United Republic of Tanzania

TECHNOLOGY NEEDS ASSESSMENT FOR CLIMATE CHANGE ADAPTATION

Technology Action Plan Report

AGRICULTURE AND WATER SECTORS

2018

Vice President's Office

DISCLAIMER

FOREWORD

Tanzania started the process of a Technology Needs Assessment (TNA) for climate change mitigation and adaptation with a stakeholder's meeting in September, 2015. I am glad to report that this process has now been concluded and has resulted in the identification and prioritisation of technologies that Tanzania should mitigate and adapt to climate change. With the help of her partners, Tanzania was keen to engage in the TNA process because the country has seen the reality of climate change for a number of years now. The rise in the frequency of droughts, floods and extreme temperatures, the increase in the unpredictability of rainfall during the rainy season and the increase in mean temperatures already wreak havoc on the livelihoods and general wellbeing of our people. To make matters worse, the occurrence of such climatic hazards is projected to increase. All our development efforts and the great score we have made over the past decades risk being reversed by climate change impacts. Clearly we cannot continue with business as usual. It is for this reason that Tanzania find it prudent to adapt and contribute to the global efforts to mitigate the climate change.

The United Republic of Tanzania has recognized this need for some time now and has been preparing the ground for action with regards to climate change adaptation and mitigation. In 2012 Tanzania developed a National Climate Change Strategy. This Strategy has been developed in response to the growing concern of the negative impacts of climate change and climate variability on the country's social, economic and physical environment. Its overall aim is to enhance the technical, institutional and individual capacity of the country to address the impacts of climate change. The Strategy covers adaptation, mitigation and cross-cutting interventions that will enable Tanzania to benefit from the opportunities available to developing countries in their efforts to tackle climate change.

A lot has already been done to respond to climate change and yet the threat remains huge that more needs to be done with even greater urgency. In conducting the TNA process, consultation with key stakeholders was the core approach taken at every stage. Stakeholders scored and identified the sectors and technologies that needed to be given priority in devising the needed actions. They went on to identify the barriers that would hinder the diffusion of the selected technologies and specified measures required to overcome the barriers. These stakeholder representatives came from civil society, the private sector, academia and government. The determination and desire to forge our effort together is an indication of how climate change mitigation and adaptation is such an important national issue and is of great concern to all who work to better the lives of our people.

The TNA process on climate change adaptation has produced three reports which should be read together as the unfolding narrative of its results:

1. Technology Needs Assessment Report - This report presents the methodology used in the TNA process, how sectors and technologies were identified and prioritized. For climate change adaptation two sectors Agriculture and Water – received the highest scores and were consequently selected for further analysis. In each of the sectors, three technologies were prioritised and taken forward for barrier analysis.

2. Barrier Analysis and Enabling Framework Report – This report documents the barriers to technology diffusion identified by stakeholders and their root causes. Measures and the enabling framework for technology diffusion in the respective sectors and for each technology are also detailed in the report

3. Technology Action Plans – This TAP report provides the steps and actions required to take forward the identified measures in each sector and for each technology. Generally the actions needed to enhance diffusion of the technologies include a) Conduct research on economic feasibility of technologies, b) conducting awareness raising c) put in place financial incentives including lowering lending rates d) engaging development partners and making efforts to access global funds e) developing supportive policy and legislation and f) strengthening institution arrangements and collaboration.

I am grateful to the stakeholders who participated in the process over a period of about two years. I thank our partners, the United Nations Environment Programme (UNEP) and the UNEP DTU Partnership (UDP) in collaboration with the Regional Centre Energy Research Centre, University of Cape Town and GEF for the financial support rendered to the TNA process in Tanzania. I wish to also recognize the work of the consultant, who facilitated the process and documented the outcomes from the stakeholder consultations into the reports mentioned above. It remains for all of us to work together to ensure that the results of this intense and elaborate process will result in tangible and practical initiatives on the ground. The Vice President's Office has made climate change a top priority in its work. I and my colleagues will therefore work very hard to ensure that the projects identified come to fruition. We need the continued support of everyone.

Hon. January Makamba (MP)

Minister of State, Vice President's Office (Union and Environment)

EXECUTIVE SUMMARY

This report III of Technology Needs Assessment (TNA) was preceded by two other reports. Report I document various technologies in agriculture and water sector which were prioritized for Tanzania in the wake of climate change adaptation; Three technologies were prioritized for each sector. Agriculture sector prioritized Improved Seed Varieties, System of Rice Intensification and Drip irrigation. Water sector prioritized Rain water harvest, Smart water meter and Waste stabilization Ponds. While report II analyses barriers for technology diffusion and suggests the enabling frameworks (measures) to remove the identified barriers. Report III presents the action plan of the technologies based on report II. The TAP report is mostly based on and builds upon the content of the Barrier Analysis report. A TAP is built upon the measures identified in a TNA for overcoming barriers to technology implementation and specifies how to implement these measures, including that is responsible, when, and from where to secure funding. As such, a TAP serves as a bridge between the analysis of prioritized technologies and their implementation. TAP is built from selected measures identified in Report II, to be actions. The actions are further developed to activities that enable the envisaged actions to work. TNA comprises of actions to be implemented to remove technology diffusion barriers, identified in Report II, with a specified timeframe. The actions are further sub divided into activities so as to come up with concrete outputs.

Report III is consisting of two major sections, the Technology Action Plan and Project Ideas brief for both agriculture and water sector. As earlier said, each sector has three technologies of which each has its own developed action plan and project idea in this report. Development of TAP, based on measures identified in Report II of barriers and measures for both sectors.

Technologies in agriculture sector included improved seed varieties, system of rice intensification and drip irrigation. Measures selected for actions were as follows:

Improved seed varieties technology had four measures selected to be actions. Actions includes enhancement of access to finance through groups, capacity building for extension workers and farmers, strengthened research and development and strengthened enforcement legal and regulatory frameworks to support ISV and marketing.

System of Rice Intensification technology actions are to establish small holder credit facilities, establish SRI demonstration plots and on farm trials and increase campaigns of climate change awareness and how to reduce risk exposure where adoption of SRI should be emphasized

Drip irrigation action are enhancing access to finance through credits and build / strengthen capacity of key stakeholders

For the water sector, the technologies were rainwater harvesting, smart water meter and waste stabilization pond.

Rain water harvesting actions are periodic tax policy reviews for RWH harvest, establishment of national water fund and institutional capacity building in RWH.

Smart water meter actions are procurement and installation of smart water metering system, awareness raising and provision of customer service for SWM and staff training on SWM applications and maintenance.

Waste water stabilization ponds actions are enable municipalities to access loans and grants to meet constructions cost, invest on research and impose strict and elevated tax for operators discharging waste water.

Overall these actions were chosen basing on different criteria including effectiveness towards the technology implementation in terms of cost both oh human and financial resources. Best interms of avoiding conflicts with other measures or country/sector policies and the possibility/ suitability of the action to take place basing on previous practices.

Furthermore, in this report, project ideas were developed with the aim of sharing the possible projects that can lead to smooth implementation of the TAP.

Tables below, presents the summary matrix for technologies action plan.

Summary matrix for Improved Seed Varieties TAP

Sector	Agriculture	
Sub-sector	Seeds	
Technology	Improved Seed Varieties	
Ambition	150,000 small scale farmers with 1 ha with a total of 150,000 hectares of land by the year 2025	
Benefits	Enhance food security and income generation	
Action	**Activities to be implemented**	**Sources of funding**
Action 1: Enhance access to finance	Activity 1.1:Advocacy for lowering bank's interests rates and incentives promotion	Government and private sector
	Activity 1.2:Inventory of groups and training needs for supporting collateral	Government
Action 2: Capacity Building for extension officers and farmers	Activity 2.1: Identify needs and training for farmers ISV and good agronomic practices	GoT, Private sector (PS)
	Activity 2.2: Tailor made trainings for extension officers	GoT, PS and Development partners
	Activity 2.3: Develop and implement communication programme on ISV	GoT, PS
Action 3: Strengthen Research and Development	Activity 3.1: Engage in dialogues to solicit funds to train technical staff local and international	GoT, DPs and PS
	Activity 3.2: Upgrade infrastructures at TOSCI	GoT, PS
Action 4:Strenthened enforcement and legal and regulatory frameworks to support ISV and marketing	Activity 4.1: Conduct a study on challenges of seed quality control and action plan to address	GoT
	Activity 4.2:Review seed release regulations to reduce release time	GoT
	Activity 4.3: Promote policy framework for market oriented approach for ISV products	GoT

Summary matrix for System of Rice Intensification TAP

Sector	Agriculture	
Sub-sector	Rice	
Technology	System of Rice Intensification	
Ambition	150,000 rice farming households with 1 ha of rice farm for maintaining 150,000 ha of SRI farms in 5 regions by the year 2025.	
Benefits	Less costly requires 70-90% less rice seeds,more environmental friendly as 20-25% less nitrogen fertilizer and chemicals Increasing 10-15% of productivity. Control pests and diseases (such as sheath blight, golden snail, root rots, etc.) Strengthening resistance to pathogens, and as a result, reducing costs of pesticide.	
Action	**Activities to be implemented**	**Sources of funding**
Action 1 Establish small holder credit facilities for farmers	Activity 1.1 conduct economic and financial feasibility studies of SRI methodology	GoT
	Activity 1.2 Sensitise the decision makers and MFI on the importance of access to loans for farmers	
	Activity 1.3 Carry out market survey to identify potential buyers of the product (Rice) and their willingness to pay for the rice	
Action 2 Establish SRI demonstration plots and on farm trials.	Activity 2.1 Develop tailor made trainings aiming at building various capacities on SRI	
	Activity 2.2 Design and operate SRI demonstration plots	
Action 3 Increase campaigns of climate change awareness and how SRI investment can reduce risk exposure	Activity 3.1 Develop awareness material targeting different stakeholders (Private Sector, Decision Makers, farmers, financial institutions) on cc and SRI	
	Activity 3.2 Develop a communication strategy to profile the target stakeholders particularly the adopters of the technology	
	Activity 3.3 Implement awareness campaign on SRI as a means of reducing water use and increasing yield	

Summary matrix for Drip Irrigation TAP

Sector	Agriculture	
Sub-sector	Irrigation	
Technology	Drip Irrigation	
Ambition	To achieve the adoption of drip irrigation technology for 1,000,000 households of small scale farmers and cover 1,800,000 ha of various horticulture crops, over a period of 10 years by 2030.	
Benefits	Drip irrigation is a good option for farmers to optimally use limited amount of water and also help in environmental conservation. It has been found to increase farmer yields by up to 300% compared to non-irrigated traditional production practices, save 30 to 70% on water usage, and reduce the cost of labour by up to 80%.	
Action	**Activities to be implemented**	**Sources of funding**
Action 1: Enhance access to financing	1.1 Develop financial incentives to assist lowering the cost of drip irrigation systems (e.g. introduce subsidies, tax exemptions)	GoT
	1.2 Sensitise the policy makers on the importance of incentives and or subsidies for the drip irrigation based irrigation to compete with other irrigation technologies for small scale farmers	GoT
	1.3 Lower commercial bank's lending rates	GoT
	1.4 Strengthen an existing National Irrigation Development fund to enhance investment in drip irrigation	GoT, DPs
	1.5 Engage in dialogue with development partners to provide subsidies for the technology as it contributes to global benefit	GoT, DPs
Action 2 Build / strengthen capacity of key stakeholders	2.1 Develop specialized training aimed at building the capacities in relevant institutions – in areas of installation, operation and maintenance of drip irrigation system	GoT
	2.2 Strengthen National Irrigation Commission to enhance uptake of more drip irrigation initiatives	GoT
	2.3 Strengthen inter-ministerial coordination	GoT

Summary matrix of Rainwater Harvesting Technology

Sector	Water	
Sub-sector	Rainwater harvesting	
Technology	rooftop rainwater harvesting	
Ambition	Constructing Roof Rainwater Harvesting units for 150,000 households comprising 4 people.	
Benefits	Reduce main-water consumption by around 50%. Low investments, low skilled labour and low operational costs, but provides high benefits.	
Action	**Activities to be implemented**	**Sources of funding**
Action 1:Periodic tax policy reviews for RWH equipment	1.1Consultative workshop for traders and suppliers of RWH equipment and related materials	Ministry of Finance, Ministry of Water
	1.2 Tax reduction and exemptions for RWH equipment on government revenues	Ministry of finance
Action 2: Establishment of national water fund	2.1Water sector stakeholders workshop on national strategy for water resources management financing mechanisms	Ministry of water, DPs
Action 3:Institutional capacity building in RWH	3.1 Awareness raising on RWH	Ministry of water, DPs
	3.2 Specialized training on RWH in water resources training institutes and vocational training centres	Ministry of water, DPs
	3.3 Training of village level artisans on RWH	Ministry of water, DPs
	3.4 Coordination and funding of RWH activities	Ministry of water, DPs

Summary matrix for Smart Water Metering TAP

Sector	Water	
Sub-sector	Water Metering	
Technology	Smart Water Metering (SWM)	
Ambition	The targeted institutions are the water utility authorities in cities and municipalities such as the Dar es Salaam Water Supply Company (DAWASCO), Tanga Urban Water Supply and Sanitation Authority (TANGAUWASA). The TAP is expected to last over 10 years in selected regions.	
Benefits	The technology targets to reduce water and revenue losses through leakages by 50%. Increase revenues of water services.	
Action	**Activities to be implemented**	**Sources of funding**
Action 1: Procurement and installation of smart water metering system	1.Purchase of SWM devices	Ministry of water, DPs, water utility authorities
	1.2 Installation of SWM system	Ministry of water, DPs, water utility authorities
Action 2: Staff training on SWM applications and maintenance	2.1Training of a special unit dealing with SWM within water utility authorities	Ministry of water, DPs, water utility authorities
	2.2 Training of other staff	Ministry of water, DPs, water utility authorities
Action 3: Awareness raising and provision of customer service for SWM	3.1 Awareness raising on SWM	Ministry of water, DPs, water utility authorities
	3.2 Customer support services	Ministry of water, DPs, water utility authorities
	3.3 Marketing of SWM system	Ministry of water, DPs, water utility authorities

Summary matrix for Waste Stabilization Ponds TAP

Sector	Water	
Sub-sector	Waste Water	
Technology	Waste stabilization ponds (WSPs)	
Ambition	The technology targets to increase the number of households connected to the central sewage system , in total the technology targets to 200,000 household by 2030. Furthermore, the TAP will renovate existing WSP especially those in very bad condition	
Benefits	Waste water reuse can produce obvious benefits as it reduces the need for extraction of water from surface and groundwater resources. Especially given the current pressure and water shortage due to climate change impacts, reused waste water can provide an alternative water resource	
Action	**Activities to be implemented**	**Sources of funding**
Action 1: Enable municipalities to access loans and grants to meet constructions cost	1.1Asses capacity of the council to service the loan	Ministry of water, DPs, water utility authorities
	1.2 Engage a team of technical people to develop bankable projects to attract funding	Ministry of water, DPs, water utility authorities
	1.3 Invite collaboration of private sector and municipalities to co funding	Ministry of water, DPs, water utility authorities
Action 2: Supporting research on waste water management	2.1 Soliciting research proposals from the Tanzanian scientific community on waste water management	Ministry of water, DPs, water utility authorities

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ABBREVIATIONS AND ACRONYMNS

AMI	Advanced Metering Infrastructure
AMR	Automated Meter Reading
ARIs	Agriculture Research Institutes
ASA	Agriculture Seed Agency
BoT	Bank Of Tanzania
CWSS(P)	Community/Commercial Water Supply and Sanitation (Programme)
DPs	Development Partners
DI	Drip Irrigation
EWURA	Energy and Water Utility Regulation Authority
GDP	Gross Development Product
GoT	Government of Tanzania
ISV	Improved Seed Varieties
LGAs	Local Government Authority (s)
MFAEAC	Ministry of Foreign Affairs and East Africa Community
MFI	Micro Finance Institute
MFP	Ministry of Finance and Planning
MoWI	Ministry of Water and Irrigation
NAWAPO	National Water Policy,
NGOs	Non Governmental Organization (S)
NIC	National Irrigation Commission
NRW	Non Revenue Water
NWSDS	National Water Sector Development Strategy,
PO-RALG	President's Office Regional Administration and Local Government
PS	Private Sector
RWH	Rain Water Harvesting
SAGCOT	Southern Agriculture Growth Corridor of Tanzania
SRI	System of Rice Intensification
SWM(S)	Smart Water Metering (System)
TAIB	Tanzania Agriculture Investment Bank
TAP	Technology Action Plan
TDV	Tanzania Development Vision 2025
TIB	Tanzania Investment Bank
TNA	Technological Needs Assessment
TOSCI	Tanzania Official Seed Certification Institute
VTI	Vocational Training Institute
WDMI	Water Development and Management Institute
WRMD	Water Resources Management and Development (Programme)
WSDP	Water Sector Development Program
WSP	Waste Water Stabilization Pond.

CHAPTER 1: TECHNOLOGY ACTION PLAN AND PROJECT IDEAS FOR AGRICULTURE SECTOR

1.1 Technology Action Plan (TAP) for Agriculture Sector

1.1.1 Sector Overview

The agriculture sector was prioritized for TNA because of its importance in the economy of the country and vulnerability to climate change. In Tanzania, agriculture sector is the backbone of the economy with its contribution to the total GDP of the order of 32 % and engagement of 75% of national labour force. The agriculture sector holds prominent importance for food, livelihood security and socio economic wellbeing of the people. Agriculture contributes almost a third of the total export earnings in the country providing livelihoods to over 80 % of the population (World Bank, 2016, URT, 2014, FAO. 2016). However, the sector is seized with many challenges. Low productivity has been linked to a combination of several factors, including: over-reliance on rainfall, utilization of rudimentary and unsustainable production methods, poor access to inputs, and low extension service capacity to deal with climate change issues (FAO, 2013).

By definition the agricultural sector is comprised of crops, livestock, fisheries, forestry and hunting sub sectors. However, agriculture in this document refers to crop production taking into account the synergies with other closely related policies like livestock, cooperatives, marketing and irrigation. Existing policies related to agriculture sector's development and technology deployment in Tanzania are summarized on table 1; Tanzania has a huge potential of agriculture with 44 million hectares of arable land. By 2014, only 32% of the arable land was cultivated. The high population growth rate (about 2.7%) has contributed to significant land degradation and forest cover loss. The country has a deforestation rate of about 372,000 hectares per annum (NBS, 2015).

Small scale farmers are considered as primary users of arable land ranging from 80–90% of agricultural land with subsistence farming operating on a range of 0.9 to 3.0 ha, a production scale that is too low to generate significant income streams to farmers for effective poverty reduction and agricultural development.

Tanzania's population was estimated at 53 million people in 2015, 68% of them residing in rural areas (World Bank, 2016). Most smallholder farmers are women; in general, 55.2% of women and 44.8% of men in the country are engaged in agriculture. Ownership of productive resources is skewed towards men; barely 20% of the women have ownership of agricultural land (WB, 2016). Adoption of agricultural technologies is low, with cultivation generally done by hand tools (62%), animal traction (24%) and only 14% mechanized. Thus productivity is low and closing the agricultural yield gap would offer opportunities for agricultural sector growth and livelihoods improvements throughout the county.

Tanzania does not have accurate data on economy- and sector-wide greenhouse gas (GHG) emissions. However, available data on national GHG emission indicates an average of 171.73 tons of CO_2equivalent (including emissions from land use change and forestry sector (LUCF) (WRI, 2012). Furthermore, some available data indicates per capita GHG emissions of approximately 2.7 tons of CO_2equivalent, depending on the source and accounting methods. Projections show a potential twofold increase in total emissions by 2030, under a scenario of continuous population growth, increased deforestation, expansion of agricultural land and farming activities, free-range livestock keeping, continued use of biomass energy, and the current industrial development pathway the country is pursuing.

As such, implementation of low-carbon options, such as those suggested in the TNA process could support existing efforts to reduce emissions levels in the country. In addition, improved measurement of GHG emissions in the agriculture sector, particularly focusing on the emissions reduction potential of various practices and technologies, can incentivize the adoption and scale-up of TNA technologies that target adaptation and productivity objectives.

The Ministry of Agriculture, (MoA) through Tanzania Agriculture Climate Resilience Plan, identifies three priority risks for agriculture: amplified water stress, decreased crop yield, and increased vulnerability of smallholder farmers.

Consequently, the Technology Need Assessment (TNA) exercise undertaken with stakeholders involvement identified and prioritized 3 adaptation technologies for the sector. The technologies and their targets were:

(1) Promotion of use of improved seed varieties (ISV) which are characterized by early maturing, pests and drought tolerant meant to enhance resilience of crops to climate change hazards, particularly drought, extreme heat and shorter rain seasons. This technology is mainly targeted at small scale farmers across the country to address the increasing threat of food insecurity. The Agricultural National Sample Census provided data on the actual use of improved varieties, which was about 17 % (NPS, 2012). The target set in the TNA is to achieve the diffusion of improved seed varieties technology to cover at least 25% of smalls scale farmers in a period of 10 years. This target for the transfer and diffusion of improved seed varieties is to introduce the technology to 150,000 farmers by the year 2025.

(2) System of Rice Intensification (SRI) is a technique aimed at increasing the yield of rice produced while addressing the water availability challenge. Given the impacts of climate change on water availability, SRI technology is targeted mainly at small scale rice growing farmers in areas where there is low productivity mainly due to scarcity of water, poor agronomic practices and low soil fertility. The preliminary target for the transfer and diffusion of system of rice intensification (SRI) is to introduce the technology to 100,000 ha of farms by the year 2025.

(3) Drip-irrigation in order to optimize use of water which is likely to become scarce in the future while enhancing food production. The target is to achieve the adoption of drip irrigation technology in at least 1ha of each farm for 50,000 small scale farmers making 150,000ha of various horticulture crops, by the year of 2025.

Table 1: Existing policies related to Agriculture Sector's development and Technology Deployment in Tanzania

Name of the policy	Main contents	Remarks on technologies
The National Agricultural Policy (NAP) of 2013	Seeks to increase productivity and farmers' adaptive capacity through reduced dependency on rainfall, increased private sector investment in agriculture, improvement of road infrastructure problems and promotion of new energy sources, such as biofuels.	Committed to bring about a green revolution that entails transformation of agriculture from subsistence farming towards commercialization and modernization through crop intensification, diversification, technological advancement and infrastructural development.
Kilimo Kwanza (Agriculture First) of 2009	a public–private plan aimed to achieve a green revolution and boost private sector participation by increasing concessionary lending to agriculture, empowering agricultural cooperatives, creating commodity exchanges, removing market barriers to agricultural	Improving access to and use of agricultural knowledge and technologies, and accelerating land reform.
The Seeds Act (2003)	Implemented by the Crop Development Department at MAFC and the Tanzania Official Seed Certification Institute (TOSCI). It lays down the procedures for dealing with seeds and includes a register of authorized producers and dealers.	Regulates the production and trade of all varieties of agricultural seeds including the necessary provisions for quality assurance.
National Irrigation Policy	To ensure sustainable availability of irrigation water and its efficient use for enhanced crop production, productivity and profitability that will contribute to food security and poverty reduction.	Promotes adoption of appropriate technologies with higher efficiency on irrigation water use, which has not adequately been adopted by irrigators.
Agriculture Climate Resilience Plan (ACRP) formulated in 2014,	Mainly aimed at improving water use efficiency and promoting land, soil and water management, climate resilient crop varieties, and disaster risk management strategies, among others.	
Cereals and Other Produce Act (2009)	Enforced by the Directorate of Food Security at the MAFC. It includes a mechanism for coordinating the production, provision of information regarding food security and specific procedures to deal with food shortages.	Facilitate research on cereals by promoting appropriate technologies

1.1.2 Action Plan for Technology Improved Seed Varieties

1.1.2.1 Introduction

The United Republic of Tanzania has had mixed experiences in its quest to achieve food security. One of the factors constraining the country's efforts has been lack of good quality seeds. The seed multiplication sub sector is faced with weak research and extension culture, low level of awareness among farmers and poor technology applications. All these have

adversely affected efforts to increase agricultural productivity and improving rural livelihoods in a sustainable manner. Improved seeds[1]varieties technology reduces the risk of total crop failure and provides the producers with chances of dealing with the uncertainty created by climate change because they require relatively little rainfall. These are quality, high performance seeds that are adapted to local conditions. In the portfolio of common on-farm and non-farm livelihood adaptation strategies, crop adaptation(changing to crop species or varieties that are resistant to climatic stress) is among the most cited adaptation measures (Westengen and Brysting, 2014).

ISV is a consumer good involving public and private sectors as well as different actors within the market chain, mainly seed and seedling importers, which are usually agriculture companies. Most of the imports are on demand, where farmers make their special orders. Imported plant material is in many cases patented, by plant breeders with Intellectual Property Rights (IPR), which add to the price and make the ISV more costly.

Tanzania has a Seeds Act (2003) which emphasizes private sector participation in seed production and distribution in the country and has introduced measures to ensure that seeds produced and imported meet a set of required standards. Under the Act, a National Seed Committee functions as an advisory body to the Government. An official Seed Certification Institute (TOSCI) was also formed, with major functions relating to variety release and registration, seed certification, and training. Regulations associated with the Act were introduced in 2006. To address public varieties under the Act, Tanzania established a public Agriculture Seed Agency (ASA). The Act allows for a mechanism to promote on-farm seed production and multiplication of seeds. Smallholders are now able to produce "Quality Declared Seed" (QDS) by following the formal certification process.

ISV has economic, environmental and nutritional benefits. Economically ISVs are known to increase yield thus providing opportunity to move from subsistence farming to profitability. This increase of quality and yield of crops is bound to increase food security for the household and improve nutritional value of food available. Furthermore, ISV use is coupled with better agronomic practices which adhere to good practice of environmental conservation.

In 2008, the total arable land available in Tanzania was 14,642,284 hectares, 99.1 per cent of which is on the Mainland and 0.9 per cent in Zanzibar (NBS, 2012). Some 20% of the

[1]Seeds that aim at increasing quality and production of crops by having characteristics such as drought tolerance, high yielding and early maturity (FAO, 2009).

cropped area is planted in the short rainy season and 80% in the long rainy season. However, reports from De Groote et al, (2014), ASARECA, (2012), and Mafuru, *et al*, (1999) show very low adoption of improved seed varieties.

Generally, the proportion of farmers who are aware of improved seed varieties such as sorghum varieties ranges from about 16% in Lindi (Southern Tanzania), to as high as 80 % in Dodoma (Central Tanzania). Those with experience in growing these varieties also ranged from as low as 6% (Lindi) to as high as 62 % in Dodoma (Mgonja *et al*, 2002).

Only 27 % of cropped area for maize is estimated to have used improved seed. With respect to rice cultivation, this proportion is much lower, with only 1 % of cropped area estimated to be planted with improved seed. The 2010/11 National Panel Survey (NPS) found that just 16.8 % of rural households used improved seeds (WB, 2012). With such low levels of awareness, there is a need to promote use of this technology to enhance food security.

1.1.2.2 Ambition for the TAP

The target for the transfer and diffusion of improved seed varieties is, to introduce the technology to 150,000 farmers by the year 2025. In order to achieve these targets the stakeholders and players to be involved include policy makers and implementers such as Ministries of Agriculture, Finance, Trade and Industry; research institutions such as Uyole Agriculture Research Institute; seed multipliers, Tanzania Seed Company; wholesalers and retailers; and farmers who grow the crops and service providers including financial institutions and local NGOs and CBOs.

1.1.2.3 Actions and Activities selected for inclusion in the TAP

i. Summary of barriers and measures to overcome barriers

Table 2 is a summary of the identified barriers and measures to meet the specified ambition for transfer and diffusion of the technology. The information already available in Report II is condensed and edited to provide a justification for the actions proposed in this TAP.

Table 2 Summary of barriers and measures for the Improved Seed Varieties (ISV) technology

Barriers	Measures
Economic and financial	
• ISV are expensive compared local available varieties	• Reduce the cost of ISV release by regulating TOSCI regulations
• Difficult to access finance for investment	• Increase knowledge of available financial services to farmers, encourage formation of farmer's groups and associations
• Economic viability is not guaranteed	• Increase farmers 'market access, processing and distribution channels
Non financial	
• Low awareness and information	• Strengthen information sharing and awareness using farmer field schools and ASA to promote development of new seed companies in under-served regions of Tanzania
• Inadequate human capacity to support use of ISV (Extension services)	• Promote Public private partnership (PPPs) to strengthen capacity of farmers and extension agents
• Inability to distinguish genuine and fake seeds	• Develop seed quality control programme to educate stakeholders
• Complexity of using ISV against the surrounding investment	• Strengthen budget of research and development to enable address technical issues of farmers towards ISV
• Delayed release of ISV	• Reduce time required for seed variety release and process of committee approval
• Limited incentive to produce for market	• The Tanzanian government should consider promotion schemes for agriculture similar to those existing in tourism and mining (e.g. tax reductions, special loan facilities).
• Convenience and acceptability of ISV not evaluated	• Develop demonstration fields for observation and learning, for making informed decisions. • Establish networks of value chain to address value chain actor coordination challenge

ii. Actions selected for inclusion in the TAP

This section is providing a list with narrative descriptions of each of the measures selected as actions to be included in the TAP. It also provides arguments for why these measures have been selected as actions. Table 3; gives a summary of selected actions.

a. Enhance access to financing through registered groups

This action is aiming to enable farmers to access credit and loans. It has been always noted that farmers are not able to meet loan condition required by Microfinance Institutions (MFI) to access funds. Currently, financial system of the country channels loans and credit to registered groups. However, the groups formed need to have their own clear objectives and been able to have bylaws that can ensure trustworthy of the group. Thus lending groups or associations will act as collateral to a farmer to be able to access funds. As these associations will be legally registered with a clear profile they will be in a position to access funds from funders. Furthermore, these groups can also address the issues related to value additions through value chain approach to improve productivity and commercial value, market access and distribution channels. These groups can further address the challenges of availability of seeds and other agricultural inputs by strengthening small scale entrepreneurs and agro vets to set up seed distribution business, increase market access-processing and distribution channels. A group has more power to bargain with input suppliers, banks and other credit suppliers, and with buyers of their products than individual farmers. Such efforts will increase capacity of farmers to access finance needed for adopting the technology.

b. Provide adequate training to extension officers and farmers on ISV

This is addressing a long standing challenge of inadequate access to/availability of information and knowledge to enable further adoption of the technology. Training could improve communication between farmers and extension officers; assist in informed decision making and profitable use of technology. The training can also help extension officers to have confidence of the prevailing challenges such as outbreaks of pests and diseases and advice accordingly. Having enough information enables extension officers to be confident and to be trusted by farmers enough to handle their challenges.

c. Increase funding to Research and Development

Research and development area is an important component for technology diffusion. The role of ensuring that enough knowledge is available for given specie and how it fairs on a given environment requires funds. It is important that researchers interact with farmers to get feedback of the product produced. Thus lead to release of improved varieties of ISV for various ecological regions on time and enhance the use and diffusion of the technology. Currently, there is limited funding on this area resulting into poor performance in technology diffusion.

d. Improve policy and regulation of seed chains and marketing

Seed Act, 2003 sets clear guidelines of management of seeds in the country and seed regulation, 2007 are specific laws governing seed activities. Improving these will create a conducive environment for ISV diffusion and development. This will include actions that will allow Tanzania Official Seed Certification Institute (TOSCI) to be in a position to extend its operations by having enough human capacity, infrastructure, legal mandate to release seeds as needed. Issues such as the institutions' limited human and infrastructure

capacity to implement ISV program, weak inter-institutional collaboration, limited coordination between research and extension for ISV project implementation, limited capacity for ISV distribution monitoring and weak planning and assessment of ISV program at institutional level can be addressed. This will improve extension services and facilitate harmonization of strategies and policies of all key players for enhancement of the technology at all levels. This is necessary as using higher yielding seeds requires broad change of input systems as well as developing new markets for agricultural produce.

Table 3: Actions selected in Improved Seed Varieties for inclusion in the TAP

Category	**Measures**	**Actions selected for TAP**
Economic and financial	i. Reduce cost of release of seeds by regulating processes at Tanzania Official Certification Institute (TOSCI). ii. Simplifying the variety release procedures	i. Support formation of lending groups
	i. Increase knowledge of available financial services such as information on credit acquisition to farmers. ii. Support the formation of lending groups or associations to reduce MFI cost	
	Increase farmers' Market access- processing and distribution channels by supporting and building long-term relationships for the different actors in the agriculture value chain.	
Non Economic and Financial		
	Engage with the private sector in public private partnerships (PPP) so as to train farmers	i. Capacity building to extension officers and farmers on ISV ii. Increase funding to Research and Development iii. Improve policy and regulation of seed chains and marketing
	Strengthen the research and development to provide necessary support to farmers to be able to address technical issues of the adopted technology.	
	Reduce time for release of improved seed varieties	
	i. Establish a seed quality control programme. ii. Funding support for the development of an inclusive seed R&D programme.	
	i. Demonstration of improved seeds: The release of new varieties needs to be accompanied by establishment of demonstration fields which can be used for the learning purpose where all technical issues can be resolved. ii. Establish networks: Government to address the value chain actor coordination challenge through consultation with all key stakeholders in seed management.	

iii. *Activities identified for implementation of selected actions*

This section aims to expand the identified Actions into more specific "Activities." Table 4; shows a list of activities which need be implented for achieving the identified action.

Table 4: Activities identified for implementation of ISV actions

Actions	Activities
1. Enhance access to finance	1.1 The ministry of Agriculture to work with policy makers to advocatecontral Bank to lower banks' interests rates and incentives promotion 1.2 Village meetings for inventory of existing groups and to raise awareness on use of ISV technology, their benefits, management and supply and connecting the small groups with multidisplinary (such as business, legal, financial) association etc for information sharing 1.3 Establishment of lending groups or associations to act as collateral for loan acquisition
2. Capacity building for extension officers and farmers on ISV	2.1 Identify training needs of farmers in areas related to ISV and better agronomic practices 2.2 Tailor made trainings for extension officers to refresh their technical capacity and training for farmers. 2.3 Devise communication channels which are cost-effective, e.g. community schools, farmer field schools, radio listening groups etc for knowledge generation and awareness raising
3. Strengthen Agriculture and Research Institutes on Research and Development for ISV	3.1 Develop a baseline study to determine reserach needs 3.2 Solicit funding local and international to train technical staff and upgrade infrastructure in research institutes to build ISV research capacity 3.3 Strengthen institutes' networking with seed stakeholders and private sectors to enhance feedback of technology through regular meetings and visiting to the fields.
4. Improve policy and regulation of seed chains and marketing	4.1 Conduct a study on challenges of seed quality control and action plan to address the challenges 4.2 Review framework for seed release process so that it includes farmers and private sector in various stages. 4.3 Advocate for policy framework for enabling market oriented deployment for ISV products

Actions to be implemented as Project Ideas

Among the four actions choosen in the actions above two of them can be combined to form a project idea that addresses both actions for farmers and extension workers. Training and formation of groups as collateral to enhance access to finance can be combined into a project idea. The two measures are able to address barriers of inadequate knowledge on various issues related to improved seeds and low capacity to access credit and soft loans. The groups formed can be used to impart knowledge, to communicate between farmers and experts (extension workers, researcher etc). The activities should include efforts to reduce price on inputs, and train farmers on farming techniques.

To build capacity in farmers, it is important to start with good extension, education, and also gradually. Good seeds do not produce good yields if they are not accompanied with improved agronomic practices. Thus the training has also to include extension experimental plots

(farmers' field schools) among farmers' fields and proper attention should be paid in their exhibition. It is essential to make sure that the trials are successful, in order to win farmers trust and willingness to use ISVs. Participation of experienced agronomists, soil and water scientists, pest control specialists and extension workers at all levels is crucial.

1.1.2.4 Stakeholders and Timeline for implementation of TAP

Overview of Stakeholders for the implementation of the TAP

Table 5; intends to describe the stakeholders identified and their roles as required for each of the actions to be implemented.

Table 5: Stakeholders and timeline for implementation of ISV TAP

Stakeholder	Role
1. VPO-DOE	Focal Point of the United Nations Convention on Climate Change Sourcing funds from climate funds and Global Environmental Facility Responsible for environmental policies and environmental management
2. Ministry of Agriculture	Responsible for agriculture/ seed policies Oversees and coordinates all the project activities Sourcing for funds to implement the technology Responsible to present agriculture strategies and programmes to cabinet Streamline and rationalize functions of seed regulatory institutions within the ministry Promotes use of improved seeds
3. Local Government Authority	To coordinate implementation of the Seed Act; distribution of extension officers,microfinance institutes and legalisation of groups
4. Ministry of Finance and Planning including Bank of Tanzania	Responsible for financial policies including incentives Responsible to negotiate and regulate the interest rates for loans for farmers
5. Ministry of Industry, Trade and Investment (MITI)	Formalising agricultural marketing systems of seeds and agro products, Promoting agro-processing industries, Promoting standard packaging of farm produce and products from ISV; and Identifying opportunities of ISV products markets locally, regionally and internationally. Key when ago products from ISV are to be marketed
6. Tanzania Official Seed Certification Institute (TOSCI)	Development of guidelines and inspector training programs Monitoring and control of quality of seeds as recognized in Seed Act. Responsible for management of seeds released Responsible to issue certification for seeds Responsible for developing seed market
7. Agriculture Research Institutes (ARIs)	Responsible to conduct research on new varieties
8. Academic Institutes	Responsible for teaching, research and development. Responsible to teach and generating competent agriculture extension officers at all levels and research officers
9. NGOs	Responsible for awareness creation Promotion of ISV technology
10. Development Partners	Financing and advising on collaboration and cooperation.
11. Private sector	Responsible throughout the seed chain to address various needs especially

	distribution
12. Farmers	Direct beneficiaries

Scheduling and sequencing of specific activities

Table 6: below aim at describing the sequence and timing of specific activities developed as well as the nature and scale of the activity

Table 6: Scheduling and sequencing of ISV specific activities

Action	Activity	Timeframes (Planning and Implementation)						Responsible body
		Y1	Y2	Y3	Y4	Y5	Y6	
Enhance financial access	lowering of banks' interests rates and incetives promotion							PORALG, MAFC, MFP, MFI, Private sector instititutes
	Formation/Inventory of groups for training on credit acquisition and roles of group to support collateral role.							PORALG, MAFC, MFP, NGOs, Private sector instititutes
Strengthen Capacity of key stakeholders extension officers and farmers	Identify training needs of farmers							VPO, MAFC, PORALG
	Tailor made trainings for extension officers							VPO, MAFC, PORALG
	Develop and implement communication programme on ISV							MAFC, PORALG,TOSCI, NGOs, Academic Institutes, ARIs
Strengthen Research and Development	Solicit funding local and international to train technical staff and upgrade infrastructure in research institutes and TOSCI							VPO, MAFC, MFAEAC, ARI, TOSCI, Academic Institutes, Development Partiners
	Strengthen networking with seed stakeholders and private sectors to enhance feedback of technology							MAFC, MITI, MFAEAC, ARI,TOSCI, Private Sector
Strengthen enforcement and legal and regulatory frameworks to support ISV and marketing	Conduct a study on challenges of seed quality control and action plan to address							MAFC, MFAEAC, MITI, TOSCI,
	Review seed release regulations to reduce release time							MAFC, TOSCI
	Promote policy framework for market oriented approach for ISV products							MAFC, MITI, MFP, Bank of Tanzania, Private Sector, NGOs.
	Monitoring and evaluation							VPO, MAFC, PORALG.

1.1.2.5 Estimation of Resources Needed for Action and Activities

Successful implementation of any project depends much on the capacity of the implementers. In order for the technology diffusion to succeed and to be sustained there is a need to strengthen capacity of farmers to access funds, extension officers to link farmers and researchers, research institutes on issues related to improved seed varieties. In order to ensure accelerated diffusion there will be a need to train individual farmers in local villages who are to be local extension officers and to ensure marketing framework is in place. Table 7; provides a summary of the same.

Table 7: Estimation of resources needed for ISV action and activities

SN	Activity	Estimated Cost (USD)	Source of funds	Justification
	Advocacy for lowering of banks' interests rates and incetives promotion	45,000	GoT	Study to avail economic impact of not using ISV
	Inventory of existing groups and the training needs for group formation in areas related to credit acquisition and roles of group to support collateral role.	72,000	GoT	Avail benefits of groups beyond collateral for adaptation
	Identify training needs for farmers in areas related to ISV and better agronomic practices	109,000	GoT and DPs	Increase capacity of farmers through farmer field school
	Tailor made trainings for extension officers to refresh their technical capacity.	75,000	GoT	Increase capacity of extension services
	Strengthen capacity of TOSCI to Implement government seed policy	83,700	GoT and DPs	TOSCI is responsible for seed release process
	Develop and implement communication programme on ISV	38,000	GoT, DPs	Increase awareness of ISV
	Solicit funding local and international to train technical staff and upgrade infrastructure in research institutes and TOSCI	450,000	GoT and DPs	Changing climate necessitate frequent training and up-to-date equipment
	Strengthen networking with seed stakeholders and private sectors to enhance feedback of technology	43,000	GoT	Feedback is important for effective actions
	Promote policy framework to enhance seed quality control	180,000	GoT, DPs	Protect farmers against fake/ counterfeit products
	Review seed release regulations to reduce release time	120,000		Various meetings to reduce seed release time
	Promote framework for market of ISV products	70,000		To enable marketing of products resulting from use of ISV
	Monitoring and evaluation	100,000		
	Total	**1,385,700**		

1.1.2.6 Management Planning

Risks and Contingency Planning

Any endevour is faced with risk thus a need for contigency planning, table 8 provide a detailed overview of identified risks and contingency plans

i. Increased fake seeds

Table 8: Risks and contingency plans for ISV TAP

Risks	Description	Contigency Plan
Increase fake seeds	Due to increased awareness ,demand could be high resulting in	Train few farmers of important features to be retail seed sellers
Availability of seeds	Insufficient supply of seeds resulting from high demand.	Generate a demand list beforre the start of the season
Markets f or crops	Increased yield may result to surplus for selling while markets are not available.	Establish network of farmers and value chain actors
Lack of funds	Lack of funds to implement proposed intiatives.	Explore funds opportunities

Next Steps

In order to ensure that a sharpened focus can be achieved and appropriate resources committed to their achievement of ISV technology diffusion and adoption, these immediate and critical requirements identified are important.

a) immediate requirements to proceed

- The focal point (The vice president's office) to convene a meeting with stakeholders to share the outcome of TNA project
- The Ministry of Agriculture to appoint a project manager who will refine and develop a plan to allow the TAP to be implemented and develop a budget line for the implementation

b) Critical Steps

Develop a clear understanding of the project among the stakeholders and build a close coordination among the research institutes, TOSCI and Ministry of Agriculture.

1.1.3 Action Plan for Technology System of Rice Intensification (SRI)

1.1.3.1 Introduction

Rice is a second most important cereal food (staple and commercial) crop in terms of number of farmers, area planted and production volume in Tanzania. Besides meeting local consumption demands, the rice sector is a major source of income and employment in rural areas. Total area under rice cultivation in 2005 was 702,000 hectares representing 18% of Tanzania cultivated land (Rice Sector Strategy, 2009) of which 90 % is under small scale farmers and the rest under large scale. The leading regions in rice production are Shinyanga, Tabora, Mwanza, Mbeya, Rukwa and Morogoro. Others include Kilimanjaro, Arusha, Manyara, Iringa, Mara, Tanga and Kigoma.

Majority of rice producers in Tanzania are small scale/ subsistence farmers who practice continous flooding rice production techinique. This technique uses large amount of water with very low yield of between 1-1.5 tons/hectare. Due to various reasons including climate change, the demand of water for irrigation purposes in Tanzania outstrips the amount of water available for irrigation and other demands. For example, 70% of subsistence farmers in Usangu plain have limited access to water as water is directed to replenish the Ruaha National Park ecosystem. Despite the water scarcity, the country faces increased demand for more food to feed the growing population.

The system of rice intensification (SRI) on the other hand is an approach that can address the growing challenge of food security while adapting to water scarcitity and reduces emission of carbon by reducing the time when soils are flooded with water. Rice/paddy cultivation is among the sources of GHG emissions from agriculture. Permanently flooded soils release more methane than soils that are flooded and then dried between production periods. SRI is an agro ecological technique for increasing the productivity of irrigated rice by changing the management of plants, soil, water and nutrients. System of rice intensification (SRI) is a potential Climate Smart Agriculture (CSA) practice that can be relevant for promoting rice production. CSA can be defined as a concept that sustainably increases productivity, resilience (adaptation), reduces or removes greenhouse gases (mitigation), and enhances achievement of national food security and development goals. The technology is more profitable to farmers as well-managed SRI farms yield can be up to 6.3 tons/ha, compared to conventional rice farming that produce 1-1.5tons/ha (more than 60% increase in yield).

1.1.3.2 Ambition for the TAP

The target for the transfer and diffusion of system of rice intensification (SRI) is to introduce the technology to 150,000 rice farming households with 1 ha of rice farm to achieve 150,000 ha of SRI farms in 5 regions by the year 2025. In order to achieve these targets the stakeholders to be involved include policy makers such as Ministries of Agriculture, Finance and Planning, Trade and Industry; research institutions such as Uyole Agriculture Research Institute; wholesalers and retailers; and farmers who grow the crops and service providers including financial institutions and local NGOs and CBOs.

1.1.3.3 Actions and Activities selected for inclusion in the TAP

Summary of barriers and measures to overcome barriers

The BA & EF identified a number of barriers to diffusion of the technology; these were divided on to economic and financial barriers and non-economic financial barriers. SRI adoption is hampered by inadequate financial resources; this contributes to limited investment towards a technology by private sector, civil society organizations which would be key to stimulate adoption. Furthermore, farmers needs to able to have access to finance so as they are able to transform their agriculture into a meaningful investment to buy farm equipment. Table 9 gives a summary of barriers and their measures.

Table 9: Summary of barriers and measures for System of Rive Intensification (SRI) technology

Barriers to and measures to overcome Barriers to System of Rice Intensification		
Barrier Category	Barriers	Measures
Economical and Financial Barriers	Inadequate financial resources	i. Support to establishment of informal savings and credit groups at community level: ii. Encourage private public partnership to initiatives such as SACGOT at the small scale level iii. Enhancing producer price support mechanism, facilitate market access and avail information on markets to small scale farmers.
	Lack agriculture credit and loans	i. Establish small holder credit facilities. ii. Relevant state institutions such MAFL, research institutions, academia etc should conduct economic and financial feasibility studies and make the study findings available to the public and to the decision makers to support investment on the technology
Non Financial Barriers		
Information and awareness	Access to information and extension services	i. Establish SRI demonstration plots and on farm trials. ii. Exchange visits of rice scientists, extension

Barriers to and measures to overcome Barriers to System of Rice Intensification		
Barrier Category	Barriers	Measures
		officers, processors and farmers
	Perceptions of climate change among the farmers	Increase campaigns of climate change awareness and how to reduce risk exposure where adoption of SRI should be emphasized.
Human Skill	Limited human capacity	i. Strengthening of farmer field schools and training institutions to train farmers and to learn on what works in practice. ii. Training of early adopter farmers, processors, extension officers and other stakeholders in rice technologies at the Ministry of Agriculture Training Institutes/centers ii. Increase management skills of increased production**;** introduce/adopt supporting technologies to complement the realized gain from SRI.
Policy , legal and regulatory	Inadequate regulations and bylaws	Advocate the harmonization of principals of SRI and existing policy regulations.
Institutional and Organizational Capacity	Poor institutional coordination	i. Strengthen water user associations (WUAs) on use of water for irrigation. ii. Ministry of Agriculture Fisheries and Livestock (MAFL) and Ministry of Water and Irrigation (MoWI) to coordinate farmers to manage the canal collectively to increase their likelihood of adoption of SRI.
Social, Cultural behaviour	Poor acceptance	Enhance use of farmer field schools and deliberate identification of champions within the community who can influence the community on decisions.

Actions selected for inclusion in the TAP

The following table 10; shows actions that were selected from measures identified in the BA&EF process (Report II).

Table 10: Actions selected for inclusion in the SRI TAP

Identified measures to overcome barriers	Measures selected as actions for inclusion in TAP
i. Farmers to establish small holder credit facilities through sensitization form LGAs: facilities from banks such as TIB and TAIB should focus on majority farmers who are small scale farmers. **ii.** Relevant state institutions such as MoA, research institutions, academia etc should conduct economic and financial feasibility studies and make the study findings available to the public and to the decision makers to support investment on the technology	Establish small holder credit facilities
i. Establish SRI demonstration plots and on farm trials. **ii.** Exchange visits of rice scientists, extension officers, processors and farmers to share experience and encourage network of technology adopters.	Establish SRI demonstration plots and on farm trials.
Increase campaigns of climate change awareness and how to reduce risk exposure where adoption of SRI should be	Increase campaigns of climate change awareness and how to reduce risk exposure where adoption of

emphasized. Understanding of the contribution of technologies to yield variability is important.	SRI should be emphasized.

Summary of measures selected as actions for inclusion in TAP

This section provides narrative descriptions of the measures selected as actions to be included in the TAP and arguments for why these measures have been selected as actions. Among the criteria used have been the effectiveness of the measure, the alignment with the existing legal and mandates of the institutions and compatibility with the country priority and plans.

i. Establish small holder credit facilities
National policies, which support smallholder credit, can be an important adoption driver to overcome wealth constraints to investment in new technologies. Initiatives from banks such as TIB and TAIB should focus on majority farmers who are small scale farmers. Through research such initiatives can come up with packages that make it possible for farmers to access credit.

ii. Establish SRI demonstration plots and on farm trials.
These initiatives spread information without much effort through informal communication networks. Knowledge sharing about the technology could then be facilitated through communication infrastructure, media access and a functional network of continuously updated extension agents such as NGOs and local agro dealers.

iii. Increase campaigns of climate change awareness and how to reduce risk exposure
Such awareness and knowledge will support strengthen of communities in reducing impacts of climate change and save water use. Awareness on how SRI can reduce risk exposure and understanding of the contribution of technologies to yield variability will be emphasized.

Activities identified for implementation of selected actions

After the development of actions which from measure that were developed, Table 11 shows activities which a more specific to achive the actions developed.

Table 11: Activities identified for implementation of SRI selected actions

Actions	Activities	Responsible
1. Establish small holder credit facilities for farmers	1.1 conduct economic and financial feasibility studies of SRI methodology	Academia, R&D institutes
	1.2 Sensitise the decision makers and MFI on the importance of developing special financial/credit mechanism to facilitate loans access for farmers	Ministry of agriculture, MFP,PO-RALG, Commercial Banks, NGOs
	1.3 Carry out market survey to identify potential buyers of the product (Rice) and their willingness to pay for the rice	Ministry of Agriculture, Ministry of Trade and Industries,
2. Establish SRI demonstration plots and on farm trials.	2.1 Develop tailor made trainings on SRI	MoA, ARIs, NGOs
	2.2 Design and operate SRI demonstration plots	Ministry of Agriculture, NGOs

3. Increase campaigns of climate change awareness and how SRI investment can reduce risk exposure	3.1 Develop awareness material targeting different stakeholders (Private Sector, Decision Makers, farmers, financial institutions) on cc and SRI	Ministry of Agriculture, VPO, NGOs,
	3.2 Develop a communication strategy Profile the target stakeholders particularly the adopters of the technology	Ministry of Agriculture , PO-RALG and NGOs
	3.3 Awareness raising campaign on SRI as a means of reducing water use and increasing yield	Ministry of agriculture, ARIs,PO-RALG, NGOs

1.1.3.4 Stakeholders and Timeline for implementation of TAP

Overview of Stakeholders for the implementation of the TAP

This section describe the stakeholders identified and theirs roles as required for each of the Actions to be implemented. Table 12, gives a summary of the same.

Table 12: Overview of stakeholders for implementation of the SRI TAP

SN	Stakeholder	Role
1.	Ministry of Agriculture	Responsible for Agriculture policies and harmonization with SRI principles Oversees agriculture projects Sourcing for funds to implement the technology Promotes use of technologies in agriculture
2.	Vice President Office	Focal Point of the United Nations Convention on Climate Change Sourcing funds from climate funds and Global Environmental Facility to implement adaptation technologies Responsible for environmental policies and environmental management
3.	Ministry of water and Irrigation	Responsible for coordination and allocation of water for irrigation
4.	President Office-Regional Administration and Local Government.	Responsible for coordination at the local governments
5.	Ministry of Finance and Planning	Responsible for financial policies including incentives Responsible to negotiate loans for funding Ministry of Agriculture projects Responsible for regulating commercial banks
6.	Ministry of Foreign Affairs and East Africa Cooperation	Responsible for foreign relations
7.	Development Partners	Responsible for supporting technology adoption initiatives
8.	Ministry of Trade, Industries and Investments	Formalizing agricultural marketing systems, promoting agro-processing industries, promoting standard packaging of farm produce and products and identifying opportunities of markets locally, regionally and internationally.
9.	NGOs	Responsible for awareness creation Promotion of technology

Scheduling and sequencing of specific activities

The following table 13; is giving details of scheduling and sequencing for implementation of specific activities of SRI

Table 13: Scheduling and sequencing of SRI specific activities

Action	Activity	Planning		Implementation		Responsible body
		Start	End	Start	End	
1.Establish small holder credit facilities for farmers	1.1 conduct economic and financial feasibility studies of SRI methodology	2019	2020	2021	2022	Academia, R&D institutes
	1.2 Sensitise the decision makers and MFI on the importance of access to loans for farmers	2020	2021	2022	2024	Ministry of agriculture, MoFP,PO-RALG, Commercial Banks, NGOs
	1.3 Carry out market survey to identify potential buyers of the product (Rice) and their willingness to pay for the rice	2020	2021	2022	2024	Ministry of Agriculture, Ministry of Trade and Industries,
2. Establish SRI demonstration plots and on farm trials.	2.1 Develop tailor made trainings aiming at building various capacities on SRI	2020	2020	2021	2023	MoA, ARIs, NGOs
	2.2 Design and operate SRI demonstration plots	2020	2021	2021	2023	Ministry of Agriculture, Ministry of water and Irrigation, NGOs
3. Increase campaigns of climate change awareness and how SRI investment can reduce risk exposure	3.1 Develop awareness material targeting different stakeholders (Private Sector, Decision Makers, farmers, financial institutions) on cc and SRI	2020	2020	2021	2025	Ministry of Agriculture, VPO, NGOs,
	3.2 Develop a communication strategy to profile the target stakeholders particularly the adopters of the technology	2020	2020	2021	2022	Ministry of Agriculture , PO-RALG and NGOs
	3.3 Implement awareness campaign on SRI as a means of reducing water use and increasing yield	2020	2020	2021	2023	Ministry of agriculture, ARIs,PO-RALG, NGOs

1.1.3.5 Estimation of Resources Needed for Action and Activities

In order for the technology diffusion to succeed and to be sustained there is a need to build capacity of extension officers and farmers. In order to ensure accelerated diffusion there will be a need to train the trainers to ensure replication of training programmes in as many areas with rice farmers. Table 14; provides a summary of the needed resources.

Table 14: Estimation of resources needed for action and activities for SRI

SN	Activity	Estimated Cost (USD	Source of Funds	Justification
1.	Establish a unit to oversee the implementation of the TAP	120,000	GoT	Recruit at least two people; conduct practical training on SRI; Office furniture
2.	Conduct economic and financial feasibility studies of SRI methodology	38,000	GoT	Engage a consultant to study effective incentives
3.	Sensitise the decision makers and MFI on the importance of access to loans for farmers	25,000	GoT,	Develop sensitisation materials, Conduct meetings
4.	Carry out market survey to identify potential buyers of the product (Rice) and their willingness to pay for the rice	20,000	GoT,	Engage consultant to study appropriate markets and modalities of pricing ;conduct stakeholders meeting
5.	Develop tailor made trainings aiming at building various capacities on SRI	250,000	GoT, Development partners	develop training materials, tuition fees, subsistent allowances, stakeholder meetings
6.	Design and operate SRI demonstration plots	245,000	GoT, DPs	Produce guidelines on the practices and principles applicable in a local area
7.	Develop awareness material targeting different stakeholders (Private Sector, Decision Makers, farmers, financial institutions) on cc and SRI	225,000	GoT, DPs	Unveil importance of SRI to adapt to impacts of climate change
8.	Develop a communication strategy to profile the target stakeholders particularly the adopters of the technology	20,000	GoT	To build a network of farmers to assist marketing
9.	Awareness raising campaign on SRI as a means of reducing water use and increasing yield	75,000	GoT	To sensitize investment on the technology
	Total	**1,018,000**		

1.1.3.6 Management Planning

Risks and Contingency Planning

Table 15; gives a detailed overview of identified risks and contingency plans

Table 15: Risks and Contingency plan for SRI technology

Risk Item	Description	Contingency action
Cost Risks	SRI requires good organization on irrigation schemes times	To sensitize farmers who are on the same scheme to allow irrigation on required times.
Policies	Policies need to support investment	Awareness and continuous lobbying with decision makers
Extension officers	May be few to address the demand	Ministry of Agriculture and PO RALG to increase their resources to increase the number

Next Steps

To ensure that the activities anticipated are implemented there are: a) immediate requirements to proceed and b) critical steps to succeed. Through these **requirements**, a sharpened focus can be achieved and appropriate resources committed to their achievement.

Immediate Requirements

- Develop a comprehensive plan on SRI to deliver on the activities and actions, this include provision of adequate personnel, stakeholder consultation processes
- A dedicated team is developed to carry out the extension officers' survey and data analysis, produce the results to eliminate challenges and improve work conditions.

Critical Requirements

- Ensure policy environment and legal framework are supportive of SRI.
- Identification of stakeholders and potential partners to drive SRI processes.
- Appointment of people with Skills, knowledge, and commitment to carryout surveyto determine baseline situation .
- Allocation of adequate financial resources to support the survey processes.

1.1.4 Action Plan for Technology Drip Irrigation

1.1.4.1 Introduction

Irrigation is important in Tanzania to deal with the erratic rainfall, especially in the context of climate change. Irrigation can minimize frequent food shortages that are attributable to dependence on rainfall, and increase yields. However, to do this effectively requires a range of infrastructure that will provide for a wide range of crops and efficient water use. Tanzania is endowed with irrigation potential area of 29.4 million hectares of which 2.3 million hectares is of high potential, 4.8 million hectares is of medium potential and 22.3 million hectares is of low potential. Out of this potential area only 461,326 hectares (equivalent to 1.6% of the area is under irrigation) and contributes 24% of the national food requirement at present (Rukiko, 2016).

Recognizing this need, the government of Tanzania has made ambitious commitments to expand the area irrigated, and set up the National Irrigation Commission (NIC) to deliver on this potential. The commission envisages to improve the traditional irrigation schemes and expand the area under irrigation from 461,326 Hectares up to 1,000,000 Hectares by 2020/21 This target alone is expected to cost a hefty 6.8 trillion shillings (USD $3 billion) (Pham, A. 2016)

Drip irrigation is a good option for farmers to optimally use limited amount of water and also help in environmental conservation. Drip irrigation has been found to increase farmer yields by up to 300 percent compared to non-irrigated traditional production practices, save 30 to 70 percent on water usage, and reduce the cost of labour by up to 80 percent (Fintrac, 2016). Therefore using drip irrigation technology provides a room for the prospects of boosting optimal use of limited amount of water, improved productivity and increase incomes for small-scale farmers.

1.1.4.2 Ambition for the TAP

The target is to achieve the adoption of drip irrigation technology for 1,000,000 households of small scale farmers and cover 1,800,000 ha of various horticulture crops, over a period of 10 years by 2030. The cost of a drip irrigation system varies widely and ranges from US$ 800 to US$ 2,500 per hectare depending on the specific type of technology, automatic devices, and used materials as well as the amount of labour required.

1.1.4.3 Actions and Activities selected for inclusion in the TAP

Summary of barriers and measures to overcome barriers

The BA & EF identified a number of barriers to diffusion of the technology; these were divided on to economic and financial barriers and non-economic financial barriers. Drip irrigation adoption is hampered by inadequate financial resources; this contributes to limited investment towards a technology by private sector, civil society organizations which would be key to stimulate adoption. Furthermore, farmers need to able to have access to finance so

as they are able to transform their agriculture into a meaningful investment to buy farm equipment. Table 16 gives a summary of barriers and their measures.

Table 16: Summary of barriers and measures to adoption and diffusion of Drip Irrigation (DI) technology

Barriers to and measures to overcome Barriers to Drip Irrigation		
Barrier Category	Barriers	Measures
Economic and financial	a) High capital cost	i. Government taxes on importation to be reduced or eliminated Attract more private sector involvement in the market chain of the same to improve the financial viability of the deploying technology and increase uptake
	b) Difficulty to access finance	i. Government to engineer provision of credit facilities, grants, and subsidies as instruments to support farmers to invest in drip irrigation (DI) equipment. ii. Establish an appropriate land tenure system to enable farmers to own the land legally and enhance their capacity of collateral for accessing loans. iii. Local governments Authorities (LGAs) should consider establishing a fund to provide low interest credits/loans for drip irrigation projects. iv. Development institutions with a mandate to promote these technologies could consider providing required funds on agreed terms.
Non-Financial Barriers		
Information and awareness	Low level awareness of the technology	Consistent awareness creation
	Farmers mindset	With the aim of transforming their farming practices, provide knowledge to farmers through demonstration farms on off season harvest, train them on diversification of crops, marketing and record keeping.
Technical	Insufficient understanding of the use of the kits and functionality	Effective utilization of drip irrigation needs to be tied to technical assistance to ensure farmers are maximizing the benefits of the system and applying other required and complementary good agricultural practices.
	Inadequate pest and disease control	Promote technical assistance to provide irrigation management, crop production, agronomic training and advice, and market access support.
Policy, legal and regulatory barriers	Government policy and incentives	Reduce or remove VAT and duties for drip irrigation equipment to enable local private sector to supply irrigation equipment to small scale farmers at affordable cost. Local standards for drip irrigation equipment and vetting systems need to be developed for quality control.

Barriers to and measures to overcome Barriers to Drip Irrigation		
Barrier Category	Barriers	Measures
Institutional and organizational capacity barriers	Weak link between research extension and farmers	Strengthen the collaboration among the stakeholders through training, regular 'sharing' meetings and developing system of communications
	Limited institutional capacity for research and development	Call to increase budget for R&D institutions, increasing numbers of skilled/ technical people, strengthen southsouth collaboration to enable sharing of new knowledge
Social, Cultural behaviour	Resistance to adopt the technology, and fear of unknown	Provide extensive awareness programme through media to ensure a large section of the population become familiar with the technology.
	Community conflicts	Deliberate efforts to solve land conflicts by strengthening coordination of village and LGAs are important.

Actions selected from identified measures for inclusion in the TAP

Measures identified from Report II of barrier analysis and enabling framework are eligible to be actions that can be developed to be included in the action plan. Table 17; shows measures selected to be actions.

Table 17: Action selected from identified measures for inclusion in the DI TAP

Barrier Category	Identified Measures to overcome barriers	Measures selected as Actions for inclusion in TAP
Economic and financial		
a) High capital cost	i. Government taxes on importation to be reduced or eliminated ii. Attract more private sector involvement in the market chain of the same.	Enhance access to finance through credits
b) Difficulty to access finance	i. Government to engineer provision of credit facilities, grants, and subsidies ii. Establish an appropriate land tenure system to enable farmers to own the land as collateral for accessing loans. iii. Local governments Authorities (LGAs) should consider establishing a fund to provide low interest credits/loans for drip irrigation projects. iv. Development institutions with a mandate to promote these technologies could consider providing required funds on agreed terms.	
Non-Financial Barriers		
Information and awareness	Consistent awareness creation	Build / strengthen capacity of key stakeholders
	Provide knowledge to farmers through demonstration farms on off season harvest, diversification of crops, marketing and record keeping.	
Technical	Effective utilization of drip irrigation needs to be tied to technical assistance to ensure farmers are applying other required and complementary agronomic principles	

Barrier Category	Identified Measures to overcome barriers	Measures selected as Actions for inclusion in TAP
Policy, legal and regulatory barriers	Reduce or remove VAT and duties for drip irrigation equipment Local standards for drip irrigation equipment and vetting systems need to be developed.	

Summary of Actions selected for inclusion in the TAP

The following is the summary of measures that has been selected as actions for development of TAP. This section also provides arguments for why these measures have been selected as actions. Among the important criteria for selection of the measure is the effectiveness, efficiency of the actions, ease of implementation of action.

i. Enhance access to finance through credits

Small scale farmers are being faced by an increasing challenge of scarcity of water due shortage of rains. Many of these farmers are not well informed for available options such as drip irrigation. Irrigation projects such as drip irrigation require large capital investment that is not readily available for farmers. Local banks do not have products that can accommodate small scale farmers. Another reason that may make the banks reluctant to finance such projects is the fact that, small scale farmers do not meet the criteria put forward by bank's products for credit.

Investment on drip irrigation technology in Tanzania has a high initial capital costs. Such high initial costs may also reflect high-risk perceptions to financial institutions. Furthermore, there is a general lack of appropriate financing instruments as well as financial sectors not being ready to finance projects considered to be risky. There are no incentives on import or local manufacturing of drip irrigation devices in the country, most of drip irrigation projects are being promoted by donors such as the USAID and Bill and Melinda Gates Foundation. Thus enhancing access to finance for drip irrigation investment can enable adoption and diffusion of the technology.

ii. Build / strengthen capacity of key stakeholders

For effective adoption and diffusion of the technology of drip irrigation it is important to enhance capacity of stakeholders to address many of the non financial barriers**.** The level of awareness about the technological possibilities and immense socio-economic and environmental benefits derivable from drip irrigation among the citizens and decision-makers is relatively low in Tanzania. This calls for increased awareness and capacity to address the inadequate knowledge that look at drip irrigation in terms of commercial high investment such as flower business. Such capacity that will enable the development of large scale drip irrigation in Tanzania. The current flow of information about the development, various applications, dissemination and diffusion of drip irrigation resources and technologies are also inadequate. This may result in poor confidence of the technology among the public, private and financing sectors on the adoption of the technologies.

Furthermore, there is a need of government policy and incentives instituted by the government to support the profitable exploitation of irrigation (generally and particularly drip irrigation) for any intending investors. To enable this, capacity enhancement is needed for policy makers and decision makers to consider drip irrigation as an option for irrigation that uses the small amount of water for production (suitable for semi-arid areas) and its convenience of operation.

Activities identified for implementation of selected actions

This section aims to expand the identified Actions into more specific "Activities." Table 18 shows a list of activities which need be implented for achieving the identified action.

Table 18: Activities identified for implementation of DI selected actions

Action	Activities
1. Enhance access to financing	1.1. Develop financial incentives to lower the cost of drip irrigation systems including introducing subsidies and tax exemptions 1.2. Sensitise the policy makers on the importance of incentives and or subsidies for the drip irrigation to enable it to compete with conventional irrigation technologies for small scale farmers 1.3. Strengthen an existing National Irrigation Development fund to enhance investment in drip irrigation 1.4. Develop products that will lower commercial banks' lending rates 1.5. Engage in dialogue with development partners to provide subsidies for the technology as it contributes to global benefit
2. Build / strengthen capacity of key stakeholders	2.1. Develop specialized training aimed at building the capacities in relevant institutions – in areas of installation, operation and maintenance of drip irrigation system 2.2. Strengthen National Irrigation Commission to enhance uptake of more drip irrigation initiatives 2.3. Strengthen inter-ministerial coordination

Actions to be implemented as Project Ideas

Build / strengthen capacity of key stakeholders will be action that is to be developed as project idea. It has been selected because once there is adequate human capacity for the project; it will be possible to proceed with implementation of the project.

1.1.4.4 Stakeholders and Timeline for implementation of TAP

Overview of Stakeholders for the implementation of the TAP

This section describe the responsible body for activities identified. Table 19; clarify stakeholders for the implementation of activities developed.

Table 19: Overview of stakeholders for implementation of the DI TAP

SN	Activities	Responsible body
1.	Develop financial incentives	Ministry of Finance and Planning Ministry of Agriculture
2.	Sensitise the policy makers on the importance of incentives and or subsidies the technology	Ministry of Agriculture, National Irrigation Commission, PO RALG, NGOs
3.	Develop products that lower commercial banks' lending rates	Ministry of Finance and Planning Bank of Tanzania Commercial Banks
4.	Strengthen an existing National Irrigation Development fund to enhance investment in drip irrigation	Ministry of Agriculture, PORALG, Development Partners
5.	Engage in dialogue with development partners	Ministry of Agriculture Ministry of Finance and Planning Vice Presidents Office Ministry of Foreign Affairs and East Africa Cooperation
6.	Develop specialized training	Universities, Dar es Salaam Institute of Technology, Vocational Training institutes
7.	Strengthen NIC	Ministry of Agriculture NIC

SN	Activities	Responsible body
		Ministry of Finance and planning Development Partners
	Strengthen inter-ministerial coordination	Ministry of Agriculture

Roles of Stakeholders

This section describe role of the different stakeholders who have been identified as required for each of the actions to be implemented. Table 20; Clarify and describe the roles of each stakeholder.

Table 20: Stakeholders and their roles in implementation of DI TAP

SN	Stakeholder	Role
1.	Ministry of Agriculture	Responsible for agriculture policies Oversees agriculture projects Sourcing for funds to implement the technology Responsible to present agriculture strategies and programmes to cabinet Promotes irrigation
2.	Vice President Office	Focal Point of the United Nations Convention on Climate Change Sourcing funds from climate funds and Global Environmental Facility Responsible for environmental policies and environmental management
3.	Ministry of Water and Irrigation	Oversees sustainable management and development of water resources for social and economic development.
4.	Local Government Authorities (LGAs)	To coordinate the execution of irrigation interventions as part of agricultural development
5.	Ministry of Finance and Planning	Responsible for financial policies including incentives Responsible to negotiate loans for funding Irrigation projects Responsible to cope with contractual obligations of the Government
6.	Universities,	Responsible for teaching, research and development. Responsible to teach engineers
7.	Water Development and Management Institute (WDMI)	Responsible for teaching technicians
8.	Vocational Training Institutes	Responsible for teaching artisans
9.	NGOs	Responsible for awareness creation Promotion of technology
10.	National Irrigation Commission (NIC)	The sole off-taker of irrigation initiatives
11.	Development Partners	Providing assistance in terms of funding and technical aspects in different interventions to achieve the set objectives.

Scheduling and sequencing of specific activities

The following section describe the sequence and timing of specific activities, as welll as the nature and scale of the activity to enable taking of the TAP. Table 21, gives a summary of the time and reponsible stakeholder for the action.

Table 21: Scheduling and sequencing of specific DI activities

Action	Activity	Planning		Implementation		Responsible body
		Start	End	Start	End	
Enhance access to financing	Develop financial incentives	2019	2019	2019	2021	MFP, MOA
	Sensitise the policy makers	2019	2019	2019	2020	MOA

Action	Activity	Planning		Implementation		Responsible body
	on the importance of incentives and or subsidies					MoWI NGOs
	Lower commercial banks' lending rates	2019	2019	2019	2020	MFP BoT Commercial Banks
	Strengthen a National Irrigation Development Fund	2019	2019	2020	2024	MOA MoWI DPs
	Engage in dialogue with development partners	2019	2019	2019	2020	MOA, MoWI, MFP VPO, MFAEAC
Build / strengthen capacity of key stakeholders	Develop specialized training	2019	2019	2019	2022	Universities, WDMI VTI
	Strengthen NIC	2019	2019	2019	2022	MOA MoWI LGAs NIC MFP DPs
	Strengthen inter-ministerial coordination	2019	2019	2019	2024	MOA LGAs

1.1.4.5 Estimation of Resources Needed for Action and Activities

The following table 22; gives details of resources needed for implementation of drip irrigation actions and activities.

Table 22: Estimation of costs of actions and activities for DI technology TAP

SN	Activity	Estimated Cost (USD	Source of Funds	Justification
1.	Establish a unit to oversee the implementation of the TAP	**30,000**	GoT, Development partners	Recruit at least two people; conduct practical training on drip irrigation systems; Office furniture
2.	Develop financial incentives	10,000	GoT	Engage a consultant to study effective incentives
3.	Sensitise the policy makers on the importance of incentives and or subsidies	15,000	GoT, Development partners	Develop sensitisation materials, Conduct meetings
4.	Lower commercial banks' lending rates	15,000	GoT,	Engage consultant to study appropriate lending rate; conduct stakeholders meeting
5.	Strengthen a national Irrigation Development Fund	13,000	GoT, Development	Engage a consultant to study modalities of

SN	Activity	Estimated Cost (USD	Source of Funds	Justification
			partners	establishing and operating a fund, stakeholder meetings
6.	Engage in dialogue with development partners	5,000	GoT, Development partners	Develop position paper, hold meetings
7.	Develop specialized training	100,000	GoT	develop training materials, pay tuition fees and subsistent allowances
8.	Strengthen NIC	50,000	GoT	Coordinate irrigation activities
9.	Strengthen inter-ministerial coordination	5,000	GoT	Conduct meetings
	Total	**243,000**		

1.1.4.6 Management Planning

Risks and Contingency Planning

This sub section on Table 23 aim at providing an overview of identified risks and contingency plans.

Table 23: Risks and contingency plan for DI TAP

Risk Item	Description	Contingency action
Cost Risks	Policy considers Drip irrigation as a new tech not well known to stakeholders and expensive.	Every component of the project should consider an awareness programme on Drip irrigation.
Availability of Government Contribution risk	Moneys from private sector/ donors depends with government co-funding	During project preparation all potential projects in kind contributions will be established Encourage PPP
Scheduling Risks	Delays in operation of Irrigation Development Fund	Discuss with LGAs to use of funds for women and youth as a source of funds.

Next Steps

This section describes a) immediate requirements to proceed and b) critical steps to succeed. Through these **immediate and critical requirements**, a sharpened focus can be achieved and appropriate resources committed to their achievement.

Immediate Requirements

- Develop a comprehensive programme on drip irrigation schemes to deliver on the activities and actions, this include provision of adequate personnel, stakeholder consultation processes

- A dedicated team is developed to carry out survey on the extension officers with the aim of and data analysis, produce the results to eliminate challenges and improve work conditions.

Critical Requirements

- Ensure policy environment and legal framework are supportive of drip irrigation technology.
- Identification of stakeholders and potential partners to drive drip irrigation initiatives
- Allocation of adequate financial resources to support the survey processes.

Table 24: TAP Overview table for Improved Seed Varieties (ISV) Technology

TAP overview table								
Sector	Agriculture							
Sub-sector	Seeds							
Technology	Improved Seed Varieties							
Ambition	To introduce the technology to 150,000 farmers by the year 2025.							
Benefits	Enhance food security and income generation							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Enhance access to finance	Activity 1.1:Advocacy for lowering bank's interests rates and incentives promotion	Government and private sector	Ministry of agriculture and Vice Presidents office	1 year	Poor political support	Established financial incentives	Number of meetings	45,000
	Activity 1.2:Inventory of groups and training needs for supporting collateral	Government	Ministry of agriculture and President Office Regional and Local Administration	1 year	Unwilling of group formation	Established groups	Number of groups established and registered	72,000
Action 2: Capacity Building for extension officers and farmers	Activity 2.1: Identify needs and training for farmers ISV and good agronomic practices	GoT, Private sector (PS)	VPO, Ministry of agriculture and PORAL	3years	Existence of fake seeds	Established farmer field schools	Number of farmers using ISV	109,000
	Activity 2.2: Tailor made trainings for extension officers	GoT, PS and Development partners	Ministry of Agriculture	2 years	Unavailability of funds	Identified extension officers to be trained	Number of extension officers trained	75,000

	Activity 2.3: Develop and implement communication programme on ISV	GoT, PS	Ministry of Agriculture (R&D , TOSCI)	4 years	Poor coordination of involved institutions	Involve TOSCI	Existence of communication strategy	38,000
Action 3: Strengthen Research and Development	Activity 3.1: Engage in dialogues to solicit funds to train technical staff local and international	GoT, DPs and PS	Ministry of Agriculture	5 years	Lack of political will	Dialogues conducted	Number of staff trained	83,700
	Activity 3.2: Upgrade infrastructures at TOSCI	GoT, PS	Ministry of Agriculture, Ministry of Finance and Planning	2 years	Poor institutional framework	Strong coordination	Improved functioning of institution	450,000
	Strengthen networking with seed stakeholders and private sectors to enhance feedback of technology	GoT, DPs, PS	Ministry of Agriculture	3 years	Poor coordination	Strengthened communicati on	Frequent reports	43,800
Action 4:Strenthen enforcement and legal and regulatory frameworks to support ISV and marketing	Activity 4.1: Conduct a study on challenges of seed quality control and action plan to address	GoT	Ministry of Agriculture, PORALG	2years	Poor coordination of stakeholders	Wide coverage of stakeholders	Comprehensive report	180,000
	Activity 4.2:Review seed release regulations to reduce release time	GoT	Ministry of Agriculture and PORALG	2 years	Scientific regulation	Engage stakeholders	Reduced time of release of new varieties	120,000
	Activity 4.3: Promote policy framework for market oriented approach for ISV products	GoT	Ministry of Agriculture, MITI	5 years	Lack of political will	Produced draft of regulations shared	Framework for market of agriculture produce set and implemented	70,000

Table 25: TAP overview table for System of Rice Intensification (SRI) Technology

TAP overview table								
Sector	Agriculture							
Sub-sector	Rice							
Technology	System of Rice Intensification							
Ambition	The preliminary target for the transfer and diffusion of system of rice intensification (SRI) is to introduce the technology to 150,000 rice farming households with 1 ha of rice farm for maintaining 150,000 ha of SRI farms in 5 regions by the year 2025.							
Benefits	This technology is less costly requires 70-90% less rice seeds, more environmental friendly as 20-25% less nitrogen fertilizer and chemicals than normal while increasing 10-15% of productivity. SRI helps to control pests and diseases (such as sheath blight, golden snail, root rots, etc.) while strengthening resistance to pathogens, and as a result, reducing costs of pesticide.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1 1.Establish small holder credit facilities for farmers	Activity 1.1 conduct economic and financial feasibility studies of SRI methodology	GoT	**Ministry of Agriculture**, Academia, R&D institutes	1-2 years	Delay in undertaking the study	Starting of SRI practices	Progress reports, feasibility study report,	15,000
	Activity 1.2 Sensitise the decision makers and MFI on the importance of access to loans for farmers	GoT,DPs	**Ministry of agriculture**, MoFP,PO-RALG, Commercial Banks, NGOs	2 year		Starting of SRI practices	Awareness materials, reports of meetings	10,000
	Activity 1.3 Carry out market survey to identify potential buyers of the product (Rice) and their willingness to pay for the rice		**Ministry of Agriculture,** Ministry of Trade and Industries,	1 year		Starting of SRI practices	Market survey report	15,000
Action 2 Establish SRI demonstration	Activity 2.1 Develop tailor made trainings aiming at building		MoA, ARIs, NGos	2 years		Trainings of different groups	Number of trainings, Training manuals, Training reports	30,000

plots and on farm trials.	various capacities on SRI					undertaken		
	Activity 2.2 Design and operate SRI demonstration plots		**Ministry of Agriculture**, NGOs	1 year		Starting of SRI practices	Number of demonstration plots, procurement reports	45,000
Action 3 Increase campaigns of climate change awareness and how SRI investment can reduce risk exposure	Activity 3.1 Develop awareness material targeting different stakeholders (Private Sector, Decision Makers, farmers, financial institutions) on cc and SRI		Ministry of Agriculture, **VPO**, NGOs.	3 years			Awareness materials,	10,000
	Activity 3.2 Develop a communication strategy to profile the target stakeholders particularly the adopters of the technology		**Ministry of Agriculture** , PO-RALG and NGOs	2 years		Networks of rice farmers exists	Communication strategy in place	7,000
	Activity 3.3 Implement awareness campaign on SRI as a means of reducing water use and increasing yield		Ministry of agriculture, **VPO,** PO-RALG, ARIs NGOs	1 year		Starting of SRI practices	Number of meetings, Reports of meetings	7,000

Table 26: TAP overview table for Drip irrigation (DI) Technology

TAP overview table	
Sector	Agriculture
Sub-sector	
Technology	Drip Irrigation
Ambition	achieve the adoption of drip irrigation technology for 1,000,000 households of small scale farmers and cover 1,800,000 ha of various horticulture crops, over a period of 10 years by 2030.

Benefits	Drip irrigation is a good option for farmers to optimally use limited amount of water and also help in environmental conservation. Drip irrigation has been found to increase farmer yields by up to 300% compared to non-irrigated traditional production practices, save 30 to 70 % on water usage, and reduce the cost of labour by up to 80% (Fintrac, 2016).							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity**
Action 1: Enhance access to financing	Develop financial incentives to assist lowering the cost of drip irrigation systems (e.g. introduce subsidies, tax exemptions)	GoT	MoA, MoWI, NIC, **MFP**	3 years		Number of implemented projects	Incentives documented	10,000
	Sensitise the policy makers on the importance of incentives and or subsidies for the drip irrigation based irrigation to compete with other irrigation technologies for small scale farmers	GoT	**MoA**, NIC, PO-RALG,VPO, NGOs	2 years	Lack of political will	Number of implemented Projects	Meeting reports, Number of incentives documented	15,000
	Lower commercial bank's lending rates	GoT	MoA, **MFP**,BoT,Commercial Banks	2 years	Missing cooperation from banks	Number of implemented Projects	Agreed lowered lending rates	15,000
	Strengthen an existing National Irrigation Development fund to enhance investment in drip irrigation	GoT, Development Partners	**MoA**, MoWI, DPs,	5 years	Irrigation fund is not operational	Number of supported projects	Amount of money in the fund	13,000
	Engage in dialogue with development partners to provide subsidies for the technology as it contributes to global benefit	GoT, Development partners	**MoA,** MoWI, MFP, VPO,	2 years		Amount of support received	Number of meetings and minutes	5,000

Action Build / strengthen capacity of key stakeholders	Develop specialized training aimed at building the capacities in relevant institutions – in areas of installation, operation and maintenance of drip irrigation system	GoT	MoA, Universities, WDMI, VTI	4 years		Number of trained students	Specialized curricula	100,000
	Strengthen National Irrigation Commission to enhance uptake of more drip irrigation initiatives	GoT	MoA, MoWI, LGAs, NIC, MFP, DPs	4 years	Delayed getting funds, Lack of Political will	Number of implemented projects	Number of projects	50,000
	Strengthen inter-ministerial coordination	GoT	MoA, LGAs	6 years			Number of meetings, minutes	5,000

1.2 Project Ideas for Agriculture Sector

1.2.1 Brief summary of the Project Ideas for Agriculture Sector

The following project idea in the agriculture sector was identified on the basis of their contribution to socio-economic development and climate change adaptation potential. Further they were prioritised among a list of other technologies with the assistance of Multi-Criteria Analysis. The target group for improved seed varieties, system of rice intensification and drip irrigation are communities living in areas where there is limited availability of such initiatives. The objective of concept idea for ISV and SRI technologies is to increase food access/ availability. While the objective of the drip irrigation is to promote widespread use amongst farmers in order to enable them produce food even when there is no rain. Diffusion of the three technologies will be done through public awareness campaigns, technical capacity building and financial assistance to the target users and/or promoters of the technologies.

1.2.2 Specific Project Ideas

1.2.2.1 Specific Project Idea: Promotion of increased local production of Improved Seed Varieties.

Introduction/Background

Among many input factors affecting productivity in agriculture, type of seeds used plays an important role to success. For good quality and high return of crops per unit area, farmers need to carefully choose good type/varieties and viable type of seeds. For the said situation, improved seed varieties provide an important means to raise crop yields and also opening up a possible opportunity for farmers to transform their small scale agricultural products producer to large scale.

Objectives

Through this project, it is anticipated that there would be promotion of locally produced high-yielding and farmer-desired varieties of seeds for better products. The project is expected to further provide an opportunity to farmers to benefit from using quality seeds through;

i. Having good quality seed with high return per unit area as the potential of the crop can be fully exploited.
ii. Lessening infestation of land with weed seed/other crop seeds.
iii. Contribution to have less disease and insect problem among seeds used by farmers which are also vigorous and free from pests.
iv. Having seeds that can be adopted themselves for extreme climatic condition and cropping system of the location and easy to respond well to the applied fertilizers and nutrients.
v. Very easy facilitation of yield prediction, crops with high produce value and their marketability.

Relationship to the country's sustainable development priorities

The project is in line with;

i. The national agriculture policy with the general objective of having an Agricultural research services strengthened in order to enhance productivity, competitiveness and profitability of the agricultural sector.
ii. The national Agriculture Sector Development Programme II encouraging increased supply and use of improved seeds. The effective potential market demand of improved seed in the country is estimated at about 60,000 tons per year, while the current availability of improved seeds (mainly maize and rice) is 35,352 tons. Only about 25% of farmers are using improved seeds, mainly due to inadequate availability and accessibility of improved seeds, but also low awareness on improved varieties/technologies adapted to their farming conditions.

Project Deliverables e.g. Value/Benefits/Messages

The project is important especially during this era of raising productivity while coping with current climatic conditions.

Project Scope and Possible Implementation

The project intends to cover national level in terms of policy and advocacy work and at community level the project will cover selected districts in its initial stages. The aim is to upscale to national coverage through integration of lessons learned during the implementation in selected districts.

Project activities

i. Establish national stakeholders group for advocacy work on using improved seed varieties
ii. Prepare user friendly advocacy materials to be used by policy makers and agriculture extension officers to advocate and educate farmers on the importance of improved seed varieties for agricultural productivity
iii. Establish groups of champions/testimony tellers on the benefits accrued through their shift from using traditional seeds to improved ones

Timelines

The project is expected to be implemented in three years

Budget/Resource requirements

S/N	Activity	Costs($)		
		Year 1	Year 2	Year 3
1.	Establish national stakeholders group for advocacy work on using improved seed varieties	65,000	45,000	
2.	Prepare user friendly advocacy materials		70,000	
3	Establish groups of champions/testimony tellers on the benefits accrued through their shift from using traditional seeds to improved ones	38,000	60,000	60,000
	Total	103,000	175,000	60,000

Measurement/Evaluation

i. Establish baseline information on estimated demand and supply of improved seeds in the country
ii. Develop monitoring and evaluation framework to monitor performance and target achievements for identified activities on advocating and scaling up of use of improved seeds

Possible Complications/Challenges

i. Lack of knowledge among farmers on better means of adapting and use of improved seeds
ii. Challenges on transforming from use of traditional/common seeds to improved seeds
iii. Inadequacy of technologies involved in developing improved seeds

Responsibilities and Coordination

Institution/Partner	Responsibilities
Ministry of Agriculture	-Coordination -Guidelines on policy issues
Universities and Research institutes	-Technical assistance on research -Training
Local agro dealers and private sector	Seed distribution,
Development partners	-Sharing of best practices -Provision of avenues on knowledge sharing

1.2.2.2 Specific Project Idea: Promotion of System of Rice Intensification (SRI) through training.

Introduction/Background

The use of modern agricultural production practices is of paramount importance to increase yields, preserve soil, cost of production reduction and other benefits. One challenge on adapting modern ways is technology imbedded in the process of acclimatizing. Methods with simple technologies and processes are more adaptable and easy to cope with by farmers. To this end, one of them is system of rice intensification accompanied by low cost in terms of resources, water usage and yielding more grains.

Objectives

The project aims at increasing productivity per unit input among rice growers. This would be achieved through;

i. Conducting training through demonstration among farmers and creating systems where framers would be able to learn from others on the system.

ii. Use the system to advocate for farmers to use climate change friendly agricultural practices, where under this system less amount of water is used.

Relationship to the country's sustainable development priorities

This is in line with national development initiatives like ASDP II which among other areas focuses on Increasing the efficiency of irrigation schemes by professional management schemes will improve farmers 'returns and sustainability of investments.
The objective of irrigation development under this program is to improve crop productivity and sustainable returns for small- and medium-scale farmers on an expanded irrigated area. This support including irrigation development, planning and professional management for intensification.

Project Deliverables e.g. Value/Benefits/Messages

The project is important since it provides one best means of coping with current climate change by enabling farmers to utilize minimum amount of water in their rice fields. Unlike traditional means where rice growers use flooding systems, through this approach do not necessarily need to have large volumes of water for irrigation.

Project Scope and Possible Implementation

The project intends to cover national level in terms of policy and advocacy work and at community level the project will cover selected districts in its initial stages. The aim is to upscale to national coverage through integration of lessons learned during the implementation in selected districts.

Project activities

i. Conduct a baseline study to establish areas where the SRI can work better among areas where rice is grown
ii. Training of extension officers on how the SRI works
iii. Deployment of trained extension officer to identified areas to work with farmers on the implementation of SRI
iv. Assessment of project successes and areas for improvement

Timelines

The project is expected to be implemented in three years

Budget/Resource requirements

S/N	Activity	Costs($)		
		Year 1	Year 2	Year 3
3.	Conduct a baseline study to establish areas where the SRI can work better among areas where rice is grown	120,000		
4.	Training of extension officers on how the SRI works	25,000	70,000	
5.	Deployment of trained extension officer to identified areas to work with farmers on the implementation of SRI		135,000	120,000
4	Assessment of project successes and areas for improvement			60,000
	Total	145,000	205,000	180,000

Measurement/Evaluation

i. Establish baseline information on whether SRI is applied or not to understand whether this would be a new project of this kind or an improvement and continuation of already existing systems.

ii. Develop monitoring and evaluation framework to monitor performance and target achievements for identified activities on advocating the system to be adapted by farmers

Possible Complications/Challenges

i. Lack of knowledge among farmers on adapting to SRI

ii. Inadequacy of technologies involved in developing fields for SRI

Responsibilities and Coordination

Institution/Partner	Responsibilities
Ministry of Agriculture	-Coordination -Guidelines on policy issues
Sokoine University of Agriculture	-Technical assistance on research -Training
Development partners	-Sharing of best practices -Provision of avenues on knowledge sharing and study tours (if needs arise)

1.2.2.3 Specific Project Idea: Promotion of local manufacturing of equipment used for drip irrigation.

Introduction/Background

Drip irrigation systems play an important role on the way to increasing productivity, especially in this era of climate change which results into water scarcity due to unpredictability of rain and water supply. Currently, equipment for such system is imported thus has a high investment and maintenance cost due to import duty and tax. The system's return on investment is high enough for even smallholder farmers to repay the cost of investment in reasonably short period. The project development dwelled much on the actual situation on the ground where there exist drip irrigation systems, though practiced at relatively low scale.

Objectives

This project intends to promote up scaling of use of drip irrigation by small scale farmers by promoting locally manufactured drip irrigation equipment in order to;

i. Reduce cost associated with importation of equipment used for drip irrigation

ii. Reduce running and maintenance cost since they are mainly imported

iii. Contribute to capacity building and knowledge generation among practitioners who are manufacturing these equipment

iv. Attract more farmers to practice drip irrigation due to affordable prices of equipment for irrigation

Generally, productivity is expected to increase resulting to improved socio-economic development status among the farmers and the community at large.

Relationship to the country's sustainable development priorities

Project activities:

i. Organize stakeholders workshop to brainstorm and provide recommendations for upscaling drip irrigation in the country

ii. Prepare policy brief and other advocacy materials to be used for advocacy work among policy and decision makers to buy-in ideas to promote establishment of small industries to manufacture equipment for drip irrigation

iii. Conduct advocacy activities to farmers on the likely benefits to be accrued when one adapts and practice drip irrigation system

Timelines

The project will be implemented over three years

Budget/Resource requirements

S/N	Activity	Costs($)		
		Year 1	Year 2	Year 3
1.	Organize stakeholders workshop to brainstorm and provide recommendations for up scaling drip irrigation in the country	70,000		
2.	Prepare policy brief and other advocacy materials to be used for advocacy work	20, 000	23,000	
3.	Conduct advocacy activities to farmers on the likely benefits to be accrued when one adapts and practice drip irrigation system	350 000	300 000	250 000
4.	Monitoring and evaluation of the project	20,000	30,000	30,000
	Total	390,000	353,000	280,000

Measurement/Evaluation

i. Establish baseline information on current status of locally manufactured equipment and use

ii. Identify milestones, indicators and targets for the project

iii. Conduct monitoring regularly during the implementation of the project and evaluate the project midway and at the end to be able to establish what level of success has been achieved

Possible Complications/Challenges

i. Lack of community/farmers awareness on the benefits and positive impacts of drip irrigation

ii. Rigidity among farmers, policy and decision makers to change from existing farming systems to new ones

iii. Initial costs associated with the introduction of the new system such as;

- ❖ Establishing industries to manufacture equipment for the scheme
- ❖ Laying down systems and networks for distribution of locally manufactured equipment
- ❖ Financial and human resources for introducing and acquiring ne methodologies and skills adaptive to the new system

iv. Minimum political will due to other priorities already set by the government

Responsibilities and Coordination

Institution/Partner	Responsibilities
Ministry of water and Irrigation	Coordination
Ministry of Agriculture	Training for good agricultural practices
President Office Regional and Local Government Authority	Sensitization
Tanzania Bureau of Standards (TBS)	Setting standards for the locally produced devices
Commission for Science and Technology (COSTECH)	Technology incubation
Universities and Research Institutions	Training of technicians
Small Industries Development Organization (SIDO)	Promotion of local technology
-NGOs	Awareness
Development Partners	Advise and facilitate funding

CHAPTER 2: TECHNOLOGY ACTION PLAN AND PROJECT IDEAS FOR WATER SECTOR

2.1 TECHNOLOGY ACTION PLAN FOR WATER SECTOR

2.1.1 Sector Overview

Tanzania is endowed with relatively abundant freshwater sources, but these are unevenly distributed– both in time and space. According to the Food and Agriculture Organization (FAO), in 2008 Tanzania had 96.27 km^3 of renewable water resources per year. This corresponds to 2,266 m^3 per person a year. On average, Tanzania's annual renewable water resource is 89 km^3 and the annual average available water per capita was 2000 m^3 in 2012 compared to 2700 m^3 in the year 2001. This amount is projected to reduce by 30% corresponding to 1400m^3 per capita per year in 2025 as a result of diminution of water resources and increase of population (WSSR, 2014).

Despite of all these resources, Tanzania is faced with severe and widespread water shortages in many areas because of climate variability, poor distribution of the resource in time and space, and inadequate management of the water resources.

The semi-arid central and northern parts of the country, including areas immediately south of Lake Victoria receive less than 700 mm of rainfall per annum and are dry for an average of seven consecutive months a year. River flows in these areas are intermittent. In the southern, western and northern highlands, which receive more than 1,000mm/year of rainfall, rivers are perennial, and some of these experience frequent floods.

Global water demand is expected to increase by 22% by 2030. Climate change is affecting weather patterns and especially the water cycle. Some regions are seeing amplifications in floods, droughts and hurricanes. According to the United Nations, almost 3 billion people in 48 countries will face water scarcity by 2025 (DCU, 2013). With 80 million more people on earth each year, water demand will keep going up unless we change how we use it. The United Nations has set the level of availability of renewable freshwater resources, at 1700m^3/capita/year denoting water stress, and 1,000m^3/capita/year denoting water scarcities. However, due to projected population growth alone, Tanzania's annual renewal rate is projected to drop to 1,500m^3/capital/year by 2025, thus categorizing the country as water stressed (World Bank, 2006).

Water resource Management in Tanzania

In 2002 the Tanzanian government issued the *National Water Policy*, which sets out key principles for the sustainable management and development of water resources, with river basins or sub-catchments as the principle management unit.
The policy recognises the complex linkages between water and sectoral development and that water has both a social and economic value. It calls for the adoption of IWRM in Tanzania,

promoting participatory decision making and devolving responsibility for service delivery to the lowest levels of Government (ICID,2012;)

To implement the policy, MoWI has developed a *National Water Sector Development Strategy* (2006–2015) and a *Water Sector Development Programme* (2006–2025). Most recent is the *Water Resource Management Act* (2009), which clarifies the institutional framework for IWRM and institutional mandates (described in Section 3.2.2), giving the basin water boards legal recognition. Table 27 provides a summary of existing policies related to water sector development and technology deployment.

Three technologies were identified in the water sector report II and include Rainwater Harvesting, Smart Water Meters and Waste Water Stabilizing ponds. Uptake of such technologies is expected to reduce water shortage, thus making the country resilient to climate change impacts.

Table 27: Existing policies related to water sector development and technology deployment in Tanzania

Name of the policy	When enacted/revised	Main contents	Remarks on technologies
National Water Policy	2002	The main objective of the Policy is to develop a comprehensive framework for sustainable development and management of water resources. The Policy aims at ensuring that communities are fully involved in the management of water supply schemes. It addresses cross-sectoral interests in water, watershed management and integrated and participatory approaches for water resources planning, development and management.	Supports SWM and RWH technologies which aim to conserve water and ensure sustainable water resources management
National Environmental Policy	1997	The Policy aims to provide the framework for making fundamental changes of mainstreaming environmental considerations into decision making in Tanzania. It calls for a coherent policy where priorities can be defined for the promotion of long-term economic growth, creating incentives for sustainable Utilisation of natural resources, disincentives for environmental pollution and degradation, and effective management of the	Supports SWM and RWH technologies which aim to conserve water and ensure sustainable water resources management. The policy also provides directives on waste water management which supports the technology on waste water stabilization ponds

		overall environment.	
National Forest Policy	1998	The overall objective of the Policy is to enhance the contribution of the forest sector to the sustainable development of Tanzania and the conservation and management of her natural resources for the benefit of present and future generations. The Policy, among other aspects, recognizes the high value of forests due to the high potential for royalty collection, export and tourism earnings as well as the recycling and sequestering of carbon and conservation of globally important biodiversity. Furthermore, the policy emphasizes on biodiversity conservation; describes the importance of forest ecosystems for maintaining biodiversity and the threats to biodiversity. One of the main objectives envisaged in the policy focuses on ensured ecosystem stability through conservation of forest biodiversity, water catchments, and soil fertility.	Supports SWM and RWH technologies which aim to conserve water and ensure sustainable water resources management
National Irrigation Policy	2010	Some of the objectives of the Policy includes promotion of efficient water use in irrigation systems; and ensure that irrigation development is technically feasible, economically viable, socially desirable and environmentally sustainable. The Policy aims to have irrigation systems which are environmentally sound by ensuring compliance to relevant legislation; protecting and conserving water and land sources; pollution control in irrigated agriculture; and promotion of proper land use practice.	Supports SWM and RWH technologies which aim to conserve water and ensure sustainable water resources management

2.1.2 Action Plan for Technology Rainwater Harvesting

2.1.2.1 Introduction

Rainwater harvesting (RWH) is a process of concentrating, collecting and storing water for different uses at later time, in the same area where rain falls or in another area during the same or later time (Pacey and Cullis, 1986; Dutt et al., 1981). Rainwater harvesting technology is highly recommended for increasing water supply among many regions notably in water stressed areas. In terms of hydrology, much of rainwater is wasted through surface runoff and evapotranspiration. The portion of the rainwater penetrating into the soil for groundwater recharge will also sustain water flow in rivers. However, water balance in a given area is determined by surface runoff and evapotranspiration forces which account for water availability. Having rainwater harvesting technology in place saves water that would otherwise be lost through surface runoff and evapotranspiration.

Captured rainwater can supply or augment both potable and non-potable uses such as range rehabilitation, tree and agroforestry, domestic stock, gardening and crop production. RWH is regarded as a simple and effective method of storing water for countries with seasonal rainfall patterns like Tanzania. Adopting the RWH technology implies that excess rainfall can be reserved into tanks during wet seasons then later used during dry seasons.

2.1.2.2 Ambition for the TAP

The rainwater harvesting technology proposed will serve two purposes. The water collected will be used for gardening and cleaning and also for increasing groundwater recharge. The RWH technology is being targeted at residential sector. The technology targets constructing Roof Rainwater Harvesting units for 150,000 families of 4 people.

2.1.2.3 Actions and Activities selected for inclusion in the TAP

Summary of barriers and measures to overcome barriers

The BAEF Report identified financial, non-financial, technical, human skills, policy, legal, regulatory and institutional capacity barriers and measures to overcome such barriers. RWH in most households is hampered by high initial costs related to materials. Moreover, the investment cost for commercial RWH is high. Low awareness on the need to harvest rainwater for future use, lack of adequate skills to construct RWH facilities, lack of political will to progress the RWH and limited capacity of local water users to manage water resources appear to be barriers for adoption of RWH technology. Some measures were proposed which include 50% tax cut for RWH harvest, financing of RWH investments through microfinance schemes, development aids and establishing a water fund which among other things will finance RWH activities. Other measures include monitoring of weather data for proper design of RWH infrastructures, conducting training and awareness raising on RWH and water resources management; and developing a national RWH guide book.

Actions selected for inclusion in the TAP

This section aim to select measures which will be included as action in the TAP. The secion will further narrate on the arguments as to why the particular measures have been selected . Table 28 gives details of the measures selected.

Table 28: Actions selected for inclusion in the Rain water Harvest (RWH) Technology

Caterogies	Identified measues to overcome barriers	Measures selected as Actions for inclusion in TAP
Economic and financial	- 50% tax cut for RWH harvest - financing of RWH investments through microfinance schemes - Establishing national water fund	-Periodic tax policy reviews for RWH harvest - Establishment of national water fund
Technical	-Monitoring of weather data	Institutional capacity building in RWH
Informationand awareness	-Awareness raising on RWH	
Human skill	-Staff training	

Periodic tax policy reviews for RWH harvest

This action aims at providing a tax incentive for imported goods that are used in construction or installation of RWH facilities with a view of curbing the economic barrier for the diffusion of RWH technology. By reducing import duty by 50%, RWH harvest and related materials would be affordable by most of households and local investors. This action is particularly important because it reduces the capital costs.

Establishment of national water fund

Lack of funds is cited as one of the barriers for the diffusion of RWH technology not only in rural areas, but also in urban areas. Due to high cost involved in setting up a rainwater harvesting system, very few individuals and institutions are able to afford the technology. Establishment of national water fund would be catalytic in the diffusion of RWH and would enhance overall water resources management activities in the country. While the country has special funds for wildlife and forests which finance wildlife and forest conservation activities respectively, there is no special fund for water resources management. Water is a vital resource for human well-being, it ought be given special care especially in the wake of climate change whose impacts may adversely affect its availability. This action enhances the country's preparedness for climate change adaptation in the water sector.

Institutional capacity building in RWH

Implementation of the above mentioned actions would not produce tangible results if the key players in RWH are not capacitated to plan, design, construct, install and manage the RWH systems. Moreover, a general public campaign on the link between climate change and RHW technology is of paramount importance if the country wants to achieve a reasonable level of technology diffusion. When the public has access to information about the technology, clearly understand how the technology works and its importance in their livelihoods they are more likely to adopt it.

Activities identified for implementation of selected actions

From actions selected, table 29 sumaaries the activities that will enable the selected actions to take place.

Table 29: Activities identified for implementation of RWH selected actions

Action	Activities
1.Periodic tax policy reviews for RWH harvest	1.1 Consultative workshop for traders and suppliers of RWH harvest and related materials
	1.2 Evaluate the impact of tax reduciton and exemptions for RWH harvest on government revenues and assessment of alternative revenue sources for advocacy.
2. Establishment of national water fund	2.1 Water sector stakeholders workshop on national strategy for water resources management financing mechanisms to delibarate fund establishment
3.Institutional capacity building in RWH	3.1 Awareness raising on RWH
	3.2 Specialized training on RWH in water resources training institutes and vocational training centers
	3.3 Training of village level artisans on RWH
	3.4 Coordination of RWH activities

Actions to be implemented as Project Ideas

Among the three actions descripted above, a single project that addresses all actions can be developed. Establishment of national water fund and institutional capacity building can form a project titled "promoting rainwater harvesting technologies for enhanced climate change adaption". The selected actions fit well in the proposed project because the activities of each action match with the envisaged activites for the project. By addressing the financing mechanism and awareness raising on RWH , the project appears to address significant barriers of techology diffusion.

2.1.2.4 Stakeholders and Timeline for implementation of TAP

Overview of Stakeholders for the implementation of the TAP

This section describe the stakeholders who are needed for each of the actions to be implemented. Table 30 clarify and descrbe the role of the different stakeholders.

Table 30: Overview of stakeholders and timeline for implementation of RWH TAP

S/N	Stakeholder	Role
1	VPO- DOE	To oversee the implementation of the action
2	Ministry of Water	Prepare national guidebook for RWH, financing of RWH
3	Ministry of Finance and Planning	Planning the financing options of RWH activities and evaluate the implication of tax excemption for imported and locally made RWH harvest
4	Local government authorites	Coordinate RWH activities in respective localities
5	Water utility authorities	Construct and install RWH systems
7	RWH experts	Provide technical advise
8	Development partners	Financing of RWH activities
9	RWH harvest Traders	To supply RWH harvest equipments
10	Households	Install and operate RWH systems

Scheduling and sequencing of specific activities

For actions to be implemented, scheduling and sequencing of specific activities is important, table 31 describe the sequence and timing of specific activies as well as the nature and scale of the activity.

Table 31: Scheduling and sequencing of RWH specific activities

Action	Activitity	Timeframe									
		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
1.Periodic tax policy reviews for RWH harvest	1.1Consultative workshop for traders and suppliers of RWH harvest and related materials										
	1.2Evaluate the impact of tax reduction and exemptions for RWH harvest on government revenues and assessment of alternative revenue sources. 1.3 Implement…….										
2.Establishment of national water fund	2.1Water sector stakeholders workshop on national strategy for water resources management financing mechanisms										
3.Institutional capacity building in RWH	3.1Awareness raising on RWH										
	3.2Specialized training on RWH in water resources training institutes and vocational training centers										
	3.3Training of village level artisans on RWH										
	3.4Coordinattion of RWH activities										

2.1.2.5 Estimation of Resources Needed for Action and Activities

Estimation of capacity building needs

To successfully implement the actions and activities geared towards the adoption of RWH technology in the country, capacity building is needed in different levels, namely central government level, local government level and household level. Despite the fact that RWH is not novel in the country, its implementation has been for so long haphazardly done. The government has neither a concrete policy nor a national strategy for RWH. While much investment has been done in water supply from groundwater and surface water both in rural and urban areas, the government overlooks the fact that RWH has a huge potential to contribute in national water supply. Even the popular water sector development programme has no RWH component. Thus, it is opportune time that ministry of water and other related ministries are tasked to progress RWH. As this will be a new thing in a traditional

government setting, some of sort of capacity building in terms of planning, design and coordination will be necessary. This will go hand in hand with capacity building in local government authorities (municipal and district councils). Capacity building will involve training senior officers on how to engage the private sector in a public-private partnership for RWH investments. At household level, capacity building would entail training of households on water resources management and various options for construction of low cost RWH

Estimations of costs of actions and activities

The costs of actions and activitis can be divided into two, those related to training, coordination and harvest.Table 32, gives details of cost of actions and activities

Table 32: Estimations of costs of RWH actions and activities

SN	**Item**	Amount USD
1.0	Capacity building	
1.1	Training workshop for senior central government officials	200,000
1.2	Training workshop for senior local government officials	150,000
1.3	Training workshop for house holds	100,000
1.4	Training workshop for public-private partnerships in RWH	300,000
1.5	Awareness raising campaigns , publicity and advocacy	300,000
2.0	Cost of Technology	
2.1	Tanks (10 m^3) and installation (@ USD700/household)	105,500,000
	Total cost	**106,550,000**

2.1.2.6 Management Planning

Risks and Contingency Planning

For effective implementation of the actions identified, risks and contigency plans have to be identified. Table 33 providing a detail overview of identied risks and contigency plans.

Table 33: Risk and contingency planning for RWH

Risks	**Potential impact**	**Probability**	**Contingency plan**
1. Lack of funds to implement the technology	H	L	Explore many ways of soliciting funds
2. Lack of political will to support the technology	H	L	Engage senior government into discussion about the need for the technology and associated benefits to the country
3. The technology receives little social acceptance	M	L	Awareness raising and advocacy campaigns
4. The cost of technology becomes higher than expected	M	L	Include 20% contingency in the budget
5. The trained staff do not perform to the expected standard	M	L	Provide more training opportunities to the staff

Note: H=High, M=Medium and L=low

Next Steps

Immediate requirements: Organize a water sector meeting for senior government officials to discuss the actions for RWH technology and chat the way forward for implementation
Critical requirements: Start planning for financing mechanisms

2.1.3 Action Plan for Technology Smart Water Meter

2.1.3.1 Introduction

Smart Water Metering (SWM) is a sophisticated but most efficient way of monitoring water consumption at any point on a regular basis. The technology can easily detect water leakage from the supply system and automatically stop the inlet flow. It presents a new approach to promote water security with uncertain but significant future risks from population growth, hydrological variability and extreme events, and intensifying water allocation demands across water supply, agriculture, industry and ecosystems. Strategic and transparent water resource decision making is central for water security to be achieved (Hope et al., 2011). The current system used by water utilities fails to control water leakage leading to loss of revenue, hence non-revenue water (NRW). A high level of NRW implies that a huge volume of water being lost through leaks is not being invoiced to customers. For example in Dar es Salaam, 50% of supplied water is not invoiced to customer, hence lost due to leakages. With the introduction of SWM such losses will be avoided.

2.1.3.2 Ambition for the TAP

The technology target to reduce NRW by 50% and the targeted institutions are the water utility authorities in cities and municipalities such as the Dar es Salaam Water Supply Company (DAWASCO), Tanga Urban Water Supply and Sanitation Authority(TANGAUWASA). The TAP is expected to last over 10 years in selected regions.

2.1.3.3 Actions and Activities selected for inclusion in the TAP

This section consist of four subsections that consists of summary of barriers and measures as identified in report II of BA &EF , selected actions from the measures, activities that will successfully delivers the planned actions and selected actions to be developed as project ideas.

Summary of barriers and measures to overcome barriers

Report II identified financial, non-financial, technical, human skills, policy, legal, regulatory and institutional capacity barriers and measures to overcome such barriers. High cost for procurement and operation of the SWM is the most challenging barrier facing water utility authorities in Tanzania. Moreover, SWM requires specialized skills to fully apply and operate the systems. Furthermore low awareness on SWM was identified to be a barrier for diffusion of SWM technology. Some measures proposed included public private partnership in SWM investment, subsidizing water utility authority to purchase and install SWM systems in their water supply networks. Others measures included awareness raising on SWM, customer profiling and staff training on how to use the SWM systems.

Actions selected for inclusion in the TAP

From the summary of barriers and measures, actions were to be developed. Measure are furthe supported with arguments as why they were seled to actions for the TAP. Table 34 summaries the identified actions from the measures.

Table 34: Actions selected for inclusion in the SWM TAP

Caterogies	Identified measues to overcome barriers	Measures selected as Actions fornclusion in TAP
Economic and financial	- Public private partneship in SWC investment -Subsidizing water utility authority to purchase and install SWM systems in their water supply networks	Procurement and installation of smart water metering system
Technical	-Improve infrastractures such as electricity supply - Institutional capacity building of water utility authorities	
Informationand awareness	-Awareness raising on SWM systems	Awareness raising and provision of customer service for SWM
Human skill	-Staff training	Staff training on SWM applications and maintenance

Procurement and installation of smart water metering system

The water utility authorities will be required to float the tenders looking for a firm that is technically and financially capable of supplying and from the central government or from development partners.

Staff training on SWM applications and maintenance

Once the SWM have been procured and installed, the staff that will be operating this modern metering system must be trained on how to use the devices and do some basic repairs.

Awareness raising and provision of customer service for SWM

SWM is a new thing not only to water utilities authorities, but also to customers. Hence, for customers to embrace this new technology; a comprehensive awareness campaigns are needed. Thus, the water utility authorities ought to aggressively market that technology which does not only improve revenue collection but also contributes to water conservation.

Activities identified for implementation of selected actions

In the first year (stage 1) of the project, a dedicated unit will have to be created and provided with the facilities (computers, printers, software, etc). The training (stage 2) will be in two parts, the first part will consist of a basic training and the second part will consist of a more advanced training. The third stage of the project, the training will be dedicated to the decision making team usually the management team involved with the use of the outputs from the model for decision making. In the last two years, the focus will be more on providing technical support to the technical team and ensuring knowledge transfer as well identifying kind of data needed and data collection.Before the trainings, procurement of the SWM systems will have to be done first. Advovacy, publicity and marketing of the SWM backed by

customer service tailored to satisfy each customer can be an importantat ingridient and strategy for technology diffusion. Table 35 provides a summary of actietes identified for the actions to work.

Table 35: Activities identified for implementation of SWM selected actions

Action	Activities
1.Procurement and installation of smart water metering system	1.1 Purchase of SWM devices
	1.2 Installing of the SWM system
2. Staff training on SWM applications and maintenance	2.1 Training of a special unit dealing with SWM within water utility authorities 2.2 Training of other staff
3Awareness raising and provision of customer service for SWM	3.1 Awareness raising on SWM
	3.2 Customer supportservices
	3.3 Marketing of SWM system

Actions to be implemented as Project Ideas

From the above mentioned actions a single project titled " capacity building of water utility authorities in smart water metering systems" can be developed as a project idea.

2.1.3.4 Stakeholders and Timeline for implementation of TAP

Identifying of stakeholders and sequencing their role is key to ensuring effective implementations of actions. This section will have two subheadings one identifying stakeholders and their roles and second section will give schedule and sequencing of activities.

Overview of Stakeholders for the implementation of the TAP

Stakeholder mapping is an improtant task for succesful action implementation. Table 36 gives an overview of stakeholders and their roles

Table 36: Overview of stakeholders for implementation of SWM TAP

S/N	**Stakeholder**	**Role**
1	VPO- DOE	To oversee the implementation of the actions
2	Ministry of Water	Financing and provide guideline for SWM systems
3	Water utility authorities	Procurement of SWM devices
4	EWURA	Quality assurance in the tarrif and billing system
5	TBS	Quality assurance of the procured devices
6	Development partners	Financing of SWM systems
8	Customers	Take care of the SWM installed in their premises

Scheduling and sequencing of specific activities

The sheduling and sequencing of activities is summarised in table 37 below.

Table 37: Scheduling and sequencing of SWM specific activities

Action	Activities	Timeframe									
		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10

Action	Activities	Timeframe									
		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
1.Procurement and installation of smart water metering system	1.1 Purchase of SWM devices										
	1.2 Installing of the SWM system										
2. Staff training on SWM applications and maintenance	2.1 Training of a special unit dealing with SWM within water utility authorities 2.2 Training of other staff										
3Awareness raising and provision of customer service for SWM	3.1 Awareness raising on SWM										
	3.2 Customer support services										
	3.3 Marketing of SWM system										

2.1.3.5 Estimation of Resources Needed for Action and Activities

Estimation of capacity building needs

Considering the fact that SWM is a new technology in the country, technical assistance to water utility authorities will be required to enable them use the technology smoothly. The utilities will need to be assisted to identify the kind of skills that they will need at each level and also to identify the data which are pertinent to the technology diffusion. Moreover, financial assistance will be necessary due to high cost of purchasing the SWM systems.

Estimations of costs of actions and activities

An estimate of how much it would cost to implement the TAP is important for planning purposes. The cost can be to a large extent build on the economic asssessment undertaken as part of the BA&EF report of implementing sets of measures.

The costs of actions and activities can be divided into two, those related to training and procurement of the technology. Table 38 provides a detailed estimation of resorces needed for actions identified.

Table 38: Estimation of resources needed for SWM action and activities

SN	**Item**	Amount USD
1.0	Capacity building and advocacy	
1.1	Training of staff	500,000
1.5	Awareness raising campaigns and marketing	700,000
2.0	Cost of Technology	
2.1	Cost of smart meter (@USD 500 per meter)	705,000
2.2	Cost of Installing Smart Meter System	1,000,000
2.3	O&M per year	100,000
	Total cost	**3, 005, 000**

2.1.3.6 Management Planning

Risks and Contingency Planning

Effective implemetation of actions identified requires identification of risks and contigency plan for the same. Table 39 provide a detailed overview of identified risks and contigency plans.

Table 39: Risks and Contingency planning for SWM technology

Risks	Potential impact	Probability	Contingency plan
1. Lack of funds to implement the technology	H	L	Explore many ways of soliciting funds
2. Lack of political will to support the technology	H	L	Engage senior government into discussion about the need for the technology and associated benefits to the country
3. The technology receives little social acceptance	M	L	Awareness raising and advocacy campaigns
4. The cost of technology becomes higher than expected	M	L	Include 20% contingency in the budget
5. The trained staff do not perform to the expected standard	M	L	Provide more training opportunities to the staff

Note: H=High, M=Medium and L=low

Next Steps

This subsection of management plan aims to describe immediate requirements to proceed and critical requrements so as to have a sharpened focus and appropriate resorces committed to the achievement.

Immediate requirements

Organize a water sector meeting for senior government officials to discuss the actions for SWM technology and chat the way forward for implementation

Critical requirements

Start planning for financing mechanisms

2.1.4 Action Plan for Technology Waste Water Stabilization Pond

2.1.4.1 Introduction

Waste water reuse can produce obvious benefits as it reduces the need for extraction of water from surface and groundwater resources. Especially given the current pressure and water shortage due to climate change impacts, reused waste water can provide an alternative water resource. In Tanzania, only a very small percentage of waste water is reused. Although there is a growing interest, the common application has been for small farming practices where animal waste is applied. To a lesser extent, effluents are being used for industrial purposes or for the augmentation of domestic supplies.

Waste stabilization ponds (WSPs) are usually the most appropriate method of domestic and municipal wastewater treatment in developing countries, where the climate is most favourable for their operation. The WSPs is a simple technology that involve shallow and rectangular basins in which a continuous inflow and outflow of wastewater is happening. It is a system that comprises a series of different types of ponds with the objective of enhancing waste water treatment. WSPs are low-cost (usually least-cost), low-maintenance, highly efficient, entirely natural and highly sustainable. The only energy they use is direct solar energy, so they do not need any electromechanical treatment, saving expenditure on electricity and more skilled operation. They, however, do require much more land than conventional electromechanical treatment processes such as activated sludge.

2.1.4.2 Ambition for the TAP

The technology targets to increase the number of households connected to the central sewage system as follows: in Dar es Salaam 10% of population which is not connected to the sewer for amounting to 79446 households, in Mwanza, Nyamagana district 10% amounting to 36345 households will be targeted, while in Dodoma Urban District 82,191 households which is 20% will be targeted. Thus in total the technology targets to 200,000 husehold by 2030. Furthermore, the TAP will renovate existing WSP especially those in very bad condition.

2.1.4.3 Actions and Activities selected for inclusion in the TAP

Summary of barriers and measures to overcome barriers

Report II identified financial, non-financial, technical, policy, legal, regulatory and, institutional capacity barriers and measures to overcome such barriers. Table 40 gives a summary of barriers and measures. The summary is based on the information already available in report II to provide justification for the actions to be proposed TAP.

Table 40: Barriers and measures to Waste water stabilization Pond (WSP) Technology

Barrier Category	Barriers	Measures
Economic and financial	Poor access to affordable financing for WSPs construction	• Government to invest on attracting external support through bilateral and multilateral agreements; • Subsidize cost of construction to at least 50%.
	High investment costs	Enable municipalities to access loans and grants to meet costs of construction
Non-Financial Barriers		
Technical	Limited research on wastewater treatment technologies, WSPs	• Government should develop relevant standards and specifications that can reflect the local situation. In depth studies that can address area specific conditions for the ponds construction should be conducted. • Support research institutions through regular monitoring of the operational WSPs in order to determine the trends on operational efficiency with the objective of wastewater reuse and recycling.
Policy, legal and regulatory barriers	Absence of Policy instruments: (financial incentives, regulations and awareness programme) targeted on wastewater recycling and reuse.	• Develop supportive Policy and regulatory instruments to promote WSPs targeting economic incentives, for instance tax exemptions or subsidies to the private operators interested in investing in this sector. • On the other hand, the government can impose strict and elevated tax for those operators discharging or disposing waste water.
	ii. Weak implementation of the land policy	The government has to strengthen and enforce urban planning laws and regulations. Urban residents who happen to reside close to the WSPs have to be resettled and compensated appropriately for their reallocation.

Actions selected for inclusion in the TAP

This subsection is to identify actions from the measures developed in report II. It will provide a list of narrative description of each measures selected as actions to be included in the TAP with further arguments onto why they have been selected as actions. Table 41 provides a summary of actions selected.

Table 41: Actions selected for inclusion in the WSP TAP

Barrier Category	Barriers	Measures	Measures selected as Actions for inclusion in TAP
Economic and financial	Poor access to affordable financing for WSPs construction	• Government to invest on attracting external support through bilateral and multilateral agreements; • Subsidize cost of construction to at least 50%.	Enable municipalities to access loans and grants to meet constructions cost
	High investment costs	• Enable municipalities to access loans and grants to meet costs of construction	
Non-Financial Barriers			
Technical	Limited research on wastewater treatment technologies, WSPs	• Government should develop relevant standards and specifications that can reflect the local situation. • Support research institutions to determine the trends on operational efficiency with the objective of wastewater reuse and recycling.	• Invest on research
Policy, legal and regulatory barriers	Absence of Policy instruments: (financial incentives, regulations and awareness programme) targeted on wastewater recycling and reuse.	• Develop supportive policy and regulatory instruments to promote WSPs targeting economic incentives • The government to impose strict and elevated tax for those operators discharging or disposing waste water.	• Impose strict and elevated tax for operators discharging waste water
	ii. Weak implementation of the land policy	The government has to strengthen and enforce urban planning laws and regulations.	

Enable municipalities to access loans and grants to meet constructions cost

Urban waste water management is the primary responsibility of the municipal councils for ensuring hygine and sanitation of the environment. However, in developing countries like Tanzania, most of municipal councils have limited financial and technical capacity to construct and operate WSP owing to high construction and maintenance costs. Government intervention to enable municipalties to access loans or grants from multilateral funds such as World Bank, AFDB etc may enable this investment. This is because capital needed for such investment as WSPs is usualy lumpy thus can all be obtained from the bank as a loan. Once the WSPs are constructed and operating, a close monitoring is required to ensure that the ponds are efficient and meet the standards.

Supporting research on waste water management

To smoothly support research institutions of better ways to manage liquid waste water and enable authorities to have reqired data that can guide the country and set benchmarks for waste water recycling, delibarate efforts ought be made to support basic research in waste water management.

Activities identified for implementation of selected actions

To further develop actions to be implemented the following activities are proposed as identified in table 42.

Table 42: Activities identified for implementation of selected WSP actions

Action	Activities
Enable municipalities to access loans and grants to meet constructions cost	1.1Asses capacity of the council to service the loan
	1.2 Engage a team of technical people to develop bankable projects to attract funding
	1.3 Invite collaboration of private sector and municipalities to co funding
2. Supporting research on waste water management	2.1Soliciting research proposals from the Tanzanian scientific community on waste water management

Actions to be implemented as Project Ideas

The above mentioned actions can be merged into once project called " capacity building of municipal councils in waste water management".

2.1.4.4 Stakeholders and Timeline for implementation of TAP

Overview of Stakeholders for the implementation of the TAP

This section is to identify stakeholders which have been identified as required for each of the actions identified. Table 43 gives detailed list of stakeholders and their roles.

Table 43: Overview of stakeholders for implementation of the WSP TAP

S/N	Stakeholder	Role
1.	Ministry of water	Oversee the overall project
2.	Ministry of Finance	Support on financial aquisition
3.	VPO- DOE	To oversee the implementation of the action
4.	NEMC	Provide guidelines on waste water management
5.	Water utility and sanitation authorities	Construct and renovate WSP
6.	Ministry of Land and human settlement	Provide guidelines on urban planning
7.	Research institutions and Universities	Training and capacity development
8.	Private sector	Bring technology innovation
9.	Development partners	Financing of WSP

Scheduling and sequencing of specific activities

The following table 44 describe the sequence and timing of specific activities.

Table 44: Scheduling and sequencing of WSP specific activities

Action	Activities	Timeframe					
		Y1	Y2	Y3	Y4	Y5	Y6
1. Enable municipalities to access loans and grants to meet constructions cost	1.1Asses capacity of the council to service the loan	■					
	1.2 Engage a team of technical people to develop bankable projects to attract funding		■	■			
	1.3 Invite collaboration of private sector and municipalities to co funding	■	■	■	■		
2.Supporting research on waste water management	2.1Soliciting research proposals from the Tanzanian scientific community on waste water management				■	■	■

2.1.4.5 Estimation of Resources Needed for Action and Activities

Estimation of capacity building needs

Municipal councils lack financial capacity to develop bankable project proposals to enable them to meet the construction costs for the WSP besides building the capacity in monitoring the quality of recycled waste water. It is important that the quality of recycled waste water meet the both local and international standards so that there is no health concerns in its subsequent re-use.

Estimations of costs of actions and activities

The costs of actions and activitis can be divided into two, those related to capacity building and construction of WSP. Table 45; present the estimation of resources for WSP action and activities.

Table 45: Estimation of Resources needed for WSP action and activities

SN	**Item**	Amount USD
1.0	Capacity building	
1.1	Training workshops for municipal council and water utility authority staff	200,000
1.2	Research fund for waste water management	2,000,000
2.0	Cost of Technology	
2.1	Construction of stabilization pond (@ USD427,730/stabilization pond)	2,138,653
2.2	Annual operating costs of stabilization ponds @ 16,504/stabilization pond	82,521
2.3	Cost of construction a sewerage system (assuming 80km of pipeline (per city) at 650m TZS per 20 km)	3,388,908
2.4	Cost of renovating existing WSP	1,069,326
2.5	Water assurance	100,000
	Total cost	**8,979,409**

2.1.4.6 Management Planning

Risks and Contingency Planning

Despite careful planning of the actions, including responsibilities and costs, uncertainties will remain about what the actual implementation of the TAP will look like. Table 46 provides a risks and contingency planning

Table 46: Risks and contingency planning for WSP TAP

Risks	Potential impact	Probability	Contingency plan
1. Lack of funds to implement the technology	H	L	Explore many ways of soliciting funds
2. Lack of political will to support the technology	H	L	Engage senior government into discussion about the need for the technology and associated benefits to the country
3. The technology receives little social acceptance	M	L	Awareness raising and advocacy campaigns
4. The cost of technology becomes higher than expected	M	L	Include 20% contingency in the budget
5. The trained staff do not perform to the expected standard	M	L	Provide more training opportunities to the staff

Note: H=High, M=Medium and L=low

Next Steps

Identifying the immediate and critical requirements enables both a sharper focus of what to do, and how to secure the right resources. It is recommended that cost estimates are made for these requirements so that countries can move quickly towards implementation.

Immediate requirements

- Organize a water sector meeting for senior government officials to discuss the actions for WSP technology and chat the way forward for implementation
- A task manager within the water and sanitation authorities must be funded, selected and assigned full-time and provided with the following tools and resources: e.g. access to a financial analyst and cost estimation expertise; and, planning, scheduling and "project management" hardware and software, and other immediate activities required

Critical requirements

Legislation and supportive regulations must be drafted, endorsed and passed to enable the municipalities to widen the window of accessing loans including from private sector for technology acquisition, which are presently limited to local government loan board.

Water Sector Matrices

1. Rain Water Harvesting Technology

Table 47: TAP Overview Table for Rainwater harvesting technology

TAP overview table								
Sector	Water							
Sub-sector	Rainwater harvesting							
Technology	The household rooftop rainwater harvester referred to in this project is a 10000 litres capacity tank, with a complete piping system from collection from the roof, to the outflow from the tank. The system will also have to provide for an absorption pit to channel unused or excess rainwater collected into it, in order to promote groundwater recharge.							
Ambition	The RWH technology is being targeted at residential sector. The technology targets constructing Roof Rainwater Harvesting units for 150,000 families of 4 people.							
Benefits	Reduce water consumption by around 50%. The rainwater harvesting technology requires relatively very low investments, low skilled labour and low operational costs, but provides high benefits.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1:Periodic tax policy reviews for RWH harvest	1.1Consultative workshop for traders and suppliers of RWH harvest and related materials	Ministry of Finance, Ministry of Water	Ministry of Water	0-5years	Low attendance of participants	% of private sector involvement in RWH directly	Number of individuals owning commercially viable RWH systems	300,000
	1.2Tax reduction and exemptions for RWH harvest on government revenues	Ministry of finance	Ministry of finance	0-3 years	The government refuses to offer tax reduction and exemptions	% of RWH harvest receiving tax reduction or and exemption	Number of RWH harvest being tax-reduced and or exempt	-
Action 2: Establishment of national water fund	2.1Water sector stakeholders workshop on national strategy for water resources management financing mechanisms	Ministry of water , Development partners	Ministry of water	0-3years	Inadequate funds	A national guiding framework for financing water	The amount of funds allocated for covering water resource management costs including RWH	200,000

						resources management		
Action 3:Institutional capacity building in RWH	3.1 Awareness raising on RWH	Ministry of water , Development partners	Ministry of water	0-6	Low social acceptance	After 6 years at least 70 % of target group are aware and use the technology .	Number of households with installed RWH systems	500,000
	3.2 Specialized training on RWH in water resources training institutes and vocational training centers	Ministry of water, Development partners	Ministry of water	0-5	The trained individuals perform below expectations	At least 60% of training individuals are providing RWH help in the community	Number of individuals trained, and number of households receiving technical assistance from the trained group	200,000
	3.3 Training of village level artisans on RWH	Ministry of water, Development partners	Ministry of water	0-5	The trained individuals perform below expectations	At least 70% of training individuals are providing RWH help in the community	Number of village artisans trained, and number of households receiving technical assistance from the trained group	100,000
	3.4 Coordination and funding of RWH activities	Ministry of water, Development partners	Ministry of water	0-10	Market regulated by subsidies	After 10 years at least 60% of target group is	Number of RWH systems sold by suppliers , number of households using the	105,500,000

						using the technology	technology	

Table 48: TAP overview Table for Smart Water Metering Technology

	Water							
Sub-sector	Smart Water Metering							
Technology	Smart Water Metering (SWM) is a sophisticated but most efficient way of monitoring water consumption at any point on a regular basis. The technology can easily detect water leakage from the supply system and automatically stop the inlet flow. It presents a new approach to promote water security with uncertain but significant future risks from population growth, hydrological variability and extreme events, and intensifying water allocation demands across water supply, agriculture, industry and ecosystems.							
Ambition	The technology targets to reduce water and revenue losses through leakages by 50%. The targeted institutions are the water utility authorities in cities and municipalities such as the Dar es Salaam Water Supply Company (DAWASCO), Tanga Urban Water Supply and Sanitation Authority (TANGAUWASA). The TAP is expected to last over 10 years in selected regions.							
Benefits	The current system used by water utility authorities fails to control water leakage leading to loss of revenue, hence non-revenue water (NRW). High levels of NRW imply that a huge volume of water being lost through leaks is not being invoiced to customers. For example in Dar es Salaam, 50% of supplied water is not invoiced to customer, hence lost due to leakages. With the introduction of SWM such losses will be avoided.							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1: Procurement and installation of smart water metering system	1.Purchase of SWM devices	Ministry of water, development partners, water utility authorities	Water utility authorities	0-3years	The supplier does not meet the quality required	Number of SWM devices procured	Number of devices purchased and working	705,000
	1.2 Installation of SWM system	Ministry of water, development	Water utility authorities	0-3 years	The existing infrastructure does not	% of SWM systems Installed	Number of SWM devices installed and operation as per	1,000,000

		partners, water utility authorities			match with the installation requirements		expectations	
Action 2: Staff training on SWM applications and maintenance	2.1Training of a special unit dealing with SWM within water utility authorities	Ministry of water, development partners, water utility authorities	Water utility authorities	0-3years	The trained special unit does not deliver to expectations	% of staff fully committed and offering quality services	Number of individuals trained	400,000
	2.2 Training of other staff	Ministry of water, development partners, water utility authorities	Water utility authorities	0-2	The trained staff does not deliver to expectations	% of staff fully committed and offering quality services	Number of individuals trained	100,000
Action 3:Awareness raising and provision of customer service for SWM	3.1 Awareness raising on SWM	Ministry of water, development partners, water utility authorities	Water utility authorities	0-6	Low social acceptance	After 6 years at least 70 % of water consumers are aware and use the technology .	Number of households with installed SWM systems	200,000
	3.2 Customer support services	Ministry of water, development partners, water utility authorities	Water utility authorities	0-10	Failure to meet customer expectations	At least 80% of report cases attended	Number of customers with various problem related to SWM attended	100,000
	3.3 Marketing of SWM system	Ministry of water,	Water utility authorities	0-10	Low acceptance	At least 90% targeted	Number of customers using SWM system	700,000

		development partners, water utility authorities			by customers	market reached		

TAP overview table

Table 49: TAP Overview Table for Waste Water Stabilization Pond Technology

Sector	Water							
Sub-sector	Waste Water Stabilization Ponds							
Technology	Waste stabilization ponds (WSPs) are usually the most appropriate method of domestic and municipal wastewater treatment in developing countries, where the climate is most favourable for their operation. WSPs are low-cost (usually least-cost), low-maintenance, highly efficient, entirely natural and highly sustainable							
Ambition	The technology targets to increase the number of households connected to the central sewage system as follows: Dar es Salaam 10% of population which is not connected to the sewer amounting to 79446 households, in Mwanza, Nyamagana district 10% amounting to 36,345 households will be targeted, while in Dodoma Urban District 82,191 households which is 20% will be targeted. Thus in total the technology targets to 200,000 household by 2030. Furthermore, the TAP will renovate existing WSP especially those in very bad condition							
Benefits	Waste water reuse can produce obvious benefits as it reduces the need for extraction of water from surface and groundwater resources. Especially given the current pressure and water shortage due to climate change impacts, reused waste water can provide an alternative water resource							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity (USD)**
Action 1:Capacity building of municipal councils in waste water management	1.1 Renovation of existing waste water stabilization ponds	Ministry of water, development partners, water utility authorities	Water utility authorities	0-10years	Inadequate funds	At least 70% renovated WSP improve their efficiency	Number of renovated WSP	1,069,326
	1.2Construction of new waste water stabilization ponds with a focus on sites in vicinity of agricultural lands	Ministry of water, development partners, water utility authorities	Water utility authorities	0-10 years	Inadequate funds	At least 80% of targeted new WSP constructed	Number of new WSP constructed	2,138,653
	1.3 Enhancing the quality of treated water for reuse in agricultural production (irrigation)	Ministry of water, development partners, water utility authorities	Water utility authorities	0-10	Quality of treated water below standards	At least 50% of WSP meet the quality standards	Parameter values of treated waste water	100,000

Action 2: Supporting research on waste water management	2.1 Soliciting research proposals from the Tanzanian scientific community on waste water management	Ministry of water, development partners, water utility authorities	Ministry of water	0-10 years	The funded research proposals fail to meet the expectations	At 70% of targeted research topics funded and data submitted	Number of research projects funded	2,000,000

2.2 Project Ideas for Water Sector

2.2.1 Brief summary of the Project Ideas for Water Sector

The following project ideas in the water sector were identified on the basis of their contribution to socio-economic development and climate change adaptation potential. Further they were prioritised among a list of other technologies with the assistance of Multi-Criteria Analysis. The project ideas aim to build the capacity of the country‘s water sector to develop some technologies which enhance adaptation to climate change through improved water resources management.

2.2.2 Specific Project Ideas

2.2.2.1 Promoting rainwater harvesting technology for enhanced climate change adaptation in the water sector

Introduction/Background

Rainwater harvesting (RWH) technology involves capturing rainwater and storing it in designated storage facilities such as tanks and reservoirs. The stored water can be used to supplement water supply especially in areas with water scarcity. Moreover, the technology saves the water that would otherwise be locally lost through surface runoff and evapotranspiration. As a technology in the water sector, RWH was prioritized during the TNA by key stakeholders. The project will involve promotion of diffusion of RWH in selected areas. This is expected to result in wide application of RWH technology as a way of increasing water supply. The project was developed through a participatory process involving the Adaptation Working Groups and key stakeholders

Objectives

The main objective of the project is to provide roof rainwater harvesting units for households in selected districts and villages/suburbs. In particular, the project targets 150 households with an average of 4 people each. Furthermore, the project will provide public awareness campaigns on the RWH harvesting and train households on how to install the RWH units, water storage facilities and water quality management.

Project outputs

The project’s key outputs will be the number of household with awareness on the importance of RWH and the number of households provided with RWH units.

Relationship to the country’s sustainable development priorities

Tanzania faces severe and widespread water shortages in many areas because of climate variability, poor distribution of the resource in time and space, and inadequate management of the water resources. The shortage is very pronounced in semi- arid areas. RWH has a huge potential for complimenting the traditional water supply which relies on river flows and ground water. The project is in line with Water Sector Development Programme which among others aims to improve access to portable water. Furthermore, the project is in with Tanzania Development Vision 2025, MKUKUTA II, Water Policy 2002, Water Resources

Management Act, 2009 and Water Supply and Sanitation Act, 2009. They all recognise the need for universal access to safe water.

Project Deliverables

The project benefits include the following:

(i) Awareness on RHW: The project is envisaged to increase awareness on the importance of RWH

(ii) Tax incentive for RWH materials: The project will facilitate a process that will ensure that all the materials related to the installation of RWH units have tax relief.

(iii) Training on RWH installation at village level: The project will conduct training of artisans in rural areas with a view of enabling them to train others and install the RWH units in Households.

Project Scope and Possible Implementation

The project will be carried in selected districts /towns/cities and will focus on RWH for domestic uses. Once the project is proved to be successful, scaling up into other cities and town will be done. Considering the water challenges facing the country, implementation of this project is of paramount importance. Technically, the project appears to be feasible since all the required materials for installation of RWH structures are readily available in shops. The catchment area is the house roof which receives the falling rain and channels it to gutters which further drain the rainwater into storage tanks or reservoirs. RWH is not a new concept in Tanzania. There have been some initiatives by NGOs, public institutions and aid organizations to promote RWH. But there has been no government framework for supporting RWH.

Project Activities and Budget

The project will be implemented by the Ministry of Water and Irrigation in collaboration with the private sector and Non-Government Organizations (NGOs), development partners and the beneficiaries. The following activities will be supported:

(i) Consultative workshop for traders and suppliers of RWH equipment and related materials

(ii) Water sector stakeholders workshop on national strategy for water resources management financing mechanisms

(iii) Awareness raising on RWH

(iv) Specialized training on RWH in water resources training institutes and vocational training centres

(v) Training of village level artisans on RWH

(vi) Coordination of RWH operations

The total project budget is **USD 106,800,000**. Details of the project budget are indicated in the Table below.

Project Activities and Budget

S/N	Activity	Target Group	Main Actors	Cost in US Dollars
1	Consultative workshop for traders and suppliers of RWH equipment and related materials	Suppliers and Buyers of RWH related equipment	Ministry of Water and Irrigation	300,000
2	Water sector stakeholders workshop on	Key stakeholders in	Ministry of Water	200,000

S/N	Activity	Target Group	Main Actors	Cost in US Dollars
	national strategy for water resources management financing mechanisms	the water sector	and Irrigation, Ministry of Finance and Economic Planning, Development Partnes, The Private Sector	
3	Awareness raising on RWH	The General Public	Ministry of Water and Irrigation, NGOs, CBOs	500,000
4	Specialized training on RWH in water resources training institutes and vocational training centres	Water resources and vocational training centres	Ministry of Water and Irrigation, NACTE, VETA	200,000
5	Training of village level artisans on RWH	Village artisans	Ministry of Water and Irrigation, NGOs, CBOs	100,000
6	Coordination of RWH operations	Key players and beneficiaries of RWH	Ministry of Water and Irrigation, NGOs, CBOs	105,500,000
	Total			106,800,000

Timelines

Plan of activities

SN	Timeframe in Months	Activity
1.	01-03	Consultative workshop for traders and suppliers of RWH equipment and related materials
2.	01-03	Water sector stakeholders workshop on national strategy for water resources management financing mechanisms
3.	01 - 12	Awareness raising on RWH
4.	01 - 06	Specialized training on RWH in water resources training institutes and vocational training centres
5.	01 - 03	Training of village level artisans on RWH
6.	01-12	Coordination of RWH operations

Measurement/Evaluation

Table below shows indicators of progress. A monitoring and evaluation system will be put in place to monitor the project achievements on quarterly basis. The project will have a project steering committee chaired by the Ministry of Water and Irrigation. Other members will comprise representatives from the relevant government institutions, R&D institutions, academia, financial institutions, media, NGOs and project beneficiaries. The Project Steering Committee will be responsible for monitoring project implementation and will receive project progress reports from the Project Manager on quarterly basis.

Indicators of progress

S/N	Activity	Indicator of Progress
1	Consultative workshop for traders and suppliers of RWH equipment and related materials	Number of individuals owning commercially viable RWH systems
2	Water sector stakeholders workshop on national strategy for water resources management financing mechanisms	The amount of funds allocated for covering water resource management costs including RWH
3	Awareness raising on RWH	Number of households with installed RWH systems
4	Specialized training on RWH in water resources training institutes and vocational training centres	Number of individuals trained, and number of households receiving technical assistance from the trained group
5	Training of village level artisans on RWH	Number of village artisans trained, and number of households receiving technical assistance from the trained group
6	Coordination of RWH operations	Number of RWH systems sold by suppliers , number of households using the technology

Possible Complications/Challenges

The biggest challenge is to get funding for the project. Other challenges include convincing the government to provide tax relief for RWH related materials. The challenges will be reported to the project Steering Committee so that solutions can be found in good time.

Responsibilities and Coordination

The project will be coordinated by the Ministry of Water and Irrigation in collaboration with the interested stakeholders. These include the following: R&D institutions, Academia, Print and electronic media institutions, The Tanzania Bureau of Standards; Tanzania Revenue Authority, financial institutions; Civil society organisations and the Private sector.

2.2.2.2 Capacity building of water utility authorities in smart water metering systems

Introduction/Background

Non Revenue Water (NRW) - water that is produced for consumption and lost before it reaches the customer - is a serious challenge. In Tanzania, it is on average at 37% in urban areas, while in a large city as Dar es Salaam it is estimated to as much as 50 %.Currently, the national water authorities in Tanzania face a number of challenges with NRW, which results in water supplies that do not meet the demand and inadequate water infrastructure, which results in water losses that reduce financial viability of water utilities, which again results in

poor services and inadequate water access, availability and affordability. Smart Water Meters (SWM) was identified and prioritized during TNA by water sector stakeholders. This technology has a huge potential for reducing NRW.

Objectives

The main objective of the project is to reduce NRW by 50% for water utility authorities in cities and municipalities such as the Dar es Salaam Water Supply Company (DAWASCO), Tanga Urban Water Supply and Sanitation Authority(TANGAUWASA).

What are the outputs and are they measurable?

The project's key outputs will be the number of SWM installed, the number trained staff, the percentage increase in revenue collection and the percentage decrease in NRW.

Relationship to the country's sustainable development priorities

Tanzania faces severe and widespread water shortages in many areas because of climate variability, poor distribution of the resource in time and space, and inadequate management of the water resources. The shortage is very pronounced in semi- arid areas. SWM technology enables the country to reduce NRW thus boosting income accruing and water supply system.. The project is in line with Water Sector Development Programme which among others aims to improve access to portable water. Furthermore, the project is in with Tanzania Development Vision 2025, MKUKUTA II, Water Policy 2002, Water Resources Management Act, 2009 and Water Supply and Sanitation Act, 2009. However, the technology appears to be new in the country. Successful implementation of the project will lead to scaling up of the technology to other cities and town in Tanzania.

Project Deliverables e.g. Value/Benefits/Messages

The project benefits include the following:

(i) Awareness on SWM: The project is envisaged to increase awareness on the importance of SWM
(ii) Training of staff on SWM installation and maintenance.
(iii) Purchase and installation of SWM

Project Scope and Possible Implementation

The project will be carried in selected cities and municipals and will focus on water utilities which suffer NRW losses. Considering the water challenges facing the country, implementation of this project is of paramount importance. SWM is a completely new technology in Tanzania. Its feasibility will depend on the availability of both technical and financial support. The purchase and installation of SWM is costs a lot. Furthermore, staff training will be required to build capacity in operating the meters.

Project Activities and Budget

The project will be implemented by the Ministry of Water and Irrigation in collaboration with the private sector and Non-Government Organizations (NGOs), development partners and the beneficiaries. The following activities will be supported:

(i) Purchase of SWM devices Water sector stakeholders workshop on national strategy for water resources management financing mechanisms
(ii) Installing of the SWM system Specialized training on RWH in water resources training institutes and vocational training centres
(iii) Training of a special unit dealing with SWM within water utility authorities
(iv) Training of other staff
(v) Awareness raising on SWM

(vi) Provision of customer support services

(vii) Marketing of SWM system

The total project budget is **USD 3,205,000.** Details of the project budget are indicated in the Table below.

Project Activities and Budget for SWM

S/N	Activity	Target Group	Main Actors	Cost in US Dollars
1	Purchase of SWM devices	Water Utilities and their customers	Ministry of Water and Irrigation	705,000
2	Installation of SWM system	Water Utilities and their customers	Water Utilities	1,000,000
3	Training of a special unit dealing with SWM within water utility authorities	Water Utilities and their customers	Water Utilities	400,000
4	Training of other staff	Water Utilities and their customers	Ministry of Water and Irrigation, NACTE, VETA	100,000
5	Awareness raising on SWM	Water Utilities and their customers	Ministry of Water and Irrigation, NGOs, CBOs	200,000
6	Customer support services	Water Utilities and their customers	Water Utilities, NGOs and other partners	100,000
7	Marketing of SWM system	Water Utilities and their customers	Water Utilities, NGos and other partners	700,000
	Total			3,205,000

Timelines

Plan of activities for SWM

S/No.	Timeframe in Months	Activity
1	01-03	Purchase of SWM devices
2	01-12	Installation of SWM system
3	01 - 12	Training of a special unit dealing with SWM within water utility authorities
4	01 - 06	Training of other staff
5	01 - 24	Awareness raising on SWM
6	01-12	Customer support services
7	01 - 12	Marketing of SWM system

Measurement/Evaluation

Table below shows indicators of progress. A monitoring and evaluation system will be put in place to monitor the project achievements on quarterly basis. The project will have a project steering committee chaired by the Ministry of Water and Irrigation. Other members will comprise representatives from the relevant government institutions, R&D institutions,

academia, financial institutions, media, NGOs and project beneficiaries. The Project Steering Committee will be responsible for monitoring project implementation and will receive project progress reports from the Project Manager on quarterly basis.

Indicators of progress

S/N	Activity	Indicator of Progress
1	Purchase of SWM devices	Number of SWM devices purchased
2	Installation of SWM system	Number of SWM devices installed and functional
3	Training of a special unit dealing with SWM within water utility authorities	Number of staff for the special unit trained
4	Training of other staff	Number of other staff trained
5	Awareness raising on SWM	Number of awareness activities /events conducted
6	Customer support services	Number of customers attended and number of SWM related problem solved
7	Marketing of SWM system	Number of SWM adverts disseminated

Possible Complications/Challenges

The biggest challenge is to get funding for the project. Another challenge is obtaining the competent SWM supplier with the technical capacity to provide training on installation and repair of SWM. Furthermore, another challenge will be willingness of the customers to accept the use of SWM. Any emerging challenge will be reported to the project Steering Committee so that solutions can be found in good time.

Responsibilities and Coordination

The project will be coordinated by the Ministry of Water and Irrigation in collaboration with the interested stakeholders. These include the following: R&D institutions, Academia, Print and electronic media institutions, civil society organisations and the Private sector.

2.2.2.3 Capacity building of municipal councils in waste water stabilization pond

Introduction/Background

Waste water recycling is one of the strategies for addressing water shortage and a water saving technology used worldwide. It reduces the need for extraction of water from surface and groundwater resources. This can be achieved through waste water stabilization ponds (WSP). The WSP are usually the most appropriate method of domestic and municipal wastewater treatment in developing countries, where the climate is most favourable for their operation. As a technology in the water sector, WSP was prioritized during the TNA by key stakeholders. The project will involve rehabilitation of some existing sewage system and construction of new ones in selected locations.

Objectives

The main objective of the project is to increase the number of households connected to the central sewage system in selected urban areas.

Project Outputs

The project's key outputs will be the number of household connected to the central sewage system and the number of WSP rehabilitated and constructed.

Relationship to the country's sustainable development priorities

Tanzania faces severe and widespread water shortages in many areas because of climate variability, poor distribution of the resource in time and space, and inadequate management of the water resources. The shortage is very pronounced in semi- arid areas. Wastewater re-use has a huge potential for complimenting the traditional water supply in the country. In particular, waste water recycling can play a key role in agricultural water management in which a significant amount of irrigation water from rivers could be saved. The project is in line with Water Sector Development Programme which among others aims to improve water supply and sanitation. Furthermore, the project is in with Tanzania Development Vision 2025, MKUKUTA II, Water Policy 2002, Water Resources Management Act, 2009 and Water Supply and Sanitation Act, 2009. They all recognise the need for waste water management. Furthermore, the project is line with National Irrigation Act, 2013(applies only if the recycled water is used for irrigation purposes) which oversee irrigation activities in the country.

Project Deliverables

The project benefits include the following:

(i) Rehabilitation of existing WSP
(ii) Construction of new WSP
(iii)Increasing the number of households connected to the central sewage system in selected areas

Project Scope and Possible Implementation

The project will be carried in selected cities and municipalities. In particular, the project will be implemented in Dares Salaam city, Mwanza city and Dodoma municipality whereby 10%, 10% and 20% of population which is not connected to the sewer for Dar es Salaam, Mwanza and Dodoma respectively will be targeted. Once the project is proved to be successful, scaling up into other cities and town will be done. Considering the number of irrigation schemes in the country, implementation of this project is of paramount importance. Technically, the project appears to be feasible since wastewater is in plenty supply. However, recycling of wastewater in a new concept in Tanzania. Thus deliberate efforts will be needed to raise awareness about its importance in water resources management.

Project Activities and Budget

The project will be implemented by the Ministry of Water and Irrigation in collaboration with municipal and city sewerage authorities, the private sector and Non-Government Organizations (NGOs), development partners and the beneficiaries. The following activities will be supported:

(i) Renovation of existing waste water stabilization ponds
(ii) Construction of new waste water stabilization ponds with a focus on sites in vicinity of agricultural lands
(iii) Enhancing the quality of treated water for reuse in agricultural production (irrigation)
(iv) Soliciting research proposals from the Tanzanian scientific community on waste water management

The total project budget is **USD 5,307,979.** Details of the project budget are indicated in the Table below:

Project Activities and Budget

S/N	Activity	Target Group	Main Actors	Cost in US Dollars
1	Renovation of existing waste water stabilization ponds	Municipal authorities	Ministry of Water and Irrigation and Municipal councils , NGOs and the private sector	1,069,326
2	Construction of new waste water stabilization ponds with a focus on sites in vicinity of agricultural lands	Municipal authorities	Ministry of Water and Irrigation and Municipal councils , NGOs and the private sector	2,138,653
3	Enhancing the quality of treated water for reuse in agricultural production (irrigation)	Municipal authorities	Ministry of Water and Irrigation, NGOs, CBOs	100,000
4	Soliciting research proposals from the Tanzanian scientific community on waste water management	Municipal authorities	Ministry of Water and Irrigation and Municipal councils , NGOs and the private sector	2,000,000
	Total			5,307,979

Timelines

SN	Timeframe in Months	Activity
	01-12	Renovation of existing waste water stabilization ponds
	01-24	Construction of new waste water stabilization ponds with a focus on sites in vicinity of agricultural lands
	01 - 36	Enhancing the quality of treated water for reuse in agricultural production (irrigation)
	01 - 12	Soliciting research proposals from the Tanzanian scientific community on waste water management

Measurement/Evaluation

Table below shows indicators of progress. A monitoring and evaluation system will be put in place to monitor the project achievements on quarterly basis. The project will have a project steering committee chaired by the Ministry of Water and Irrigation. Other members will comprise representatives from the relevant government institutions, R&D institutions, academia, financial institutions, media, NGOs and project beneficiaries. The Project Steering Committee will be responsible for monitoring project implementation and will receive project progress reports from the Project Manager on quarterly basis.

Indicators of progress

S/N	Activity	Indicator of Progress
1	Renovation of existing waste water stabilization ponds	Number of WSP renovated
2	Construction of new waste water stabilization ponds with a focus on sites in vicinity of agricultural lands	Number of new WSP constructed
3	Enhancing the quality of treated water for reuse in agricultural production (irrigation)	The quality parameters of treated wastewater
4	Soliciting research proposals from the Tanzanian scientific community on waste water management	The number of research projects on waste water management

Possible Complications/Challenges

Funding for renovation and construction of new WSP appears to be the main challenge especially funds.

Responsibilities and Coordination

The project will be coordinated by the Ministry of Water and Irrigation in collaboration with the Municipal councils and other interested stakeholders. These include the following: R&D institutions, Academia, Print and electronic media institutions, The Tanzania Bureau of Standards; Tanzania Revenue Authority, financial institutions; Civil society organisations and the Private sector.

CHAPTER 3: CROSS-CUTTING ISSUES

Action plans have been elaborated for the six prioritized technologies, three in agriculture sector and three in the water sector. There are some crosscutting issues that may need common interventions. This chapter discusses such crosscutting issues:

An important measure that cuts across most of the selected technologies is the review of national policies to address price competitiveness. For example, financial measures hinge mainly on the need for government action to reduce cost of supply of inputs or materials and equipment for the technologies. This can be done at the macro level through reduction in lending interest rates to less than 20%, reduction of import duties, increasing access to credit by reducing collateral conditions for loans for small holder farmers, inadequate or lack of markets and remunerative prices, stabilization of the exchange rate and institution of tax relief incentives to suppliers of these materials and equipment.

Common barriers to the adoption of the technologies include high cost of the technologies as a result of high cost of labour, technical knowhow, equipment and materials; Inadequate funding for sustaining the technologies due to insufficient public investment and private participation, including contributions from external agencies; inadequate community and local (district) level capacity, including technical and financial management expertise, to keep the technologies functional; Limited integration of the technologies in policy plans resulting in their poor diffusion and adoption; poor coordination among government institutions hinders successfully uptake of technologies, lack of cultural acceptance of change so communities are not motivated to adopt the technologies whole heartedly; Inadequate community development specialists and logistics to design and implement appropriate community educational and awareness-raising programs in beneficiary communities.

Another major barrier is incoherent government policy on climate change to drive the adoption of the technologies. Some technologies especially those on agriculture are targeting rural communities who have low absorption capacity of the technologies because of their lack of regular income and therefore ability to afford. Thus, government actions in promoting and facilitating the diffusion and adoption of these technologies are paramount. In addition, the capacities of beneficiary communities to adopt and manage the technologies both for their well- being and for sustainability are prerequisites. Strengthening research and development (R&D) and extension linkages is also important to enable effective flow of information from research into use. This is necessary to address the knowledge gap of the user communities and technology promoters. While the national research system continues to work on prevailing technology needs there is a gap between the system and the end user, which is a major barrier to diffusion. This has to be addressed as a national policy.

Prioritization of climate change as an important economic, development and cross-cutting issue has implications for the sustainability of agriculture and water which are the most vulnerable sectors and subsequent development of strategies and /or mechanisms to increase productivity whilst building resilience within the sectors. This will provide opportunity for

prioritizing these technologies for promotion, adoption and uptake. It should also lead to increased budgetary allocation in support of the diffusion of the technologies and the facilitation of the involvement of external agencies with requisite know-how and other resources.

Apart from identified cross cutting barriers a successful adoption and diffusion needs also address challenges such as inadequate or lack of markets and remunerative prices of agricultural products, poor transport, storage, power and other infrastructure in rural areas, limited or no value addition and land degradation, among others. In many cases, the costs of production are perceived to be relatively high when compared with market prices, and the risks of investing are considerable for farming households, given that markets are unreliable. Improving transport, storage and processing and market information systems, alongside policies to regulate market and input prices, will be necessary to make adoption and diffusion of these technologies viable for these farmers. Evidence from many parts of Tanzania show that where (at least some of) these enabling conditions are in place, e.g. in Mkindo, Morogoro where SRI is practiced, in drip irrigation sites, farmers are quick to seize opportunities for commercial horticultural production and may even invest in new technologies, such as drip irrigation, without the need for external assistance.

The enabling framework to address the common barriers include enhancing access to finance for small scale farmers, investment in research and development, training and human and organizational capacity building, information and education, awareness raising, strengthening of institutional collaboration and infrastructure, setting of appropriate policies (incentives or disincentives), enforcement, relevant policy support and promotion of public-private partnership.

Summary of cross cutting barriers and their measures

Cross cutting Barriers	Cross cutting Enabling measures
Economic and financial	• Enhance access to finances through subsidies, lowering of taxes, lending rates etc.
Technical	• Embark of capacity building of communities, extension officers, R&D institutions, Vocational Training Institutions, technicians etc.
Information and awareness	• Conduct awareness campaigns to all stakeholders including adopters of technologies
Policy, legal and regulatory	• Develop appropriate policies to promote climate change adaptation etc.
Institutional/Organizational	• Strengthen coordination among institutions to enable team play

CHAPTER 4: SUMMARY AND CONCLUSION

The Technology Action Plan (TAP) report provides a comprehensive description of the action plan for adaptation technologies identified under the agriculture and water sectors. It presents the results of the process, which has led to a selection of several options for groups of measures described in the barrier analyses and enabling framework report. Under the agriculture sector, the three prioritized technologies were improved seed varieties, system of rice intensification and drip irrigation aiming to enhance food security despite of the vulnerability of the sector to climate change. For water sector, three prioritized technology options included rainwater harvesting, smart water metering and waste water stabilization ponds. All these technologies aim at efficient use of water which is threatened by changes in climate.

The TAP report has also dealt with crosscutting issues which among others include common barriers to all the technologies identified under both sectors. In agriculture sector common barriers were identified with opportunities for synergies in terms of enhancing measures to overcome them, even though there were some differences in some details. The first related to the lack of capital to invest for technology diffusion and implementation. Agriculture has been mainly for subsistence not commercial to enable stable income for investment.

The second and third common barrier was the lack of technical skills and experience necessary in the designing of the technologies, and lack of skills in the implementation of the technologies. It was suggested that this was due to the fact that farming does not necessitate training thus low number of people being trained in the necessary skills due to various reasons including high cost of training equipment.

In the water sector the common barriers identified are grouped into financial and non-financial barriers. Financial barriers include inadequate budgetary allocation and high cost of investment. On the side of non-financial barriers, these include the inadequate in skills, institutional challenges, weaknesses in policy and legal frameworks, as well as weak law enforcement and compliance.

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Annex I: List of stakeholders involved and their contacts

List of stakeholders involved in the development of TAP.

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