

2.3 Action Plan for Drip Irrigation Technology

2.3.1 About the Technology

Persistent droughts and recurring floods due to climate change have led to food insecurity and exacerbated poverty in the country. The importance of irrigation and efficient use of water is being addressed through development of more efficient irrigation systems and methods such as drip irrigation. Drip Irrigation is a technique of application of specific and focused quantities of water to soil crops. The system uses pipes, valves and small drippers or emitters transporting water from the source to the root area and applying it under particular quantity and pressure specifications.

Drip irrigation is beneficial to environment, economic and social development. The technology can provide as much as 90% water-use efficiency in contrast to surface irrigation and sprinkler systems, which provide 60% and 75% efficiency respectively, and can therefore enable farmers to adapt to climate change in crop production under erratic rainfall pattern (Quezada et al., 2012). The drip system technology is adaptable to terrains where other systems cannot work well due to climatic or soil conditions. The technology is also gender sensitive.

Drip irrigation technology has climate change adaptation benefits. It can support farmers to adapt to climate change by providing efficient water use. In seasonal droughts, drip irrigation lowers demand for water and reduces water evaporation. The initial cost of drip irrigation systems can be higher than other systems, but this cost can be compensated by high yields after the development and after the barriers are removed. The Cost Benefit Analysis (CBA) - NPV for 10 years was positive (Kshs 577,273) which clearly shows that the Drip Irrigation is a viable technology.

2.3.2 Target for Technology Transfer and Diffusion

The preliminary target for the drip irrigation technology is introduction of 500,000 and 1000 drip irrigation systems to individual farmers and institutions respectively by the year 2017. To facilitate these users and ensure effective market chain analysis and linkages, the following market actors that are targeted include 200 Drip Irrigation Kit Retailers, 500 Tanks and Pipes Retailers, 100 Maintenance Providers, 50 Wholesalers of Drip Irrigation Kits, Tanks and Pipes, Private Local manufacturers of Tanks, Pipes, Nets, Greenhouses (these are available locally but will need to increase their capacity to meet the increased demand), and 10 Importers of pipes and Kits

In order to achieve these targets the stakeholders and players to be involved include policy makers in water sector, related government ministries and departments including ministries of Water and Irrigation, Agriculture, Northern Kenya & other Arid Lands and Regional Development Authorities, Research institutions like Kenya Agricultural Research Institute (KARI). The technology implementers such as women and youth groups, Amiran Kenya, Drip Grow ApproTech, Irrigation Water Users Associations and Cooperative Societies will be key players in the transfer and diffusion of the technology.

2.3.3 Barriers to Technology's Diffusion

The main barriers to the Drip Irrigation technology transfer and diffusion include high cost of initial installation, inadequate credit and loan facilities for farmers and inadequate incentives, and technical barriers such as extensive maintenance requirement, water quality,

and inadequate extension services. Other barriers include resistance to change, preference to other irrigation methods, inadequate awareness of the existence of technology due to lack of information and awareness, high human skills requirements, inadequate training of the majority of farmers, water scarcity, and inadequate policy..

The identified categorized barriers were screened according to their significance and the most essential barriers, which need be addressed for transfer and diffusion of drip irrigation technology, were identified. High cost of initial installation an economic and financial barrier was identified. The other, non-financial, identified are high human skills/trained labour requirement, water scarcity, high maintenance costs, insecurity, and inadequate extension services.

The screened barriers were decomposed to check whether some barriers are actually composed of some of the other barriers, or whether one barrier is just more concrete. Decomposition was done for both economic and financial and non-financial barriers at four levels including broad category, barrier within barrier, elements of a barrier and dimension of barrier and results are. Decomposition of the economic and financial barrier revealed that the high cost of initial installation is associated with high cost of unit kits because few local manufacturers of local kits and lack of incentives. It is also associated with high maintenance cost for farmers.

Further analysis using casual relations and problem tree showed that the high cost of initial installation of drip irrigation kit is due to cost of components as a result of high cost of credit facilities, which is a result of inadequate credit facilities and high interest rates. The cost is increased further by the need for specialized human skills since training is required. As consequence a few farmers are adopting drip irrigation resulting in reduced acreage in drip irrigation and inadequate income from farmers leading to overall food insecurity.

The main non-financial barrier is human skill which is associated with highly skilled manpower requirement for planning, installation and maintenance of drip irrigation. These include specialized skills for preparing pipes and filters, laying the pipes, technician for repairing the pipes. Few trained technicians. It also includes inadequate awareness by farmers on how to align the pipes with crops.

2.3.4 Proposed Measures and Enabling Framework

Measures and enabling framework for overcoming barriers to the adoption and diffusion of drip irrigation technology were identified by the consultants through review of relevant policy documents, expert knowledge, literature review, and stakeholder consultation and analysis using objective trees. The identified economic, financial, and non-financial measures are:

a) **Economic and Financial Measures**

Policy measures which should be put in place in order to reduce high initial cost of installation include those geared towards reducing interest rates in order to enhance availability of credit facilities and hence financial resources for adoption of the technology. These economic and financial measures include provision of tax rebates and incentives in order to reduce the cost of importing kits and training of technicians at subsidized rates leading to more specialized manpower for kit

manufacturer. This will result in more farmers adopting drip irrigation and increased acreage under drip irrigation. Consequently there will be more income from farming and food security.

b) **Non-Financial Measure**

Non-financial measures which should be put in place include information and awareness initiatives on the use of drip irrigation technology and promotion of effective extension services in order to develop positive attitude to the adoption and diffusion of the technology; improvement of technical services in the use and maintenance of drip irrigation in order to enhance accessibility of kits to farmers and improve diffusion of the technology to local levels; human skills development in the usage and maintenance of the technology leading to enhanced use drip irrigation and removal of negative social-cultural barriers; and development of market linkages involving different actors like cooperative societies, business community and private sector in order to make inputs more available to farmers and effectively market the produce.

Once these measures are put in place the overall outcome are improved incomes, food security and livelihoods leading to poverty reduction and diversification of income generating activities.

2.3.5 Proposed Action Plan for Drip Irrigation Technology

The Action Plan for Drip Irrigation Technology includes adaptation interventions and provision of enabling framework required for effectively responding to impacts of climate change. The measures and enabling framework is to enable key actors, namely policy makers, private sector, communities and relevant institutions adopt the technology as a viable tool to enhance agricultural production and improve livelihoods while being resilient to climate change impacts. These enabling framework in sequential order include:

- (i) Information and Awareness Creation - Enhanced information and awareness creation on existence, use and benefits of drip irrigation will enhance the adoption and diffusion of drip irrigation technology at all levels. It will also help policy makers to make informed decisions especially on policy to provide incentives and tax rebates. It will also help in creating linkages between various actors namely farmers, technicians, and manufacturers and distributors of kits.
- (ii) Training of more technicians - This measure will increase a pool of experts at local levels to help farmers on the adoption and use the technology effectively and efficiently.
- (iii) Training on special skills for farmers and institutions - The purpose of this is to ensure that farmers are able to use the kits properly for efficiency in water use. This will also result in higher crop production leading to more incomes and food security
- (iv) Establishment of low interest rates credits - This measure will make credit more accessible to farmers, institutions, and manufacturers and distributors of kits and result in enhanced adoption and diffusion of the technology.
- (v) Provision of incentives - This measure includes tax waivers and rebates on drip irrigation kits and other related tools, and establishment of a special fund available to implementers of the technology at lower interest rates. This will reduce the cost of units and components and avail more finances for investment in the technology.
- (vi) Enhance Market Linkages - The increased use and diffusion of the technology will lead to more production of food and other agricultural produce which cannot be consumed at household levels. This will require that farmers are linked to outside

market to sell their products to private sector in order to add value to the products and get better returns.

The projected timeframe for implementing the measures in action plan is between 0 – 15 years. Measures to be implemented in the short-term, i.e. 0 – 5 years are establishment of low interest rates, and provision of incentives. The timeframe for the implementation of enhancement of information and awareness creation, training of technicians and farmers; and enhancement of market linkages will be between 0 – 15 years

The estimated cost for the implementation of the action plan is Kshs. 2.08 billion with training, provision of incentives and establishment of low interest rates taking the bulk of the funds.

In all these measures and enabling frameworks, the lead government institutions will create policies and provide technical guidance. The beneficiaries will be the business communities, private sectors and farmers who will implement the policies for the use and diffusion of the technology. Financial contribution will be cost sharing among various actors at all levels including development partners. The implementation of the action plan is expected to be a public, private sectors, local communities and donor partnerships.

The anticipated risks in the implementation of the action plan include lack of funds and political good will, insecurity, poor infrastructure, competition with other sectors requiring funds and incentives, inadequate participation, and shifting donor policies.

The Action Plan is summarized in table 2.3.

Table 2.3: Proposed Action Plan for Drip Irrigation Technology

Measure/actions needed	Why the measure/action is needed	Who? (Main Actors)	Time Frame (when)	Indicative Cost (million Kshs.)*	Source of Funds	Indicators of success	Indicators of risks	Expected Outcome
1.Enhance Information and Awareness creation	<ul style="list-style-type: none"> • To create sufficient awareness on the existence and use of drip irrigation technology • To create sufficient awareness on the existence technicians • To create awareness on the advantages of drip irrigation technology • To create awareness on interactions between various actors involved in use, manufactures and distribution of kits 	<ul style="list-style-type: none"> • MOA (KARI)- Curriculum development • NGOs – Implementation of Curriculum • Development of Partners – Provision of funds & technical advise • Farmers, institutions & general public – Beneficiaries 	Up to 15 years	50	GoK Private Sector NGOs Climate and Development Knowledge Network (CDKN) GEF (Adaptation Fund)	<ul style="list-style-type: none"> • Number of farmers field days and exchange programmes • Number of demonstration plots • Education materials in both electronic and prints available • 50% of targeted farmers adopting drip irrigation • Increased acreage under drip irrigation • Increased awareness of the benefits of drip irrigation by policy makers 	<ul style="list-style-type: none"> • Lack of funds 	<ul style="list-style-type: none"> • Enhanced general awareness on the existence, use and benefits of drip irrigation technology for climate change adaptation and improved livelihoods • Enhanced awareness about the drip irrigation technology to policymakers who are able to make informed decision on its use including need for incentives and tax rebates. • Wide spread use of drip irrigation technology including knowledge about water use efficiency, and high crop yields

2. Training of more technicians	<ul style="list-style-type: none"> To increase number of technicians for assembling and maintaining the kits To promote effective extension services More specialized manpower resulting in more manufacturers of kits and better service delivery. 	<ul style="list-style-type: none"> KARI and Agricultural training Institutions – Training of technicians MHEST – Provision of technical advise & training institutions Manufacturers of kits – Provision of training kits and training Development Partners – Provision of training funds and technical advise 	Up to 15 years	20	GoK Green Climate Fund	<ul style="list-style-type: none"> Number of technicians trained and able to assemble the kits More technicians deployed to work as extension officers Availability of technicians for repairing the kits 	<ul style="list-style-type: none"> Availability of training funds Timing and duration of training sessions 	<ul style="list-style-type: none"> Increased number of technicians able to assemble & maintain the kits and train farmers on effective use of drip irrigation technology Increased pool of extension services who can be deployed in other areas to diffuse the usage of the technology. Increased pool of experts as trainers to ensure the diffusion of the technology More manufacturers and distributors of kits devolved to local level
3. Training for special skills for farmers and institutions (Use and maintenance of kits)	<ul style="list-style-type: none"> To ensure that farmers are able to use the kits properly for efficiency in water use and crop production 	<ul style="list-style-type: none"> MOA – Technical advise KARI – Training of technicians MHEST - Provision of technical institutions Technical Training Colleges – Provision of training facilities and training NGOs – Training of farmers Farmers – Beneficiaries of the training 	Up to 15 years	1000	GoK Green Climate Fund	<ul style="list-style-type: none"> % of targeted farmers trained and using the drip irrigation technology efficiently % reduction in maintenance costs 	<ul style="list-style-type: none"> Timing and duration of the training Availability of training funds 	<ul style="list-style-type: none"> Special trained farmers who are able to use the kits properly & efficiently & do minor maintenance on them Higher crop production resulting in more incomes and food security
4. Establishment of low interest rates credits for drip irrigation loans	<ul style="list-style-type: none"> To make credit accessible to kit and component providers and farmers 	<ul style="list-style-type: none"> MOF and Central Bank of Kenya – Policy formulation Commercial Banks and Micro Fin. 	Up to 5 years	200	GoK Financial Institutions including micro-finance institutions	<ul style="list-style-type: none"> % rate of reduction in lending rates for commercial banks and micro-financial institutions 	<ul style="list-style-type: none"> Resistance from commercial banks Political 	<ul style="list-style-type: none"> Accessible and affordable credit available to kit& component providers as well as farmers

	<ul style="list-style-type: none"> • Increase credit facilities 	<p>Institutions – Policy Implementation</p> <ul style="list-style-type: none"> • Farmers and Private Sector – Beneficiaries 				<ul style="list-style-type: none"> • Number of new Credit Facilities established 	<p>good will</p> <ul style="list-style-type: none"> • Insecurity and infrastructure 	<ul style="list-style-type: none"> • Number of credit/bank facilities increased & devolved to local level.
5. Provide Incentives (tax waiver on kits; establishment of special irrigation fund) and tax rebates	<ul style="list-style-type: none"> • To reduce Cost of units and components by providing incentives • To avail more finances for investment by creating irrigation fund 	<ul style="list-style-type: none"> • MOF – Policy on incentives and tax rebates • MW&I – Policy Irrigation and technical advise & negotiations with MOF • MOA- Technical advise and negotiations with MOF • NEMA – Lead Agency on Climate Change Adaptation and technical advise • KRA – Implementation of tax rebates • KENFAP – Private sector and communities – beneficiaries of incentives and tax rebates 	Up to 5 years	800	GoK AfDB (Clim.Dev. Africa Special Fund)	<ul style="list-style-type: none"> • Tax rebates approved by the Treasury • Introduction of tax waiver • 2 % of Government Budget allocated for an Irrigation fund • 50% of small scale farmers accessing irrigation fund Adoption of technology by targeted farmers and institutions 	<ul style="list-style-type: none"> • Political good will • Competition with other sectors requiring incentives and rebates e.g. education, health • Development Partners willing to cooperate 	<ul style="list-style-type: none"> • Incentives and tax waiver on kits approved by the Government • Irrigation Fund established & functional
6. Enhance market linkages on farm produce	<ul style="list-style-type: none"> • To link farmers with markets for sale of their produce • To link farmers with private sector for value addition for better returns for the produce 	<ul style="list-style-type: none"> • Min. of Trade & Industry – Set training of standards • Min. of Local Government – Provision of market centres/trading space & licenses • Min. of Cooperatives – 	Up to 5 years	10	GOK, Private Sector, Cooperative Societies and Business Groups	<ul style="list-style-type: none"> • Number of market outlets established • Number of cooperative and business groups established 	<ul style="list-style-type: none"> • Market failures • Poor infrastructure e.g. roads 	Functional market outlet established

		Organization of drip irrigation farmers for marketing & value addition • Business community and Private sector – Trading partners & beneficiaries Farmers – Beneficiaries						
Total		Total (Million KShs)		2080				

*Arrived at during brainstorming sessions with stakeholders and input from various experts