

## 2.2.2 Project Idea for micro-irrigation

Mauritius is classified as a water-stressed country and faces water scarcity problems during periods of droughts. The decreasing trend in annual rainfall and increasing number of consecutive dry days recorded over the past decade along with increasing water demand for growing population, industry, tourism and agriculture have resulted in increased pressure on our diminishing freshwater resources. Currently, the agricultural sector consumes around 48 % our total fresh water resources with about 30 % of the cultivable land area under irrigation (mainly overhead) while the rest is under rain fed and thus highly susceptible to droughts. Given that climate change is expected to further worsen the situation in the future, this will have a profound effect on crop productivity, farmers' livelihood and national food security. To address this issue, the project idea for micro irrigation technology proposes a list of measures to overcome the barriers hindering investment in this technology.

### 2.2.2.1 Summary sheet for micro-irrigation

#### AGRICULTURE PROJECT IDEA : PROMOTING MICRO-IRRIGATION IN DROUGHT PRONE AREAS

##### Brief Project description

As a measure to help small scale farmers to cope with diminishing water resources in the event of climate change and sustain their production, this project aims at providing support to farmers to establish micro irrigation facilities to optimise water use. The project is targeting some 500 small scale food crop growers ( approx 250 ha) in the next 5 years. This will be achieved by provision of a financial support through a subsidy ( Rs 120,000/ha) for the purchase of micro irrigation equipment, capacity building of farmers and support to R&D and measures to encourage private sector involvement. This project will also encourage other water conservation measures such as rainwater harvesting, mulching and minimum tillage. This project will also provide opportunity for farmers to cultivate during the dry season, to grow high value crops and improve their crop yield and income.

##### Results Oriented Framework

###### Overall Goal

Reduction of crop failure due to water stress, optimise water and nutrient use while enhancing crop productivity, food security and farmers income and welfare

###### Development Objectives

Removal of barriers to the uptake of Micro-irrigation through financial incentives, technical support and capacity building

###### Inputs

- i. Survey of drought prone area with a reliable water source
- ii. Identification of farmers who can benefit from this micro irrigation scheme
- iii. Improve R& D budget to provide technical information on irrigation requirements and economic analysis
- iv. Reinforce extension services with capacity building of extension specialist in the field of irrigation
- v. Sensitisation on the impact of climate change and the measures of adaptation including optimising water use
- vi. On farm demonstrations of micro irrigation
- vii. Training of farmers in operation and maintenance of irrigation system

###### Outputs

- i. Awareness created on the benefit of investing in micro irrigation and water management among farming community
- ii. Improve farmers' resilience to climate change impacts
- iii. Promote optimum use of water resources
- iv. Enhance crop productivity by reducing water stress

###### Impacts

Long term impacts include sustaining crop production and contributing to food security.

|   |  |  |
|---|--|--|
| <p>viii. Training of installers of irrigation system in design and installation</p> <p>ix. Setting up of national standard for irrigation equipment</p> <p>x. Put in place a quality control or irrigation equipment</p> <p>xi. Measuring of impacts of micro irrigation on water resource use, crop productivity and farmers livelihood</p> <p>iv. Production of newsletters, radio and TV programs on use of micro irrigation</p> |  |  |
|---|--|--|

**Estimated costs**

This project is estimated to cost USD 1.80M or MUR 54.0M over a period of 5 years and will involve Irrigation Authority department of the Ministry of Agro Industry and Food Security, AREU, Water Resources Unit, Water Users Associations and the International Atomic Energy Agency. The sources of funding are: International donors (United Nation Fund for Climate Change, Adaptation Fund, UNDP, GEF, FAO, Strategic Climate Fund, African Development Bank), national government, regional partners and co-financing between government and private sectors.

**Proposed timeframe**

Over 5 years

**Executive bodies**

Ministry of Agro-Industry and Food Security and its parastatal bodies (Irrigation Authority, Agricultural Research and Extension Unit)

**Cost-benefit analysis**

The estimated benefit to cost ratio of 4.67 clearly demonstrate a high return from investment due to a shift to high value crop and higher productivity. This technology will also provide the following avoided future costs:

- Loss of agricultural production
- Ground water contamination and other environmental hazard due to nutrient leaching
- Impoverishment of farmers

**Risks**

- High renewal cost of equipment
- Improper maintenance by farmers resulting in inefficient operation of irrigation system Theft or vandalism
- Poor quality of irrigation equipment
- Weak after sales service
- Fire

**Profile**

Technical expertise required in irrigation water management, design and installation of irrigation system, water manager for training of farmers and technical support to farmer

**Key tasks**

- Identify critical areas with water deficit and resource poor farmers to which the technology is likely to benefit
- Identify and offer options of different micro irrigation system based on crop type, crop spacing, water source, field size and topography
- Human resource development of extension, researcher, farmers and entrepreneurs active in MI technologies
- Need to survey each farmer's field to recommend most appropriate irrigation system
- Technical support of farmers to on cultural practices to improve productivity under irrigated agriculture
- Introduce a certification scheme for ecological food / pesticide environmental Stewardship program

**Identification of key stakeholders**

Ministry of Agro Industry and Food Security, Irrigation Authority, Mauritius Sugar Research Institute, Farmers Service Cooperation, Agricultural Research and Extension Unit, Small Farmers Welfare Fund, importer and supplier Irrigation equipment, Water tank manufacturer and supplier, University of Mauritius Engineering Department,

## 2.2.2.2 Project overview

### Project scope

The purpose of micro irrigation technology is to optimise use of irrigation water, reduce wastage, improve productivity and quality while reducing the risk of crop failure in period of water shortages, minimising risk of nutrient leaching and environmental hazards and also enhancing food security and farmers livelihood.

### Project timeline:

The technology is appropriate for present and expected climate scenarios impact and likely diminishing water resources. The overall targets of this technology are to reduce risk of crop failure and improve agricultural productivity and enhancement of farmers' livelihood. Considering the areas with soil moisture deficit, this technology will target some 250 ha to be attain over 5 years and involving some 500 small scale farmers. The MI scheme will benefit some 50 ha per ha.

## 2.2.2.3 Project framework

| <b>Project Goal:</b> Adapting to climate change through Integrated pest management as a substitute for chemical control measures for pest and disease control                  |   |   |  |   |  |
|--|---|---|--|---|--|
| <b>Development objectives:</b> Removal of barriers for the uptake of Integrated pest management using investment in R& D, capacity building and appropriate enabling framework |   |   |  |   |  |
| Project Component  | Expected Outcomes   | Expected Inputs   | Expected Outputs   | Objectively Verifiable Indicators   | Expected Impacts   |
| 1. Financial incentives to encourage farmers to invest in MI technology  | Reduction of crop failure and optimise water use due to water stress, optimise water and nutrient use while enhancing crop productivity, food security and farmers income and welfare | Generate information on risk of crop failure associated with water stress, survey of drought prone area, and farmers eligible to most of the micro irrigation scheme( 40 % cost of investment in MI for a maximum of 0.5ha /beneficiary . Economic feasibility of the implementing MI project | Awareness created on the benefit of investing in micro irrigation and water management among farming community | Survey report<br>No of farmers eligible to benefit from MI scheme   | Improve farmers' resilience to climate change impacts in soil moisture deficit regions |
| 2. Investment in R&D related to irrigation and water management  | Enhance crop yield in irrigated areas through improve agronomic practices   | Investment in R& D to provide technical information on irrigation requirements and economic analysis, human resource development, improvement of infrastructural capacity, reinforce extension services with capacity building of extension specialist in the field of irrigation             | Adequate technical capacity built for supporting irrigation projects   | -No. of trained researcher and extension officer<br>- No. of training conducted<br>- Guidelines developed for MI design, installation and maintenance for different soil types . .<br>- crop types<br>- Extension irrigation specialist available | To improve agricultural production despite diminishing water resources                 |

| Project Component                       | Expected Outcomes  | Expected Inputs  | Expected Outputs  | Objectively Verifiable Indicators   | Expected Impacts   |
|---|--|--|---|---|--|
| 1.Information and awareness             | Improve awareness of benefits of MI and build adequate capacity to support MI project implementation | -Identify training needs of beneficiaries in areas related to MI technologies, water management , operation and maintenance and input supply<br>- Sensitisation on the impact of climate change and the measures of adaptation including optimising water use<br>-Human resource development through training of research, extension, farmers and active players involved in MI<br>-Workshop / seminar/ exhibition to promote MI at regional and national level<br>-Demonstration of MI on recognised farms of Research Institute/ progressive farmers of horticultural crops ( 0.5 ha each) | Farmers know how on the technology is improved  | No. of training / workshop , exhibition<br>No. of field demonstration<br>No. of dissemination tool developed (video, factsheet) | Increase uptake of MI to optimise water sue and improve productivity       |
| 4. Promote quality irrigation equipment | Improve efficiency of MI system  | - Training of farmers in operation and maintenance of irrigation system<br>- Training of installers of irrigation system in design and installation<br>- Setting up of national standard for irrigation equipment<br>- Put in place a quality control or irrigation equipment  | - Training and information available to farmers   | List of suppliers of irrigation equipment selling certified materials   | Increase farmers confidence in MI and improve production and food security |
| 5. Improving after sale service         | Improve efficiency of MI system and farmers yield and income   | Training of entrepreneurs in design , installation and maintenance   | Adequate after-sale service providers on local market                                   | No. of after -sale service providers  | Improve performance of MI and increase it lifespan                         |
| 6. Provision of soft loan               | Beneficiaries able to cover their own capital investment   | Information of financial institutions providing soft loan  | Awareness and cooperation of financial and banking services to help promote the measure | No of farmers applying of soft loan for micro-Irrigation project  | Ease of access to finance and services                                     |

#### 2.2.2.4 Project Justification

This project is in line with Strategic Options in Crop Diversification and Livestock Sector 2007-2015, Food Security Strategic plan (2013-2015), and the Sustainable diversified Agri-food sector strategy for Mauritius 2008–2015 aimed at fostering local food production and modernising the non-sugar sector in a competitive and sustainable manner through efficient irrigation system in view of optimising water use and improving crop productivity for national food security.

##### **Benefit-cost analysis:**

Based on the target of providing micro irrigation to some 500 food crop growers with average plot size of 0.5 ha each (total 250 ha) in water stress areas over the period of 5 years, the benefit/cost ratio for IPM technology was estimated to 4.67. This figure clearly shows that the return from investment in micro irrigation (drip or sprinkler) is high due to increase in crop yield, increase market access and saving on labour. It is thus worth to invest in this technology.

##### **Benefit to Cost Ratio of financial incentives for investing in micro-irrigation**

Taking into account the cost of implementing micro-irrigation technology involves cost of capital investment in irrigation equipment, cost of subsidy of 40 % by the government, cost of interest on capital, cost of operation and maintenance and that the benefits include incremental increase in yield, saving on water and labour for irrigation, the benefit/ cost was estimated to 4.67. This ratio shows the viability of this technology to cope with water stress conditions with forecasted decreasing trend in rainfall. This adaptation technology also provides other non market benefits such as increase cropping intensity; reduce risk of nutrient leaching which in turn minimises the risk of environmental contamination and allowing cultivation of high value crop sensitive to water stress. Micro-irrigation also allows the application of fertilisers in irrigation water (fertigation). Besides making efficient use of water, it can also improve fertiliser use while enhancing crop productivity. Water saved through this efficient irrigation system may be used to irrigate additional land. The uptake of this technology can also provide opportunity to create farm employment for design, installation and maintenance of irrigation system and also expand the local supply chain of irrigation equipment and other agricultural inputs.

#### 2.2.2.5 Monitoring and Evaluation (M&E)

The results-oriented framework will be used for M&E of project implementation. More specifically, the progress made against the Objectively Verifiable indicators (OVIs) will be monitored and reported under the governance structure of the project.

#### 2.2.2.6 Risks and their mitigation

| Risk  | Level (Low, Medium, High) | Response  |
|---|---------------------------|---|
| Theft and vandalism   | medium                    | Not much can be done  |
| Fire  | Low                       | Keeping a buffer zone from sugar cane fields                                      |
| Poor quality of irrigation equipment                                    | Medium                    | Establishment of a quality control system   |
| Poor aftersales services for equipment maintenance and trouble shooting | Medium                    | Encourage entrepreneurs to invest in design, installation and maintenance service |

### 2.2.2.7 Stakeholder mapping

| Stakeholder                                     | Roles and responsibilities  |
|---|---|
| Farmers Service Cooperation                     | Responsible for improving the efficiency and productivity of small sugarcane planters through the provision of necessary guidance and services  |
| Irrigation Authority                            | Responsible for identifying, investigating, planning, designing and implementing irrigation projects and advising planters on irrigation matters related to water availability, design, and irrigation equipment  |
| Agricultural Research and Extension Unit (AREU) | Responsible for Research and development in the non-sugar sector through high-quality research and extension for better agricultural production, and to meet the policy requirements of the government in terms of agricultural diversification and food production |
| Aquatec Ltd                                     | Manufacturer, importer and supplier of water tank   |
| Ashoka Ltd                                      | Importer and supplier of irrigation equipment   |
| Watertech Ltd                                   | Responsible to import, supply and install irrigation equipment for home garden, farm and industrial application   |
| Aqualia Ltd.                                    | Responsible to import, supply and install irrigation equipment  |
| Mauritius Sugar Research Institute              | Responsible for carrying out high quality research and development on sugar cane and other crops that meet the agricultural, commercial, and societal needs of Mauritius.   |

## 3. Project Ideas for Coastal Zone

### 3.1 Brief summary of the Project Ideas for Coastal Zone

The TNA for the Coastal Zone sector has retained four technologies, namely; Restoration of coastal vegetation, Wetland protection, Dune restoration and Rock revetment. Mauritius with its varied coastline ranging from sandy beaches to rocky shores and cliff is very much affected by coastal erosion. The causes of erosion as identified by several studies including the Study on Coastal Erosion in 2003, were from the direct interaction of the sea with the shoreline, mainly during extreme events such as cyclones and storm surges. The extent of erosion is however exacerbated in certain places because of the negative anthropogenic impacts on the health of lagoons, beaches and dunes.

Three of the four technologies retained, Restoration of coastal vegetation, Dune restoration and Rock revetment are applicable directly on the shoreline and would provide direct benefits to the location where they are applied. In contrast, wetland protection would act indirectly in mitigating the erosion impacts on an adjacent coast. Wetlands, through their hydrological services they provide, contribute to improve the water quality of the lagoon around Mauritius and thus a healthy marine environment which in turn would contribute to the stability of the shoreline.

The project ideas for the coastal zone as presented in this present report has been put forward following discussions at a committee in January 2013 with the various stakeholders including the Ministry of Environment, Beach Authority, Ministry for Fisheries, Ministry of Agro Industry and the Mauritius Oceanography Institute. Ranking of sites for implementation of the identified technologies were made based on several criteria and also considering the basic characteristics of each sites.