts of the country	Year 2 and 3 (24 months)
	Activity 1.3 Hiring lab and certification staff	Year 4 (6 months)
	Activity 1.4 Train hired staff	Year 4 (6 months)
Action 2: Improve funding for the development of improved varieties	Activity 2.1 Identify potential institutions to fund the development of improved varieties	Year 1 (2 months)
	Activity 2.2 Negotiate funding dedicated to development of improved varieties	Year 1 (3 months)
	Activity 2.3 Train plant breeders in design and management of funds and the breeding program	Year 1(4 months)
	Activity 2.4 Improve the system of variety release and registration	Year 2 and 3 (18 months)
Action 3: Create farmers awareness about improved seed and promotion the massification of community seed production	Activity 3.1 Create farmer field schools (FFS) for improved seed production and promotion	Year 2 (3 months)
	Activity 3.2 Training farmer from FFS in seed production techniques and handling	Year 2 (5 months)
	Activity 3.3 Identify personel to carry out internal seed quality control and train them	Year 2 (2 months)
	Activity 3.4 Develop a manual for a system of internal quality control	Year 2 (2 months)
	Activity 3.5 Establish demonstration plots of improved and non-improved seed	Year 3 (5 months)
	Activity 3.6 Develop audio-visual information materials to popularize the use of improved seed	Year 3 (6 months)
	Activity 3.7 Negociate loans to fund community seed production and handling	Year 4 (6 months)
	Activity 3.8 Train communities in seed business plan and management	Year 4 (3 months)
	Activity 3.9 Implementation of seed production by communities	Year 5 and 6 (24 months)
Action 4: Create incentives for local production of super bag, metal and poliethylene silos	Activity 4.1 Create a group to negociate tax incentives for importation of raw materials for making super bags, metal and polyethylene silos	Year 1 (3 months)
	Activity 4.2 Produce a list of negociation points	Year 1 (4 months)
	Activity 4.3 Submission of negociation points to government (MEF, AT, MIC) for analysis	Year 1 (1 month)
	Activity 4.4 Establishment of negociations	Year 1 (4 months)

Action 5: Promote the use of the super bag, metal silo and polyethylene for storage	Activity 5.1 Test the effectiveness of these technologies for seed and grain storage with FFS farmers	Year 1 and 2 (24 months)
	Activity 5.2 Data recording and analysis	Year 1 and 2 (24 months)
	Activity 5.3 Disseminate the results of effectiveness through audio-visual materials	Year 3 (8 months)

1.4.6 Capacity needs and cost estimated for activities

1.4.6.1 Capacity needs

For implementing the activity 1.1 of the TAP there will be a need to cinduct a short-term training in project design. Other short term training will be necessary for data handling and analysis to implement the activity 5.2.

Other needs include the need to hire a consultant to implement activities 1.4, 2.3, 2.4, 3.2, 3.3, 3.4 3.8, and 5.2. That implies that there will be a need to get funding to pay for consultant.

1.4.6.1 Cost estimates for activities

The cost estimates for implementing the activities of the five actions of TAP for seed production and promotion of low-cost storage systems are indicated in Table 9. The action 1 will cost about 2,4 million USD; the action 2 will cost about 120 thousand USD; the action 3 will cost about 1,3 million USD; the action 4 will cost about 26 thousabd USD and the action 5 will cost about 750m thousand USD. In total the TAP will cost about 5,2 million USD.

Table 11: Cost estimates for activities of Seed production and promotion pf low cost storage systems

Action	Activity	Cost estimates (USD)
Action 1: Improve seed quality control and certification through increase in number of laboratories and qualified personnel	Activity 1.1 Mobilization of funds for construction and equipping laboratories	15,000
	Activity 1.2 Building laboratories in various parts of the country	2,200,000
	Activity 1.3 Hiring lab and certification staff	100,000
	Activity 1.4 Train hired staff	75,000
Sub-Total		**2,390,000**
Action 2: Improve funding for the development of improved varieties	Activity 2.1 Identify potential institutions to fund the development of improved varieties	10,000
	Activity 2.2 Negotiate funding dedicated to development of improved varieties	10,000
	Activity 2.3 Train plant breeders in design and management of funds and the breeding program	50,000
	Activity 2.4 Improve the system of variety release and registration	50,000
Sub-Total		**120,000**
Action 3: Create farmers awareness about improved seed and promotion the massification of community seed production	Activity 3.1 Create farmer field schools (FFS) for improved seed production and promotion	50,000
	Activity 3.2 Training farmer from FFS in seed production techniques and handling	100,000
	Activity 3.3 Identify personel to carry out internal seed quality control and train them	15,000
	Activity 3.4 Develop a manual for a system of internal quality control	50,000
	Activity 3.5 Establish demonstration plots of improved and non-improved seed	300,000
	Activity 3.6 Develop audio-visual information materials to popularize the use of improved seed	70,000
	Activity 3.7 Negociate loans to fund community seed production and handling	15,000
	Activity 3.8 Train communities in seed business plan and management	50,000
	Activity 3.9 Implementation of seed production and handling by communities	600,000
Sub-Total		**1,250,000**
Action 4: Create incentives for local production of super bag, metal and poliethylene silos	Activity 4.1 Create a group to negociate tax incentives for importation of raw materials for making super bags, metal and polyethylene silos	10,000
	Activity 4.2 Produce a list of negociation points	10,000
	Activity 4.3 Submission of negociation points to government (MEF, AT, MIC) for analysis	3,000
	Activity 4.4 Establishment of negociations	3,000
Sub-Total		**26,000**

Action 5: Promote the use of the super bag, metal silo and polyethylene for storage	Activity 5.1 Test the effectiveness of these technologies for seed and grain storage with FFS farmers	350,000
	Activity 5.2 Data recording and analysis	300,000
	Activity 5.3 Disseminate the results of effectiveness through audio-visual materials	100,000
Sub-Total		**750,000**
Total		**4,536,000**
Management of TAP		453,600
Contingecy		226,800
Grand-Total		5,216,400

1.4.7 Management planning

1.4.7.1 Risks and contingency planning

The risks foreseen for implementation of the TAP are related to cost. These risks are expected to affect activity 1.2 and 3.5. For activity 1.2 there is a possibility of the costs calculated for the activity are lower in relation to the actual costs for constructing the labs and equipping the labs. By recognizing that risk, the technology working group decided to add a percentage of about 20% to the costs of that activity. In relation to activity 3.5, the technology working groups decided to reduce the number of demonstration plots to be established by up to 5% in case the estimated costs are low than the actual costs during the implementation.

1.4.7.2 Next Steps

The next steps for implementation of the TAP for seed production and promotion of low-cost improved storage systems will include the creation of management team that will be responsible for establishment of the plan. The funds for establishing the plan will be supported by the government budget.

Table 12: Summary table for TAP of seed production and promotion of low cost storage systems

Sector Agriculture								
Technology: Seed Production and Promotion of low cost improved storage systems								
Ambition: Massification of seed production and promotion of lowcost storage systems in the country (Manica, Sofala, Tete, Zambezia, Nampula and Cabo Delgado). The Action plan aims to target about 75% of smallholder farmers in the country.								
Benefits: Seed production will ensure quick recover and resume of production after the destruction or loss of crops due to drought, floods and cyclones. Good quality seed has force that enables it to withstand any stresses level caused by the limited availability of water and high temperatures in addition to resist the attack of pests and diseases. Low cost improved storage systems can contribute to resilience by enabling the storage of grain keeping it in quantity and quality for people during and after the drought, flood or cyclone. Seed storage on the other hand, will ensure the availability of seed for the resuming production after the bad harvest or crop losses due to drought, floods and cyclones.								
Shares	**Activities**	**Funding source**	**Responsible institution and focal point**	**Duration**	**Risk**	**Success Criteria**	**Indicatorsfor monitoring the implementation**	**Budget by Business**
Action 1: Improve seed quality control and certification through increase in number of laboratories and qualified personnel	1.1 Mobilization of funds for construction and equipping laboratories	Government budget/Development partners	MASA/DINA	12 months	Pontential funders not interested	After 4 years, seed quality control and certification improved in 80% in the country	Funds mobilized	15,000
	1.2 Building laboratories in various parts of the country	Government budget/Development partners	MASA/DINA	24 months	Lack of funds		Laboratories built	2,200,000
	1.3 Hiring lab and certification staff	Government budget	MASA /DINA	6 months	Lack of budget provision		Staff hired	100,000
	1.4 Train hired staff	Government budget/Development partners	MASA/DINA	6 months	Lack of funds		Staff trained	75,000
Action 2: Improve funding for the development of improved varieties	2.1 Identify potential institutions to fund the development of improved varieties	Government budget/Development partners	MASA / IIAM / Institutions of Higher Education and Research	2 months	Lack of knowledge of potential lenders	After 4 years, more than 30% of the seed produced using the recently improved varieties	Potential funders indentified	10,000
	2.2 Negotiate funding dedicated to development of improved varieties	Government budget	MASA / IIAM / institutions of Higher Education and Research	3 months	Potential funders not interested in funding		Negociations made	10,000
	2.3 Train plant breeders in design and management of funds and the breeding program	Government budget/Development partners	MASA / IIAM / Institutions of Higher Education and Research	4 months	Breeders not willing to partici+ate		Plant breedrs trained	50,000
	2.4 Improve the system of variety release and registration	Government budget/Development partners	MASA / IIAM / Institutions of Higher Education and Research	18 months	Authorities not willing to create changes		Release and registration system improved	50,000

Action 3: Create farmers awareness about improved seed and promotion the massification of community seed production	3.1 Create farmer field schools (FFS) for improved seed production and promotion	Development partners	MASA/DNEA	3 months	People not willing to form FFS	Aftter 5 years, more than 50% of the target population are using improved seed and stirage systems	FFS created	50,000
	3.2 Training farmer from FFS in seed production techniques and handling	Development partners	MASA/DNEA	5 months	Lack of interested / Lack of incentives		numer of farmers from FFS trained	100,000
	3.3 Identify personel to carry out internal seed quality control and train them	Development partners	MASA/DINAS//ONGs(Helvetas)	2 months	Lack of interest from lenders		Number of people to carry out quality control	15,000
	3.4 Develop a manual for a system of internal quality control	Development partners	MASA /DNEA // //NGOs/Helvetas	2 months	Lack of funds for covering the costs for manual development		Manual developed	50,000
	3.5 Establish demonstration plots of improved and non-improved seed	Development partners	MASA /DNEA // NGOs/Helvetas	5 months	Lack of people with ability and interest		Number of demos established	300,000
	3.6 Develop audio-visual information materials to popularize the use of improved seed	Development partners	MASA /DNEA // NGOs //	6 months	lack of skills to develop audio-visuals		List of audio-visuals developed	70,000
	3.7 Negociate loans to fund community seed production and handling	development partners	MASA//MEF	6 months	Financial institutions not interested in financing that activity		Report of institutions available for financing	15,000
	3.8 Train communities in seed business plan and management	Development partners	MASA//MEF	3 months	Communities not willing to participate		Number of communities that participated in training	50,000
	3.9 Implementation of seed production and handling by communities	development partners	MASA/DNEA//APROSE	24 months	Communities not motivated		Number of ha of seed production	600,000
Action 4: Create incentives for local production of super bag, metal and poliethylene silos	4.1 Create a group to negociate tax incentives for importation of raw materials for super bags, metal and polyethylene silos	Government budget/Development partners	MASA / DPCI	3 months	Unwillingness to participate	After 5 years, more than 60% of improved storage systems are made locally	List of people integrating the group	10,000
	4.2 Produce a list of negociation points	Government budget	Private Sector / CTA//MASA/DPCI	4 months	Lack of political will		List of discussion points produced	10,000

	4.3 Submission of negociation points to government (MEF, AT, MIC) for analysis	Government budget/Development partners	**Private sector/CTA//MEF //MIC//AT**	1 month			Report of submission process	3,000
	4.4 Establishment of negociations	Government budget/Development partners	**CTA//MEF//AT// MIC**	4 months			List of points agreed	3,000
Action 5: Promote the use of the super bag, metal silo and polyethylene for storage	5.1 Test the effectiveness of these technologies for seed and grain storage with FFS farmers	development partners	MASA // IIAM / IHE	24 months	Lack of funds	After 5 years, more than 75% of the target populations is using superbag ou metal silo or polyethylene silo	Number of trials established	350,000
	5.2 Data recording and analysis	development partners	MASA// IIAM / IHE	24 months	Lackof funds		Data recorded	300,000
	5.3 Disseminate the results of effectiveness through audio-visual materials	development partners	MASA// IIAM / IHE	8 months	Lack of funds		Number and type of dissemination materials produced	100,000

References

Brito, R. and Holman, EHA 2012. Responding to climate change in Mozambique: 6 Theme: Agriculture. Maputo: INGC.

FAO, 2011. World Agriculture. Toward 2030/2050. Rome.

Government of Mozambique 2017. Report on Technology Need Assessment for Agriculture Sector Adaptation to Climate Change in Mozambique. Maputo, Mozambique

INE, 2011. Evolution of agricultural production of basic food crops [Online]. Available on http://www.ine.gov.mz:82/pxwebine/pxweb/temp/agricult_produc_culturas2007525152248.xls. Accessed on 20th July 2016

INGC. 2009. Main report: INGC Climate Change Report: Study on the Impact of Climate Change on Disaster Risk in Mozambique. [Asante, K. Brundrit G, Epstein, P., Fernandes, A. Marques, MR, Mavume A, Metzger, M., Patt A., Queface, A., Sanchez del Valle, R. , Tadross, M., Brito, A. (eds.)]. Mozambique.

MINAG, 2010. Plano Estratégico para o Desenvolvimento do Sector Agrário (PEDSA), 2010-19, Maputo, Moçambique.

Ministério para a Coodenação da Acção Ambiental (MICOA) 2013. National Communicationculture. Maputo, Mozambique.

Ministério da Agricultura 2015. Plano de Acção para Adaptação da Agricultura às MudançasClimáticas, Maputo, Moçambique.

Chapter 2: Project Ideas for three technologies of agriculture sector

2.1 Brief summary of the project ideas for agricultural sector

The identification of project ideas was conducted by the technology working groups based climate change scenarios of Mozambique and analyzing the effectiveness of the three technologies to ensure agriculture sector adaptation to climate change. For conservation agriculture, there were identified two project ideas, which are: (1) identification of practices and techniques appropriate for each socio-economic and adaphic-climatic context and, (2) Promotion and massification of conservation agriculture through demonstration plotss, audio visual information, brochures, flyers and manuals. The working group of rainwater harvesting and conservation identified three (3) project ideas which are: (1) Mapping areas with pontential, (2) Conduct pilot projects and, (3) Integration of RWHC in curricula at all educational systems. Similarly, the team working on seed production and promotion of low-cost improved storage systems identified three (3) project ideas which are: (1) Creation of technical and infrastructure capacity for seed certification and quality control, (2) Massification of seed production through capacity building of farmers and extension officers and, (3) Promotion of improved storage systems for grain and seed.

One of the factors contributing to the low adoption of conservation agriculture has to do with fact that some techniques and practices are not appropriate for the different soil and climatic and economic contexts and the in same cases farmers are not aware of this technology. As a result farmers do not know the benefits and advantages of this technology compared to conventional agriculture. So, there identification of appropriate techniques and practices for each soil and climatic and socio-economic contexts will enable identification of techniques and practices that are best suited to their conditions and needs. Onother hand, the awareness creation and promotion and massification of CA through demonstration plots, provision of audio visual information will increase farmers' exposure to these practices. Both identification of farmers' suitable techniques and practices and exposure of farmers to the technology will contribute for acceptance and adoption of CA.

The low adoption and limited massification of RWHC is related to the fact that areas with potential for its implementation have not largely been mapped and the due to lack of awareness about the technology by potential beneficiaries and the society in general. So, mapping zones with pontencial will contribute

to the achievement of the targets set for transfer and dissemination of RWHC because it will enable potential investors in this technology to know where to implement it. Conducting pilot projects, on the pther hand, will enable testing the functionality of the technology at the same time that it will enable promotion and acreate awareness of potential users to the use the technology. The integration of technology in the curricula of the different education systems will build capacity in society about its operation, advantages of its use, knowledge about its construction and maintenance. This will built awareness and contribute to its wide acceptance and adoption.

The limited technical and infrastructural capacity for certification and quality control of the seed produced is one of the factors limiting seed production because seed producing companies often have to compete with others who do not produce good quality seed due to lack of seed inspection and take action on those that do not produce good quality seed. Onother hand, the limited number of seed producers makes the improved seed to be very limited and expensive. Thus, the technology working group concluded that to ensure successful transfer dissemination of seed production in Mozambique it is necessary to increase the technical capacity for seed inspection and certification and quality control as well as to extend the quality control infrastructures to ensure that the market receives seed that is of quality. This will contribute to the massification of seed production because poor quality seed will be detected. On the other hand, the training of farmers in seed production and handling will increase the number of operators in seed production which may increase the number of seed companies but it can also enable that farmers organized in groups to produce seed mainly of food security crops that commercial seed companies have not shown interest.

Extension officers are the key actors in the diffusion and transfer of agricultural technologies in Mozambique. The training of extension officers in seed production and handling will contribute significantly to popularize seed production. This may contribute to the increasing number of actors involved in seed production of improved seed and particularly for food security crops that seed trading companies have not shown interest.

The promotion of local production and use of improved grain and seed storage technologies will increase their availability and farmers awareness which will increase the possibility of their adoption because they will become more known and accessible with increased availability. This will contribute to the reduction of post-harvest losses and therefore to the increase resilience to

climate change and improved food security even in the event of occurrence extreme weather events.

1.2 Project idea for CA: Increase awareness and promotion of CA in Mozambique through demonstration plots and audio-visual information

2.2.1 Introduction

Mozambique and particularly the arid and semi-arid areas of the country are prone to drought. Conservation agriculture, which has the ability to increase soil water retention and storage, infiltration of rainwater and increased incorporation of organic matter and nitrogen content in the soil, has been referred as having potential to contribute to the resilience of populations living in drought prone areas. However, the aption has been quite low. The lack of appropriate techniques and practices suitable for socio-economic, soil and climatic contexts, the limited knowledge about the benefits and or advantages of CA compared to conventional agriculture, the fact that CA is considered laborious and the yields in the first years of its implementation are low and the high initial implementation costs are among the factors contributing to its low acceptance and adoption.

The conservation agriculture working group has pointed the awareness creation through demonstration plots and audio-visual information as having potential to enhance transfer and adoption of CA in Mozambique. Hence, this is being proposed for project idea for conservation agriculture.

1.2.2 Objectives

The objective of this project is create awareness, promote and massifiy CA in Mozambique. Specificallythe project aims to remove the barriers for transfer and and dissemination of CA by massifying the establishment of demonstrations plots and transmission of audio-visual information about the best practices and techniques of CA.

1.2.3 Expected results

The massification of demonstration plots and transmission of audio-visual information will create awareness and promote CA and its benefits which will increase the possibility of its use. The demonstration will be established using farmer field schools which in addition of creating awareness and promotion, it will offer the possibility of participating farmers to lern by doing the implement of CA. This will enhance acceptance and mainstream adoption of the technology across the country.

1.2.4 Relation of results with the country sustainable development priorities

The strategies and policies of the country and agriculture sector development, specifically, the strategic plan for agriculture development and the action plan for agriculture adaptation to climate change, has pointed to conservation agriculture as one of the technologies that can help the country to adapt to climate change. As approaches to awareness creation and dissemination of CA, demonstration plots and dissemination of audio-visual information has been referred to as having a potential to ensure massification of its dissiminação. This indicates that the approaches proposed for the transfer and dissemination of CA in this project idea fall within the national priorities for sustainable development of Mozambique.

1.2.5 Project products

Two types of products will be produzidosm for this project.
Product 1: Best techniques and practices of CA
Product 2: Number of farmers covered by the project, which are expected to be around 75% farmers in the 5 provinces that will benefit from the project. The number of producers will be achieved through direct assistance to farmers groups of FFS which is expected to cover about 50% and other 25% that will be chieved via audio-visual information (radio programs, television, Flyers, brochures and manuals)

2.2.6 Project scope

The project proposed here will be implemented initially in 5 provinces, namely, Manica, Gaza, Inhambane, Nampula and Zambezia. It is expected to cover 4 districts in each province and which are situated in arid areas and semi-arid drought prone areas. In terms of population, it is expected to cover about 75% of which 50% will be through direct assistance and 25% reached via audio-visual information. Since the promotion of conservation agriculture is already happening and various locations including where the project will be implemented, this project will be connected to current and past projects sites and will try whenever possible make masiificação of previously developed actions.

1.2.7 Project activities

Project activities will include the following:

(i) Identification of farmers / groups (FFS) interested in participating in demonstration plots
(ii) Establish and monitor demonstration plots
(iii) Produce the audio visual materials
(iv) Train extension workers in establishment, maintenance and monitoring of demonstration plots

1.2.8 Proposed calendar

The implementation of this project will have duration of 4 years of which 2 years will be to conduct demonstration plots and the last two years are for producing and disseminating audio-visuais information.

2.2.9 Budget

The budget for this proposal will cover the expenses for conducting demonstrations plots, training of extension workers and audio-visual production. The proposed budget for these activities during implementation of the project will be 1.3 million USD according the detailed budget presented below.

Table 13: Cost estimation for implementing activities of transfer of CA

Item no.	Description of activity	Cost
1	Conducting demonstrations plots	850,000
2	Training of extension workers	150,000
3	Production and dissemination of of audio-visual materials	150,000
Total		**1,150,000**
Project management	10% of the total cost	115000
Contigency	5% of the total cost	57500
Grand-Total		1,322,500

2.2.10 Monitoring and evaluation

Project M&E will be based on monitoring the progress against the project objectively verifiable indicators. The expected results of the project and activities, the indicators and means of verification to ensure project monitoring and evaluation and indicated in the table below.

Table 14: Results or activities, indicators and means of verification of the project implementation

Results	Indicators	Means of verification
Strategic objective: improved food security	% of households food secure	Survey, food security studies from SETSAN, Government 5-year program Reports
Direct impact 1: Increased productivity	Crop yield using improved seed	Survey for monitoring the impact of the project
Direct impact 2: Improved resilience to climate change	% of households producing using improved seed	Survey for monitoring the impact of the project
Intermediate result 1: Increased availability of improved seed	% of improved seed available in market	Reports from MASA, SDAEs,
Activity 1: Identification of farmers / groups (FFS) interested in participating in demonstration plots	Number and name of of groups identified and selected and their geographic location	Project progress report
Activity 2: Establish and monitor demonstration plots	Number of demonstration established and their geographic location	Project progress report
Activity 3: Produce the audio visual materials	Number or Type of audio-visual produced	Project progress report
Activity 4: Train extension workers in establishment, maintenance and monitoring of demonstration plots	Number of participants desagragated by gender/location where training took place	Training report / project progress report

2.2.11 Challenges

The challenge foreseen is the difficulty in getting funding for the implementation of the proposed project idea. Once the funding has been achieved, the implementation of idea will be carried out given that technical conditions for its implementation and political will exist given that the idea proposed fall into the sustainable development priorities of Mozambique.

1.2.12 Responsibility and coordination

The responsibility for the implementation of this project will be of the Ministry of Agriculture and Food Security through the National Agricultural Extension Directorate. This institution will be responsible for coordinating the implementation of all project activities that could be implemented by other partners including the NGOs.

1.2.13 Stakeholders mapping

The stakeholders for implementing the project are indicated in the Table below. They include MASA/DPCI, MASA/DNEA, NGOs, Research Institutions and Academia and Development partners

Table 15: Stakeholders for implementing project idea of CA

Stakeholder	Role and responsibilities
MASA/DPCI	● Planning all processes
MASA/DNEA	● Coordination of project ● Coordinating the implementation of semonstrationsdemonstrations ● Coordinationg the training ofextension workers ● Coordinating the developmentof audio-visual materials
NGOs and farmers	● Conducting demonstrations plots
Research institutions/ Institutions of higher Education	● Training of extension workers
Development Partners/ Financial Institutions	● Project Financing

1.3 Project Idea for RWHC: Mapping potential areas for implementing RWHC systems

2.3.1 Introduction

Mozambique is cyclically affected by droughts and floods. Rainwater harvesting and conservation is a technology with potential to increase resilience to drought because on one hand it can make use of rainwater that has fallen in a short period of time causing flooding and on the other water can be saved and used for agriculture and livestock watering. In addition to the potential, the technology has been implemented in small escla for water harvesting for human consumption in some areas. However, the level of acceptance and adoption is still very low especially for farming and livestock watering livestock. The lack of knowledge about potential areas for its implementation, the socio-cultural factors, the limited technical and financial capacity to adopt the technology, are among the factors that limit its massive adoption in the country. The group working on RWHC referred that project idea that can contribute to successful transfer and dissemination of RWHC is mapping areas with pontencial. Hence, this idea is being proposing for funding as project idea.

2.3.2 Objectives

The objective of this project is to contribute to enhance knowledge about he potential areas for implementation of RWHC. Specifically, the project aims to map the potential areas.

2.3.3 Expected results

The expected results of mapping potential areas are:

- Areas with potential for implementing different sizes of RWHC systems identified and mapped.
- Suitability and feasibility for implementing RWHC assessed

2.3.4 Relation of results with the country sustainable development priorities

The Government of Mozambique in its five-year plan priority 4, strategic objective 3 points to the need to build hydro-agricultural infrastructure for irrigation and livestock watering. Likewise, the national strategy for water resources management (Governo de Moçambique, 2007) in its Chapter 2, sub-chapter 2.8 about drought management, points to the need to promote and disseminate the use of methods and techniques for rainwater harvesting where is possible. This shows that the project idea proposed for this project is strongly aligned with sustainable development priorities of Mozambique.

2.3.5 Project products

This project will have two produts:

- Report describing the potential areas for implementing RWHC systems
- Maps showing locations where RWHC can be built

2.3. 6 Scope of the project

The project proposed will initially be implemented in five provinces, namely Maputo, Gaza, Inhambane, Manica and Tete. This project is expected to cover all the districts located in arid and semi-arid areas which have been affected by drought and try to cover at least 75% of the population in these areas. Given that the promotion of rainwater harvesting and conservation is already happening in some areas, this project will be connected to current and past projects in these locations and it will try whenever possible massifythe previously developed actions.

2.3.7 Project activities

The project activities will include the following:

(i) Selecting and hiring company to conduct mapping
(ii) Survey of areas where rainwater harvesting systems can be built
(iii) Map the reas with potential
(iv)Production of maps

2.3.8 Proposed timetable

The implementation of this project you will have duration of four (4) years of which 2 years will be dedicated for survey and mapping of areas and 2 for production of report and maps.

2.2.9 Budget

The budget for this proposal will cover the expenses for the payment of mapping expenses and the payment of the company that will do the mapping. It is being proposed to hire a company to do the mapping. Thus, the proposed budget for these activities during implementation of the project will be about 7,0 million USD.

Table 16: Cost estimation for activities of the project

Item no.	Activity	Estimated cost
	Lauching a bid to contract company to conduct mapping	3,000
	Field work	4,200,000
	Production of Maps	300,000
	Payment to the mapping company	1,500,000
Total		**6,003,000**
Project Management	10%	600300
Contingencies	5%	300150
Grand-Total		**6,903,450**

2.3.10 Monitoring and evaluation

Project M&E will be based on monitoring the progress against the project objectively verifiable indicators. The expected results of the project and activities, the indicators and means of verification to ensure project monitoring and evaluation and indicated in the table below.

Table 17: Results or activities, indicators and means of verification of project implementation

Results	Indicators	Means of verification
Strategic objective: improved food security	% of households food secure	Survey, food security studies from SETSAN, Government 5-year program Reports
Direct impact 1: Increased productivity	Crop yield using improved seed	Survey for monitoring the impact of the project
Direct impact 2: Improved resilience to climate change	% of households producing using improved seed	Survey for monitoring the impact of the project
Intermediate result 1: Increased availability of improved seed	% of improved seed available in market	Reports from MASA, SDAEs,
Activity 1: Selecting and hiring company to conduct mapping	Company for mapping selected and hired	Project progress report
Activity 2: Survey of areas where rainwater harvesting systems can be built	Number and name of areas surveyed	Project progress report
Activity 3: Map the reas with potential	Number and name of areas mapped	Project progress report
Activity 4: Production of maps	Number of maps produced	project progress report/Map produced

2.3.11 Challenges

The challenges foreseen for the implementation of this project are related to sourcing funds. Other challenges foreseen are related to availability of capacity locally to conduct mapping given the limited skills at country level.

2.3.12 Responsibility and coordination

The coordination of this project will be of the responsibility of the Ministry of Public Works, Housing and Water Resources. This institution will be responsible for creating a establishment team and will also be responsible for sourcing for such establishment at the Ministry of Economy and Finance.

2.3.13 Stakeholder mapping

The stakeholders for implementing the project are indicated in the Table 16. These will include the Ministry of Public Works, Housing and Water Resources, MASA//INIR//IIAM//UEM/FAEF, Communities/Farmers, private sector and development partners. The role of each stakeholder is indicated in the table.

Table 18: Stakeholder for implementing the project

Stakeholder	Role and responsibilities
Ministry of Public Works, Housing and Water Resources	● Lauching a call for bid ● Coordination of mapping activities ● Negociation with mapping company ● Monitoring the mapping activities ● Monitoring the development of maps
MASA//INIR//IIAM//UEM/FAEF	● Guide the mapping to areas with potential for agriculture and livesctok production ● Monitoring the mapping activities ● Monitoring the development of maps
Communities/Farmers	● Guide the mapping to the areas of their interest for agriculture and livestock production
Private sector	● Provide associate services for mapping
Development Partners// financial Institutions//MEF	● project financing

2.4 Project idea for the seed production: Massification of seed production through capacity building of farmers and extension officers.

2.4.1 Introduction

Mozambique is vulnerable to climatic change manifested in the form of climate extreme weather events such as floods, droughts and cyclones. Under these conditions, seed production and promotion of low-cost improved storage systems can help farmers and their families to be resilient to climate change by using the produced seed to restart production after drought or floods have taken place. The promotion of improved storage systems can also help farmers and their families to be resilient to climate change by ensuring food availability from stored grain after an extreme event have occurred of through ensuring seed availability for restart production from stored seed.

Despite having the potential to ensure the resilience, the adoption of seed production and of improved storage systems is still quite low. The lack of incentives for seed production associated with unfair competition caused low capacity for certification and quality control, the lack of awareness about the value of quality seed by producers motivated by circulation of fake seed in the market, are among the factors that contribute to tlow seed production. Onother hand, the high cost of presently existing storage systems, the lack of incentives to acquire storage systems due to lack of market production, low production and productivity are among the factors that limit the adoption of improved storage systems.

So, the technology working group identified three project ideas that they believe can contribute to successful transfer and dissemination of seed production and adoption improved storage systems. The three project ideas are: (1) Creation of technical and infrastructure capacity for seed certification and quality control, (2) Massification of seed production through capacity building of farmers and extension officers and, (3) Promotion of improved storage systems for grain and seed. For the sake of this exercise, the selected project idea for funding is the Massification of seed production through capacity building of farmers and extension officers.

2.4.2 Objectives

The overall objective of the project is to contribute to the massification of seed production in Mozambique. Specifically, the project aims to create capacity of farmers and extension officer through training on seed production, seed handling and seed business development and management.

2.4.3 Expected Results

The expected results of this project are:

- Farmers trained on seed production and handling and able to conduct seed production and handling
- Farmers trained on seed business development and management and able to develop seed business and manage it
- Extension officers trained on seed production and able to assist farmers on seed production
- Improved seed massively produced
- Seed business established
- Improved incomes from selling seed and increased production from improved seed use
- Farmers in Mozambique using improved seed

2.4.4 Relation of results with country sustainable development priorities

The strategic plan for agriculture sector development (MINAG, 2010) in its strategic objective 1, result 1.3, points to the need to strengthen the research system for development, adaptation and deployment of improved technologies such as seeds for increased production, productivity and competitiveness. On the other hand, the government's five-year plan (2015 - 2019) (Governo de Moçambique, 2015) in its priority 3, strategic objective 1, no. 39, points to the need to promote the generation of productive technologies resilient to climate and encourage its use and adoption for increased productivity and improved consumption at the household level. PEDSA in its strategic objective 2, results 2.1, 2.2 and 2.5 point to the need to improve the post-harvest management by increasing or improving the availability of improved storage conditions. This indicates that the approaches proposed for the transfer and dissemination of seed production and promotion of lowcost storage systems fall within the priorities for sustainable development of Mozambique.

2.4.5 Project products

The products of this project will include:

- Improved seed of good quality available for farmers countrywide
- Farmers developing seed business

2.4.6 Project scope

The project proposed here will be implemented in entire contry. The districts to benefit from the project will be chosen based on high agricultural production potential. In total 3, districts will be covered per province and it is expected to cover about 75% of the population in the target distrits.

2.4.7 Project activities

Project activities will include the following:

(i) identification of the districts where the project will be implemented
(ii) Identification of farmers groups (FFS) or associations that will be part of the project
(iii) Training of trainers
(iv) Training of farmers / associations or groups on seed production and handling and seed business management
(v) Linking farmers to seed companies and or agro-dealers

2.4.8 Proposed calendar

The proposed project will have duration of three (3) years. The training process will involveidentification of districts and groups of farmers, hiring trainers, preparation of training materials, implementing training which will start from theoretical part followed the in-field training. In field training will consist of implementing all steps of seed production since planting until harvesting. After field training will follow, seed processing and packaging, transporting to market, agro-dealers or seed company depending on the route to be followed.

2.4.9 Budget

The proposed budget is detailed below. It is estimated that the project will cost about 1,4 million USD.

Table 19: Cost estimation for activities of massifying seed production

Item no.	Descriptiondespeza	Estimated cost
1	Identification and selection of districts	20,000
2	Identification and selection of farmers/ group	30,000
3	Hiring training of trainers	100,000
4	Conducting training of trainers	50,000
5	Training farmers on seed production and processing	900,000
6	Seed transportation	100,000
Total		**1,170,000**
Project management	**10% of Total**	**117,000**
Contigency	**5% of Total**	**58,500**
Gran-Total		**1,345,500**

2.4.10 Monitoring and evaluation

Project M&E will be based on monitoring the progress against the project objectively verifiable indicators. The expected results of the project and activities, the indicators and means of verification to ensure project monitoring and evaluation and indicated in the table below.

Table 20: Results, indicators and means of verification

Results	Indicators	Means of verification
Strategic objective: improved food security	% of households food secure	Survey, food security studies from SETSAN, Government 5-year program Reports
Direct impact 1: Increased productivity	Crop yield using improved seed	Survey for monitoring the impact of the project
Direct impact 2: Improved resilience to climate change	% of households producing using improved seed	Survey for monitoring the impact of the project
Intermediate result 1: Increased availability of improved seed	% of improved seed available in market	Reports from MASA, SDAEs,
Activity 1: Identification and selection of districts	Number and name of districts selected	1st project progress report
Activity 2: Identification and selection of farmers or groups	Number of groups selected	1st project progress report
Activity 3: Selection and hiring trainers	Name of trainers selected	
Activity 4: Conducting training of trainers	Number of participants desagragated by	Training report / project progress report

	gender/location where training took place	
Activity 5: Training farmers	Number of participants desagragated by gender/location where training took place	Training report / project progress report
Activity 6: Training farmers	Number of participants desagragated by gender/location where training took place/Quantity of seed produced	Training report / project progress report
Activity 7: Seed transportation	Quantity of seed transported	Project progress report

2.4.11 Challenges

The challenges foreseen are related to sourcing funds for implementation of the project, creating interest in farmers to enfage the training and seed production, establishing seed business, ensuring coesion of the group to undertake seed business.

2.4.12 Responsibility and coordination

The responsibility for the implementation of this project will be of the Ministry of Agriculture and Food Security through through the National Directorate of Agricultural Extension in coordination with Nationalo Directorate for Agriculture and Silviculture and National Directorate for Planning and International Cooperation. This institution will be responsible for coordinating all project activities including those that will be implemented by other partners that may include institutions of higher education who teach agriculture and NGOs that will be involved in creating groups and participating in training and farmers assisntance.

2.4.13 Stakeholders mapping

The stakeholder for implementing the project will include MASA/DNEA, MASA/DPCI, MASA/DINAS, NGOs, SDAEs, Academia, Ministry of Finance and Development partners. The role of each stakeholder is presented below.

Table 21: Stakeholder for implementing the project

Stakeholder	Role and responsibilities
Ministry of Agriculture and Food Security/DNEA/SDAEs	● Project coordination ● Identification and selection of districts ● Identification ajnd selection of farmers or groups ● Coordinate training of farmers and extension officers ● Monitoring the implementation of the project
MASA//DINAS	● Participate in training in seed production and seed quality control
MASA/DPCI	● Planing the implementation of the project
Communities/Farmers	● Participate in training and seed production and handling
Academia	● Training on seed production
Seed companies/Agro-dealers	● Buy seed produced by farmers or associations
NGOs	● Helping in implementation of the project (organizing farmers and training)
Development Partners// financial Institutions//MEF	● project funding

References

Governo de Moçambique 2007. Estratégia Nacional dos Recursos Hídricos. Maputo, Mozambique

Governo de Moçambique 2015. Proposta do programa quinquenal do governo (2015-2019). Maputo, Moçambique.

MINAG, 2010. Plano Estratégico para o Desenvolvimento do Sector Agrário (PEDSA), 2010-19, Maputo, Moçambique.

Annex 1: List of participants

Name	Organization	Contact	Approch of consultation	Topic
Rogério Jamisse	MASA/DNEA	jamice02@gmail.com	Discussion workshop	Conservation agriculture
Inácio Nhancale	MASA/DNEA	it.nhancale@gmail.com	Bilateral meetings	Conservation agriculture
Suzie Aly	IIAM/DARN	suziealine@gmail.com	Discussion workshop	Conservation agriculture
Ricardo Maria	IIAM/DARN	ricardo_dejesus@hotmail.com	Bilateral meetings	Conservation agriculture
Gabriel Manhiça	INGC/DARIDAS	jeluanemanhica@gmail.com	Bilateral meetings	Conservation Agriculture/Rainwater harvesting
Pedro Simpson	FAO	Pedro.SimpsonJunior@fao.org	Bilateral meetings	Conservation Agriculture
Sebastião Famba	UEM/FAEF	sebastiaofamba@gmail.com	Bilateral meetings	Conservation agriculture
José M. Malunga	MASA/INIR	jose.m.malunga@gmail.com	Discussion workshop	Rainwater havesting
Cristina Manhique	ARA-SUL	manhique@gmail.com	Discussion workshop	Rainwater harvesting
David Sengo	ARA-SUL	dsengo@yahoo.com	Bilateral meetings	Rainwater harvesting
Tomás Maculuve	IIAM/DARN	tmaculuve@gmail.com	Bilateral meetings & Discussion workshop	Rainwater harvesting
Paula viola	UEM/FAEF	pmusseraviola@gmail.com	Discussion workshop	Rainwater harvesting
José Matsinhe	FAO	jose.matsinhe@fao.org	Bilateral meetings/discussion workshop	Seed production and Storage systems
Elsa Timane	MASA/DINAS	elsa.timana@gmail.com	Bilateral meetings	Seed production
Felisberto Dimande	MASA/DINAS	Felisberto.Dimande@fao.org	Bilateral meetings	Seed production
Lucas Tivana	UEM/FAEF	ltivana@yahoo.com.br	Discussion workshop	Storage systems
Rafael Nguenha	UEM/FAEF	rafaelnguenha@gmail.com	Discussion workshop	Storage systems
Almeida Almeida	INIR	almeidalmeid@gmail.com	Discussion workshop	Rainwater harvesting
Jacinto Mafalacusse	IIAM/DARN	jmafalacusser@gmail.com	Discussion workshop	Seed production
Manuel Miquitaio	INIR	Manuelmiquitai1@gmail.com	Bilateral meetings	Rainwater harvesting
Paiva Munguambe	INIR	Paiva.munguambe@uem.mz	Bilateral meetings	Rainwater harvesting
Egídio Govate	MOPHRH/DNRH	84685806/8468580	Bilateral meetings	Rainwater harvesting
Sara Guibunda	MASA/DPCI	sargilsemedo@yahoo.com.br	Discussion workshop	Conservation agriculture
Júlio Simão	CARE	jsimao@care.org.mz	Bilateral meetings	Conservation agriculture
Bordalo Mouzinho	IIAM/DARN	brmouzinho@gmail.com	Bilateral meetings	Conservation Agriculture