



Efficient Water Use for Agricultural Production (EWUAP) Project

RAPID BASELINE ASSESSMENT OF AGRICULTURAL WATER IN TANZANIA

By

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MAP OF MWANZA ZONAL IRRIGATION AREA SHOWING LAKE VICTORIA REGIONS



ACRONYMS

ANSTI	African Network of Scientific and Technological Institutions
ASDP	Agricultural Sector Development Programme
ASDS	Agricultural Sector Development Strategy
BWB	Basin Water Board
DADPs	District Agricultural Development Plans
DFID	Department For International Development
DITS	Director of Irrigation and Technical Services
EWUAP	Efficient Water Use for Agricultural Production
FAO	Food and Agriculture Organization of the United Nations
GIS	Geographical Information System
GoT	Government of Tanzania
ICR	Implementation Completion Report
IG	Irrigators' Group
IO	Irrigators' Organization
IRA	Institute of Resources Assessment
IWRM	Integrated Water Resources Management
MAFC	Ministry of Agriculture, Food Security and Cooperatives
MBAESED	Mbinga Agriculture, Environment and Socio-Economic Development Association
MDGs	Millennium Development Goals
MKUKUTA	Mkakati wa Kukuza Uchumi na Kupunguza Umaskini Tanzania
MNRT	Ministry of Natural Resources and Tourism
MoW	Ministry of Water
NIDP	National Irrigation Development Plan
NIMP	National Irrigation Master Plan
NPC	National Project Coordinator
NPES	National Poverty Eradication Strategy
NSGRP	National Strategy for Growth and Reduction of Poverty
ODATE	Orison Development Association for Training and Empowerment
PCM	Project Cycle Management
PRSP	Poverty Reduction Strategy Paper
RBMSIIP	River Basin Management and Smallholder Irrigation Improvement Project
RTK	Real Time Kinematic System
RWH	Rain Water Harvesting
SKYDEA	Skyland Development Association

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SKYZEC	Skynet Zebra Consultants, Inc.
SUA	Sokoine University of Agriculture
TANECO	Tanplanet Njegimi Express Company LTD
TAS	Tanzania Assistance Strategy
TAWLAE	Tanzania Women Leaders in Agriculture and Environment
UCLAS	University College of Lands and Architectural Studies
UDSM	University of Dar es Salaam
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WB	World Bank
WUA	Water Users' Association
ZIU	Zonal Irrigation Unit

Executive Summary

The Nile riparian countries, realizing their common concerns and interests over water, have made agreements towards cooperation by establishing the Nile Basin Initiative (NBI), which is guided by a Shared Vision *“to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources.”*

The Efficient Water Use for Agricultural Production (EWUAP) is one of the eight projects of the Nile Basin Initiative’s (NBI) Shared Vision Programme (SVP). One of the main objectives of the EWUAP Project is related to the increase in the availability of water and its efficient use for agricultural production. In this connection, the quick assessment of the agricultural sector undertaken through this study has identified constraints and areas of potential interventions and investment with respect to the theme “Efficient Use of Water for Agricultural Production”. These constraints, findings and recommendations are presented in this Study Report.

After the introductory background in Chapter One, the Report discusses the underlying National Policy Framework in Chapter Two. The relevant policies and strategies discussed include: Tanzania Development Vision 2025; National Strategy for Growth and Reduction of Poverty (MKUKUTA), Joint Assistance Strategy; Water Policy; Rural Development Strategy; Agricultural and Livestock Policy; National Land Policy; Agricultural Sector Development Strategy; Agricultural Sector Development Programme; and Environmental policy.

An overview of the Agricultural Sector is presented in Chapter Three. The following aspects of the sector are discussed in this chapter: Role of urban agriculture; agricultural performance, including rain-fed agriculture; some examples of good practices by NGOs; agro – ecological zones (AEZ) and farming systems; investment opportunities; support services and information dissemination; and constraints to agricultural production. This Chapter is followed by a discussion of the Agricultural Sector within the Tanzania Lake Victoria Basin regions of Kagera, Mara, Mwanza and Shinyanga. While the last three regions are major growers of cotton, the Kagera region is characterized by the banana/coffee/horticulture system.

Chapter Five discusses the irrigation sub-sector, covering the national irrigation potential; current status of irrigation development in the country as a whole; current status of irrigation in the Tanzanian section of the Lake Victoria Basin; Institutional framework; Challenges and constraints to irrigation development. The Chapter also discusses the challenges and constraints to Water Harvesting.

Based on the identified constraints, a set of recommendations have been drawn up. These are presented in Chapter Six – findings and recommendations, for the agricultural sector in general; and irrigation and water harvesting in particular. The major constraints addressed by these recommendations include: Poor rural infrastructure, which limits farmers’ access to markets for inputs and products; low investment in the sector by both government and private sector; Decline in the use of improved seed, fertilizers and agrochemicals; volatile and unpredictable international markets; dependence on erratic rains for agricultural development; HIV/AIDS and malaria threats that are eroding the country’s manpower; lack of access to credit facilities; and weak research-development linkage.

A project Concept Note, indicating specific areas of intervention; and the national Centres of Excellence are covered under Chapters Seven and Eight respectively. The Concept Note highlights areas of intervention to address the identified constraints. The national centres of excellence discussed include the University of Dar es Salaam (UDSM), the University College of Lands and Architectural Studies

(UCLAS), Sokoine University of Agriculture (SUA), and the Rwegalulira Water Resource Institute. While the first three are institutions of higher learning, the latter trains water technicians and have a major role to play in water resources development in the country.

Three Model Schemes, which could be used as training objects have been presented in Chapter Nine. They include Bahi irrigation scheme for water harvesting; Mombo irrigation scheme for community-managed irrigation, and Madibira irrigation project for public-private (large scale) irrigation. Finally the Bibliography and Annexes are presented in Chapters Ten and Eleven respectively.

It is worth noting that this Report has benefited from a review made on the zero draft by the participants of the National NBI Stakeholders' Workshop that was held in Dar es Salaam on 5th April, 2007. During this review valuable comments and contributions were made by the workshop participants. These and others received from other stakeholders, including those from the NBI Secretariat have been taken into account in the Final Draft of the Report.

1.0 BACKGROUND

The Nile riparian countries, realizing their common concerns and interests over water, have made agreements towards cooperation by establishing the Nile Basin Initiative (NBI), which is guided by a Shared Vision *“to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources.”*

In order to translate this shared vision into action, the NBI has launched a Strategic Action Program, which has two complementary components: 1) Shared Vision Program (SVP); and 2) Subsidiary Action Programs (SAP). The SVP includes a series of technical, socio-economic, confidence building, and training projects to be implemented basin-wide to help establish a foundation for trans-boundary regional cooperation and create an enabling environment for investments and action on the ground. The Efficient Water Use for Agricultural Production (EWUAP) is one of eight projects of the Nile Basin Initiative's (NBI) Shared Vision Program (SVP).

Agriculture, in general, while it plays a significant role in the livelihoods of households in the Nile Basin, contributing greatly to economic growth and Gross Domestic Product (GDP), it is also the main consumer of water. In addressing the common concerns and interests over water, therefore, great attention is given to the efficient use of the waters of the River Nile, on which the riparian countries rely for their basic needs and economic growth. Moreover, there is increasing pressure to reduce the amount of water allocated for agricultural production due to increasing demands from expanding urban centres, industry, mining, recreation and tourism.

It is against this background that one of the main objectives of the EWUAP Project is related to the increase of the availability of water and its efficient use for agricultural production. In this connection, the quick assessment of the agricultural sector undertaken through this study has identified constraints and areas of potential interventions and investment with respect to the theme “Efficient Use of Water for Agricultural Production”.

Agricultural Sector is still the leading sector of the economy of Tanzania, despite the rapid growth of the mining sector and accounts for over half of the GDP and export earnings. Over 80% of the poor are in rural areas and their livelihood depends on agriculture. Moreover, about 80% of the population live and earn their living in rural areas with agriculture as the mainstay of their living. It has linkages with the non-farm sector through forward linkages to agro-processing, consumption and export; provides raw materials to industries and a market for manufactured goods.

The agricultural sector has maintained a steady growth rate of over 3 percent per annum over the last decade. Although this is greater than the growth rate of the population, this rate is considered to be unsatisfactory because it has failed to improve the livelihood of the rural population, whose major occupation is agriculture. This has often resulted in localized food insecurity and hunger, which has been exacerbated by the lack of access to external resources for households.

2.0 THE POLICY FRAMEWORK

This state of food insecurity and hunger compelled the Government of Tanzania to formulate a number of strategies to guide effective interventions in the development of the agricultural sector, rural development and poverty alleviation, and which were in line with socio-economic reforms, which were adopted by the Government beginning mid-1986. These policies and strategies include the following:

Tanzania Development Vision 2025

This is a National Development Vision (2000), which will guide economic and social development efforts up to the year 2025. The overall aim of this Development Vision is to awaken, co-ordinate and direct the people's efforts, minds and national resources towards those core sectors that will enable the attainment of the country's development goals and withstand the expected intensive economic competition ahead. Its three principal objectives are: achieving quality and good life for all; good governance and the rule of law; and building a strong and resilient economy that can effectively withstand global competition. The over-arching goal of the Vision is a Tanzania of 2025, which is characterized by: (i) high quality livelihood; (ii) peace, stability and unity; (iii) good governance; (iv) a well educated and learning society; and (v) a competitive economy capable of producing sustainable growth and shared benefits.

National Strategy for Growth and Reduction of Poverty

National Strategy for Growth and Reduction of Poverty (2005) translated as *Mkakati wa Kukuza Uchumi na Kupunguza Umasikini Tanzania (MKUKUTA)*. This strategy is the development framework for the current five year phase (2005 -2010), putting poverty reduction high on the country's development agenda. It is part of Tanzania's efforts to implement its national Vision 2025. The focus is outcome orientated and organized around three clusters:

Cluster 1: Growth and reduction of income and poverty respectively,

Cluster 2: Improved quality of life and social well-being, and

Cluster 3: Governance and accountability.

It is committed to the Millennium Development Goals (MDG), as internationally agreed targets for reducing poverty, hunger, diseases, illiteracy, environmental degradation and discrimination against women by 2015. It builds on past poverty reduction papers and reviews thereof.

Joint Assistance Strategy

Joint Assistance Strategy (2004), is a coherent national development framework for managing external resources to achieve the development strategies. Set in the global context of the Rome and Paris Declarations on aid effectiveness, this initiative seeks to enhance the collaboration between Government of Tanzania (GoT) and its many development partners and deepen the impact of the relationship.

Water Policy

Water Policy (2002) sets out the direction for the water sector in achieving sustainable development and utilization of the Nation's water resources, putting special emphasis on an integrated approach to water resources management, which allows for the development and utilization of resources in ways that balance the needs of upstream and downstream users and guarantees water availability for all sectors of the economy. It thus establishes a comprehensive framework for sustainable development and management of water resources and for participatory agreements on the allocation of water for different uses. The Policy integrates principles of multi-sectoral use, treats water as a social, economic and environmental good, recognizes financing of WRM through the application of a Water User Fee, and promotes autonomy at the basin level.

Rural Development Strategy

Rural Development Strategy (2001) was part of the effort to improve the living standards of the rural people. About 80% of Tanzanian population lives in the rural areas under conditions of severe poverty.

The strategy for rural development consists of four strategic interventions:

- Promoting widely shared growth;
- Increasing opportunities and access to services;
- Reducing risks and vulnerability and
- Good governance

With regard to irrigation development, the Rural Development Strategy (RDS) proposes specific long-term objectives, which are to promote profitable irrigation infrastructure through encouragement of farmers to form irrigators' organizations, assistance for the irrigators' organizations to access credit and organization and delivery of relevant training modules for members of the farmers' organizations. Furthermore, the RDS aims to undertake research for suitable rehabilitation/improvement options for irrigation schemes to make them technically and financially more viable.

Agricultural and Livestock Policy

Agricultural and Livestock Policy (1997), since the mid-eighties, the Tanzanian economy has undergone gradual fundamental transformation that has redefined the role of the government and the private sector. Under the new environment most of the production, processing and marketing functions have been assigned to the private sector while the government has retained regulatory and public support functions.

These macro changes have and continue to have a profound impact on the agricultural sector in which, already agricultural input and output prices have been decontrolled, subsidies have been removed, and monopolies of cooperatives and marketing boards have been eliminated. These national and global macro-economic setup compelled the Government to formulate a new policy framework in which population and import demand growth rates are reconciled with food, exports crops and livestock growth rates.

Under the revised policy framework, the Government, through the Ministry of Agriculture, Food Security and Cooperatives (MAFC) has assumed a new mission of performing public sector support functions, which among others; include research, training, extension, policy formulation, information services, sanitary regulations, quality control, protection of environment, creation of optimal market conditions and promotion of agricultural growth.

The ultimate goal is the improvement of the well being of the people whose principal occupation and way of life is based on agriculture. Most of these people are small holder and livestock keepers, who do not produce surplus. Therefore the focus of this policy is to commercialize agriculture so as to increase income levels.

The National Land Policy

The overall aim of the National Land Policy (1995) is to promote and ensure a secure land tenure system, to encourage the optimal use of land resource, and to facilitate broad-based social and economic development without upsetting or endangering the ecological balance of the environment. The major theme of the policy is the conversion of land into an economic asset to which all citizens should have equal access. The implication of this philosophy is that vast economic possibilities will be opened to the masses of the rural sector, as there is enough land for every citizen capable of managing and deploying it to productive use. Within the framework of the land policy detailed rules and regulations are provided for

the use of this valuable resource and most of them are directed to the agricultural sector as well as those who depend on it for their livelihood.

Agricultural Sector Development Strategy

The Agricultural Sector Development Strategy – ASDS (2001), aims at reducing over-dependence on rainfed agriculture through rehabilitation and management of low-cost smallholder irrigation schemes including rainwater harvesting, to reduce fluctuations in production.

The primary objective of the Agricultural Sector Development Strategy is thus to create an enabling and conducive environment for improving profitability of the sector as the basis for improved farm incomes and rural poverty reduction in the medium and long-term. In terms of irrigation, the strategy seeks to encourage farmers towards integrated soil and water management by sub-soiling water harvesting and use of appropriate husbandry practices to promote optimum use of water resources. The ASDS also supported the formulation of National Irrigation Master Plan.

The ASDS is characterized by its focus on practical aspects. Its strategic approach is based on the following;

- A focus that agricultural productivity and profitability come first;
- The promotion of private sector/public sector and processor/contract grower partnerships;
- The participatory implementation of the strategy through District Agricultural Development Plans (DADP).

The ASDS proposed a target for the overall agricultural sector to grow by 5% per year on an average over the 3-year period 2005/07, which calls for, *inter alia*, the application of intensive production techniques, including irrigation.

Agricultural Sector Development Programme

The Agricultural Sector Development Programme (ASDP) was prepared by the then lead ministries in the agricultural sector: the Ministry of Agriculture and Food Security (MAFS), the Ministry of Cooperatives and Marketing (MCM), the Ministry of Water and Livestock Development (MWLD) and the President's Office - Regional Administration and Local Government (PO-RALG) after the completion of the ASDS in October 2001. The ASDP is a five-year rolling programme and will be revised and updated annually.

The ASDP documents 22 sub-programmes for implementation. The sub-programme entitled Irrigation and Water Management is under the theme of Public and Private Roles in improving Supporting Services to reduce climatic risks of crop failure due to droughts and allow better crop intensities to ensure sustainable crop production and productivity. The National Irrigation Master Plan (NIMP) is considered as one of the four priority interventions in this sub-program.

Environmental policy

The overall objectives of the National Environmental Policy (1997) are:

- To ensure sustainability, security and equitable use of resources for meeting the basic need of the present and future generations without degrading the environment or risking health or safety;
- To prevent and control degradation of land, water, vegetation, and air which constitute our life support systems;
- To conserve and enhance our natural and man-made heritage, including the biological diversity of unique ecosystems of Tanzania;
- To improve the condition and productivity of degraded areas including urban and rural settlements in order that all Tanzanians may live in safe, healthy, productive and aesthetically pleasing surroundings;

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- To raise awareness and understanding of the essential linkages between environment and development, and promote individual and community participation in environmental action; and
- To promote international co-operation on the environmental agenda, and to expand our participation and contribution to relevant bilateral, sub-regional, regional, and global organisation and programmes, including implementation of treaties.

To meet many of the objectives outlined in these policies it is important to maintain sustainable agricultural production and environmental conservation, which calls for research in irrigation development and in water harvesting technologies, particularly for community managed irrigation, in order to increase availability of water and water productivity.

3.0 OVERVIEW OF THE AGRICULTURAL SECTOR

Agricultural production in Tanzania is dominated by smallholder farmers (peasants) cultivating on average farm sizes of between 0.9 hectares and 3.0 hectares each. About 70 percent of Tanzania's crop area is cultivated by hand hoe, 20 percent by ox plough and 10 percent by tractor. It is rainfed agriculture. Food crop production dominates the agriculture economy where 5.1 million ha are cultivated annually, of which 85 percent is under food crops. Women constitute the main part of agricultural labour force. The major constraint facing the agriculture sector is the falling labour and land productivity due to application of poor technology, dependence on unreliable and irregular weather conditions. Both crops and livestock are adversely affected by periodical droughts.

Irrigation holds the key to stabilizing agricultural production in Tanzania to improve food security, increase farmers' productivity and incomes, and also to produce higher value crops such as vegetables and even flowers. This report discusses irrigation in more detail under Chapter 4.

3.1 Urban Agriculture

Urban agriculture has flourished as a household – level initiative to cope with economic hardships encountered as a result of the rising cost of living. Urban agriculture that consists of raising and growing of vegetable and food crops is found in and around Tanzanian towns and cities where there is a ready market for products of urban agriculture. Producers of vegetables, milk, broilers' meat and eggs sell to private households and to schools, hotels, hospitals, bars, cafeterias and restaurants.

3.2 Agricultural Performance

Agricultural GDP has grown at 3.3 percent per year since 1985, the main food crops at 3.5 percent and export crops at 5.4 percent per year. The overall GDP growth target for halving abject poverty by 2010 is in the range of 6-7 percent (MAFC/TCCIA).

The macro economic reforms have had and continue to have significant impact on the agricultural sector. The economic reforms have led to the opening up of the sector to private investment in production and processing, input importation and distribution and agricultural marketing. In line with its policy, the Government has devolved itself from most of production, processing and marketing functions, leaving them to the private sector. The Government has retained regulatory and coordination functions, or facilitation role and creation of a conducive environment for the private sector to flourish and become the engine of the national economy.

Rain-fed agriculture

Agriculture in Tanzania is predominantly carried out by smallholder farmers (peasants) who cultivate on average farm sizes of between 0.9 hectares and 3.0 hectares per household. About 70 percent of Tanzania's crop area is cultivated by hand hoe, 20 percent by ox-plough and 10 percent by tractor. It is rain-fed agriculture. Food crop production dominates the agriculture economy with 5.1 million hectares cultivated annually, of which 85 percent is under food crops (MAFC/TCCIA). Women constitute the main part of agricultural labour force.

Land productivity is low due to application of poor technology and dependence on unreliable and irregular weather conditions, with both crops and livestock being adversely affected by periodical

droughts. One third of Tanzania receives less than 800 mm of rainfall and is thus arid or semi-arid. Only one-third of the rest of the country has precipitation of above 1,000 mm.

The major staples include: maize, sorghum, millet; rice, wheat, pulses (mainly beans), cassava, potatoes, bananas and plantains. The following are the main export crops: coffee, cotton, cashewnut, tobacco, sisal, pyrethrum, tea, cloves, horticultural crops, oil seeds and spices, and flowers.

Irrigation holds the key to stabilizing agricultural production in Tanzania to improve food security, increase farmers' productivity and incomes, and also to produce higher valued crops such as vegetables and even flowers.

As far as crop marketing is concerned, farmers are free to sell their crops to cooperatives or private traders. Input supply has also improved as a result of private traders' involvement. Farmers are no longer confined to a single source for their essential inputs for crops and livestock. There are some snags experienced here and there due to dishonesty by some traders, but the Government is keeping oversight over these malpractices.

Cognizant of the pivotal role of the agricultural sector, both in terms of economic growth and poverty reduction and the strong influence of factors outside the sector such as infrastructure, rural financial services, land ownership and good governance, the Government has set itself a number of priority areas for action, including:

- The pursuit of macroeconomic policies that will motivate investment in agriculture by small holders and large – scale commercial farmers.
- Creation of an enabling environment and provision of proactive support to private operators, farmers' organizations, NGOs and CBOs supplying inputs and credit to small farmers and ensuring a strong regulatory mechanism.
- Concentration of budgetary allocations in agricultural research and extension.
- Provision of special support to investments in agricultural processing, particularly in fruits and vegetables and according top priority to implementation of new Land Act.

Some examples of good practices by NGOs

Following the opening of the door for the creation of nongovernmental organizations in the early 1990s by the Tanzanian government, several NGOs were formed at the community level to work on sustainable agriculture. These NGOs have operated in the field and accumulated valuable experiences that can be replicated in other areas of the country. A few of these NGOs are discussed below.

HEM Trust Fund

HEM Trust Fund is an NGO based near the town of Himo, in Moshi District, close to Mt Kilimanjaro. HEM, which stands for Himo Environmental Management, focuses on improving the livelihoods of small-scale farmers in the three districts around Mt Kilimanjaro: Moshi, Hai and Rombo. Its work involves managing and protecting the natural resources (land, water and vegetation) in these areas, introducing ways to improve small-scale farms, and promoting income-generating activities such as beekeeping, fish farming, poultry, dairy cows, tree nurseries and biogas production. The organization was officially registered in 1998 but has been working in the area since the early 1990s. HEM is involved in the following types of activities:

- **Tree nurseries** This helps individuals, groups of farmers and institutions such as schools and churches to start tree nurseries. They can grow seedlings of fruit trees and fodder species to plant themselves or to sell to others;
- **Improved stoves** This promotes the use of energy-saving wood stoves among the farmers. The aim is to reduce the number of trees cut for fuel, and to reduce the amount of time women have to spend fetching firewood.;
- **Furrow rehabilitation** Farmers have a traditional system that leads water from rivers into their fields to irrigate vegetables and other crops. HEM is helping improve this system by lining the canals with cement, so reducing the amount of water lost and allowing farmers to produce up to three crops a year; and
- **Soil and water conservation** It promotes soil and water conservation measures to boost soil fertility and increase productivity and farmers' income (see below).

HEM promotes these activities in various ways, including training and demonstrations on farmers' fields. HEM has a regular training program offering short courses to farmers on the topics listed above, as well as other new technologies.

Soil and water conservation

This is HEM's biggest and most important type of activity. The NGO promotes various soil and water conservation technologies:

- **Contour farming** – ploughing and growing crops along the contour rather than up and down the slope;
- **Grass strips** – planting grass strips to break the flow of water down the slope;
- **Mixed cropping** – planting a mix of crops to protect the soil from heavy rain and to maintain soil fertility;
- **Crop rotation** of maize, tomatoes, and nitrogen-fixing legumes such as groundnuts and beans to prevent the build-up of pests, diseases and weeds, to improve the soil structure and to maintain fertility;
- **Mulching** – using crop residues to protect the soil surface, prevent erosion and conserve moisture in the soil;
- **Fanya juu** – a trench dug along the contour, with the soil piled into a ridge upslope to control water flow, prevent erosion, and encourage the natural formation of terraces. The ridges are planted with grass and trees to stabilize them. *Fanya juus* are useful on gentle to moderate slopes of up to 8% gradient;
- **Terracing** – moving large amounts of soil to form a series of flat terraces suited for irrigation. Terraces are appropriate for steeper slopes, up to 13% gradient.
- **Check dams** – barriers across a gully or stream to slow down the flow of water, so preventing further erosion.

All these technologies aim to reduce erosion, conserve and improve the soil fertility, and keep water in the soil where crops can use it. To use the conservation techniques correctly, farmers have to know how steep the slope is: steeper slopes mean terraces or *fanya juus* have to be closer together. They also have to mark out contour lines so they can plough along the contour, plant grass strips, or construct *fanya juus* or terraces. HEM teaches them how to use a spirit level to measure the slope and mark out contours. It also teaches how to use the various soil and water conservation techniques.

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The farmers do all the work themselves. HEM provides training, technical support, advice, and an initial set of planting materials such as fodder tree seedlings and grass seeds, and lends equipment such as spades and spirit levels. It does not provide any form of payment.

For more information: contact HEM Trust Fund, hemtrustfund@kicheko.com

CHEMA

CHEMA stands for Community Habitat Environmental Management. It is a development arm of the Catholic Diocese of Rulenge. The Diocese operates in the three districts of Karagwe, Ngara and Biharamulo, in the Kagera region of northwestern Tanzania. CHEMA promotes the proper use of natural resources and locally available materials through:

- Community participatory planning and action;
- Training on watershed management, low external-input sustainable agriculture, afforestation, Beekeeping and seed security for sustainability;
- Internal inspections of certified organic farms.

CHEMA trains groups of farmers on low-external-input sustainable agriculture: three groups of 25 farmers in Ihanda, and two groups of 20 farmers in Nkwenda. Each training course included several 2-day modules, each consisting of a day of theory and a day of practice. The modules were spread out to allow farmers to implement what they had learned before going on to the next one. The modules were;

- **Soil fertility**, including composting and the use of cover crops to fix nitrogen.
- **Integrated pest management** This included biological, cultural, physical and sanitary measures. For example, the biological measures covered the use of neem leaves, hot pepper, garlic and ash to control pests;
- **Soil and water conservation** measures, including contour farming;
- **Agro-forestry**, including how to start a tree nursery; and
- **Crop management**, including intercropping, using farmyard manure and compost, mulching, and double-row planting.

Further information may be obtained at chema@satconet.net

PELUM-Tanzania

PELUM **stands** for “Participatory Ecological Land Use Management”. PELUM-Tanzania was formed to enable them to come together to facilitate learning, networking and advocacy in sustainable agriculture. The network feeds various experiences into a more strategic process to influence rural development. PELUM-Tanzania is one of the ten country working groups of the Participatory Ecological Land Use Management (PELUM) Association, which covers East, Central and Southern Africa. The PELUM Association was founded in 1995 with 25 members, and it now has more than 160 member organizations throughout the region. PELUM-Tanzania was formed in 1995 as the Tanzanian branch of the regional association. It was officially registered as a Trust Fund in 2002. Currently PELUM-Tanzania has 33 member organizations, most of which work in various aspects of sustainable agriculture throughout Tanzania. It facilitates learning, networking and advocacy in promoting sustainable agriculture, the rational use of natural resources, household seed and food security, and sustainable rural communities. It is an associate member of the Regional network called 'PELUM Association' which is a network of civil society organisations operating in East, central and Southern Africa to facilitate effective learning and advocacy in participatory land-use management.

PELUM-Tanzania's work includes capacity building, documenting and communicating information, networking of farmers' organizations, advocacy, as well as gathering and analyzing information on markets in Tanzania. The sections below describe each of these activities in turn.

One of the projects coordinated by PELUM-Tanzania is Prolinnova Tanzania. Prolinnova stands for PROMoting Local INNOVation. Prolinnova Tanzania aims to build the capacity of network members and partners in the field of Participatory Innovation Development, create a platform for communication and documentation, facilitate networking of farmer innovators and facilitate advocacy work for the protection of genetic resources. Prolinnova Tanzania partners include MVIWATA, the national farmer network, the Ministry of Agriculture, Food Security, the Sokoine University of Agriculture, the Cooperative College Moshi, INADES-Tanzania and many other NGOs.

Further information on PELUM-Tanzania may be obtained from the Country Programme Coordinator at info@pelumtanzania.org. The postal address is P. O. B 54, Dodoma, Tanzania.

3.3 Agro – Ecological Zones (AEZ) and Farming Systems

Due to variations in climatic and agro-ecological conditions, different crops are grown under different farming systems. The major staples include: maize, rice, wheat, sorghum, millet, pulses (mainly beans), cassava, potatoes, bananas and plantains.

The important export crops are: coffee, cotton, cashew nut, tobacco, sisal, pyrethrum, tea, cloves, horticultural crops, oil seeds, spices and flowers.

The following Agro – Ecological Zones can be distinguished:

- Coastal plains
- Eastern plateaus and mountain blocks
- Southern Highlands
- Northern rift zone and volcanic highlands
- Central plateau
- Rukwa – Ruaha rift valley
- Inland sedimentary
- Ufipa and
- Western highlands

Within these agro-ecological zones, ten different farming systems are practised. Please note that the areas belonging to Lake Victoria Basin are marked blue. These include: banana/coffee/horticulture system, found in *Kagera*, Kilimanjaro, Arusha, Kigoma and Mbeya regions; maize/legume system, in Rukwa, Ruvuma, Arusha, *Kagera*, Shinyanga, Iringa, Mbeya, Kigoma, Tabora, Tanga, Morogoro, Kahama, *Biharamulo*, *Kagera and Shinyanga*. In some of these areas this system is intercropped with beans and groundnuts.

Another farming system is the cashew/coconut/cassava system of coast region; eastern Lindi and Mtwara. The rice/sugar cane system is found in alluvial river valleys and plains while the sorghum/bulrush millet/livestock system is found in Sukumaland, i.e. Shinyanga and *Rural Mwanza*. Other crops grown under this system include maize, cotton, oilseeds and rice.

The tea/maize/pyrethrum system is found in Njombe and Mufindi districts in Iringa region. The system also includes the following other crops: irish potatoes, beans, wheat, wattle trees and sunflower. The cotton/maize system is wide spread, covering the following regions: *Mwanza, Shinyanga Kagera, Mara, Singida, Tabora, Kigoma, Morogoro, Coast, Mbeya, Tanga, Kilimanjaro* and Arusha. Other crops grown under this system are sweet potatoes, sorghum and groundnuts. Livestock rearing is also widespread under this system.

The horticulture based system is found in Lushoto district, Morogoro Rural, Morogoro region and Iringa rural in Iringa region. Crops under this system include vegetables, (cabbages, tomatoes, sweet pepper, cauliflower lettuce and indigenous vegetables) and fruits, (pears, apples, plums, passion fruits and avocado. Maize, coffee, Irish potatoes, tea and beans are also grown in this system.

The last two systems are the wet – rice and irrigated system, found in river valleys and alluvial plains of Kilombero, Wami, Kilosa, Lower Kilimanjaro, Ulanga, Kyela, Usangu and Rufiji, and the pastoralists and agro-pastoralist system practiced in semi-arid areas i.e. Dodoma, Singida, parts of Mara and Arusha, Chunya districts, Mbeya and Igunga district in Tabora.

3.4 Investment opportunities

These are based on the Government's intention to sell off state owned processing industries and large production farms as well as the holding parastatals.

Other potential Investment opportunities include:

- Establishing farm machinery and equipment plants
- Operating tractor hire centres
- Establishing ox training centres
- Establishing training institutes
- Establishing research centres
- Developing human & animal power technologies
- Operating agriculture mechanization centres
- Provision/training of extension experts
- Agriculture researchers
- Establishing agricultural information centres

3.5 Support services and information dissemination

While the Government still has responsibilities for delivering specific services to the farmers, it has been encouraging and advocating for the involvement and participation of the Private Sector, either independently or in collaboration with the Government. These services include; research, training, extension services, seed multiplication & marketing, procurement, distribution and marketing of other farm inputs.

3.6 Constraints to agricultural production

The following are mentioned as the major constraints to agricultural production in Tanzania. They are listed in four broad categories.

Technology development and transfer

Assessment of Agricultural sector in the Nile basin of Tanzania

- Poor crop and animal husbandry practices
- Continued use of hand tools by the majority of producers
- Continued dependence on rain-fed agriculture
- High cost and unreliable supply of modern inputs

Extension services

- Low staff motivation due to low remuneration and lack of supervision
- Weak links between research, extension and the farmer
- Lack of training on new crops and technologies

Infrastructure

- Poor transport and communication infrastructure
- Limited access to financial services

Agricultural marketing

- Few functional marketing organizations, with the collapse of the unions
- Lack of value-adding at farm or village-level
- Limited information about prices and quality requirements

4.0 AGRICULTURE IN THE LAKE VICTORIA BASIN

The Lake Victoria Basin in Tanzania comprises the regions of Kagera, Mara, Mwanza and Shinyanga. While the last three regions are major growers of cotton, the Kagera region is characterized by the banana/coffee/horticulture system. A few years back coffee was introduced in Mara region as well. Mara, Mwanza and Shinyanga regions are also famous for cattle rearing.

Other crops grown in the basin include maize, rice, sugar, tea and horticultural products. It is estimated that agricultural activities in the Lake Victoria Basin – both crop production and livestock-rearing employ some 75 % of the workforce.

4.1 Crop production in Lake Victoria Basin of Tanzania

The Ministry of Agriculture, Food Security and Cooperatives publishes the Basic Data Booklet, which provides basic data on the performance of the agricultural sector in the country. It contains data on area, production and yield for food and cash crops, agriculture and the domestic economy, rainfall, and agricultural input. It also has information on information on crop prices.

Table 1 gives some statistics about the production of selected main food crops within the Lake Victoria Basin of Tanzania by region. The figures are used to indicate the magnitude of crop production, and hence the importance of the Basin in terms of agricultural potential. Just a few crops have been picked for illustrative purposes.

5.0 IRRIGATION DEVELOPMENT

Although agriculture in general and food production in particular in Tanzania largely depends on rain-fed agriculture, the Country is endowed with a huge potential for irrigation development.

5.1 Irrigation Potential

It is estimated that the Country has 29.4 million hectares (ha) of land suitable for irrigated agriculture out of which 2.3 million ha have high development potential, 4.8 million ha have medium development potential and the remaining 22.3 million ha have low potential (NIMP 2002).

There are extensive floodplains, which are suitable for irrigated agriculture, especially for rice cultivation. They include the extensive Maasai and Wembere Steppe, Usangu Plains and the Rukwa, Rufiji (Kilombero Valley and Lower Rufiji), Kagera and middle Malagarasi River basins.

Tanzania's endowment of natural resources includes 40 million ha of cultivable land, abundant sources of water and several agro-ecological zones, which permit virtually unlimited expansion and diversification in crop production, and in particular the development of irrigated agriculture, including development rice and cash crop production. These resources have the potential to contribute significantly to the stabilization and sustainable agricultural production, increase income and to rural poverty reduction.

5.2 Current status of irrigation development

Cognizant of the contribution of irrigated agriculture to the improvement of farm incomes, attaining food self sufficiency and rural poverty reduction in the medium and long-term, a National Irrigation Master Plan (NIMP) was prepared in 2002. The plan projected that irrigated area can be increased from the current 264,000 ha (June 2006) to about 405,400 ha projected in year 2017, (see Table 2) out of the high potential area of 2.3 million hectares. It also emphasizes on the improvement of technologies applied for implementation of irrigation development projects in the country, including such improvements in irrigation infrastructure, improvement in production practices, water management and adoption of new technologies for irrigation.

A greater part of irrigation schemes use surface irrigation and are owned by smallholders, using lined and unlined canals, furrows and basins. Sprinkler irrigation is used by few large-scale commercial farmers. Drip irrigation is rarely used except on pilot schemes run by the Irrigation and Technical Services Division (DITS) of the Ministry of Agriculture, Food and Cooperatives. Almost all irrigation water on the mainland is surface water. Surveys conducted under the auspices of the NIMP indicate that groundwater is utilized on only 0.2% of all irrigated areas.

An inventory conducted by the NIMP in 2002 indicated that there were 1,428 irrigation schemes in the country, out of which 1,328 were smallholder schemes, 85 private schemes and 15 government-managed schemes. About 3% of the total area is covered by small schemes with an area of less than 50 ha each, while 58% is covered by schemes of over 500 ha each.

Gravity-fed irrigation schemes account for over 99% of the irrigated area, while the rest use pumps for water abstraction.

Table 2: Projected Irrigation Development Areas in hectares

Projected Irrigation Development	Short Term	Medium Term	Long Term
	2003-2007	By 2012	By 2017
(a) Rehabilitation of Traditional Irrigation Schemes	179,800	216,100	274,600
(b) Development of Water Harvesting Schemes	41,600	57,200	68,200
(c) New Irrigation Schemes	43,800	51,600	62,600
Total	265,200	324,900	405,400

Source: NIMP (2002)

Community-managed irrigation

Irrigation in the form of traditional irrigation schemes goes back hundreds of years in the country. There is evidence to show that between 1700 and 1890 traditional irrigation was practised in a number of regions, including Arusha, Iringa, Tanga, Mwanza, Shinyanga, Kilimanjaro, Mbeya Morogoro and Ruvuma. Traditional irrigation schemes have, however, deteriorated and become inadequate due to increase in population, wear and tear, and catchment degradation.

A greater number of community-managed irrigation schemes are managed by Water User Associations (WUA), which are responsible for operation and maintenance, including water scheduling and planning and supervision of canal cleaning.

The main irrigated crops are paddy and maize, accounting for about 48% and 31% respectively of the irrigated areas in 2002. Other irrigated crops account for 44% of the irrigated areas; these are beans, vegetables including onion, tomato and leaf vegetables, bananas and cotton. The cropping intensity is 123%.

Public – Private managed irrigation

The Government has been implementing irrigation schemes in semi arid and arid areas using rainwater harvesting technologies, particularly through the construction of dams. These schemes include the Smallholder Irrigation Development Project for Marginal Areas (SDPMA) and the Participatory Irrigation Development Project (PIDP). Private irrigation schemes produce cash crops such as tea, coffee, cashew and sugarcane.

In terms of technology, it is worth noting that the Government has been advocating the use of low cost irrigation technologies like drip irrigation, through training of farmers and irrigation technical staff in the country and abroad. In the long run it is anticipated that these technologies will find wider application, leading to higher productivity and greater agricultural production in the country. With regard to research, the government has already launched an irrigation research programme that will be used to conduct experimental trials and field demonstrations to farmers in the country.

5.3 Current status of irrigation in Lake Victoria Basin

The Lake Victoria Basin on the Tanzanian side covers substantially four regions namely Kagera, Mara, Mwanza and Shinyanga. The potential areas for these regions are as shown in table 3. In this regard, the

irrigation potential for the Lake Victoria basin is 5.52 million ha, with the following irrigation potential levels:

- High irrigation potential – 485,300 ha
- Medium irrigation potential – 1,016,000 ha
- Low irrigation potential – 4,020,800 ha

Table 3: Irrigation potential of Lake Victoria Basin

S/N	Region	High Pot. Area (ha)	Med. Pot. Area(ha)	Low Pot. Area (ha)	Total (ha)
1	KAGERA	96,300	59,000	1063,200	1218,500
2	MARA	210,100	576,500	123,400	910,000
3	MWANZA	98,500	165,000	1013,000	1276,500
4	SHINYANGA	80,400	215,500	1821,200	2117,100
TOTAL		485,300	1,016,000	4,020,800	5,522,100

There have been several studies undertaken to identify interventions in various schemes in this basin. The priority schemes among the high potential areas are as shown in table 4.

The study on construction costs of irrigation schemes have shown the rate of investment to be in the range of 2500 US\$/ha – 4500 US\$ / ha, depending on the extent of intervention (partial or full).

Table 4: Priority irrigation schemes in Lake Victoria Basin

S/no	Scheme	District	Area (ha)	Remarks/comments
1	Katunguru	Sengerema	910	Cereal production
2	Bugando	Mwanza	534	Cereal & horticultural crops
3	Bugorola	Ukerewe	200	Irrigation near the confluence of two rivers, supplemented by pumping from L. Victoria
4	Simiyu-Duma Valley	Magu	6000	Source will be R. Magogo, Moama and L. Victoria
5	Magogo Valley	Kwimba	3300	
6	Isanga Valley	Kwimba	2000	
7	Bugwema	Musoma	1600	
8	Geita plains	Musoma	2000	
9	Mara Valley	Musoma	6000	Large scale sugar scheme
10	Suguti Valley	Musoma	1500	
11	Manonga/Wembere	Kahama	70000	Diversion from Smith South
12	Biharamulo	Biharamulo	3000	
13	Nkono-Ikamba swamps	Bukoba	8000	
14	Kashasha Valley	Karagwe	3500	
15	Kabale Valley	Karagwe	2000	

Agriculture in Tanzania has been greatly affected by vulgarism of weather. This being the case, irrigated agriculture ensures contribution towards stable production, hence addressing poverty reduction scenarios and food security. In this case, there should be effort to support the development of the outlined schemes as the investment on them will bring substantial impact on productivity and profitability.

5.4 Institutional Framework

Organizations involved in irrigation development are the central government, the local governments, the private sector, NGOs, and local villages. The major actors at the central level include the Ministries of Planning, Economy and Empowerment; Regional Administration and Local Government; Finance; Agriculture, Food Security and Cooperatives; Water; Lands and Human Settlements Development.

Coordination mechanisms for the relevant organizations are necessary, but no comprehensive system has yet been established.

The Irrigation Section is at present one of three sections belonging to the Irrigation and Technical Services Division of the Ministry of Agriculture, Food Security and Cooperatives. Considering the importance of irrigation development for economic development and poverty alleviation in the rural areas and the number of actors involved, particularly the sectoral ministries, the present institutional position of the Irrigation and Technical Services Division of the Ministry of Agriculture, Food Security and Cooperatives seems appropriate to coordinate and harmonize the different organizations involved in irrigation development.

The establishment of the Central and Basin Water Boards was another step towards harmonization, control and management of water resources in the country. In addition to the Central Water Board, there are currently nine (9) designated River Basins in the country: Ruvu/Wami Basin; Pangani Basin; Rufiji Basin; Lake Nyasa Basin; Lake Rukwa Basin; Ruvuma/Lukuledi/Mbemkuru Basin; Lake Natron/Manyara/Eyasi Basin; Lake Victoria Basin; and Lake Tanganyika Basin.

The responsibility for managing the water resources of the country lies with Ministry of Water (MW). Water resources management involves water resources development, water allocation, pollution control and environmental protection. Before the 1990s water was managed by MW on the basis of administrative regions. Since the early 1990s the emphasis has changed to managing water resources on the basis of river basins. Even the river basin management component of the River Basin Management and Smallholder Irrigation Improvement Project (RBMSIIP) in the Rufiji and Pangani basins was implemented along these lines by the MW. The project, the implementation of which began in December 1996 and was completed in 2004, was intended to deal effectively with water management problems and improve the efficiency of smallholder irrigation.

At scheme level, Irrigators' Organizations (IOs), or Irrigators' Groups (IG), have been formed from the early 1990s. They are expected to become the main actor in the irrigation sector, representing part of the private sector. As such it is very important that their capacities are enhanced through adequate training and extension support as well as availing them with inputs and credit support. Their organizations should also be strengthened in terms of management.

Different institutions are involved in the areas of water harvesting, community managed irrigation, and private/public managed irrigation systems. The levels of involvement of the different institutions depend on their roles, mandates and responsibilities as well as on the capacities within them, which determines their effectiveness in fulfilling their obligations. In this respect institutions may be distinguished between those having direct and indirect involvement in the areas of water harvesting, community managed irrigation, and public/private managed irrigation.

In addition to the above mainly government related institutions, there are a number of non-governmental institutions with programmes in the agricultural sector and with the Tanzanian part of the Lake Victoria Basin. These include the academic and research institutions like SUA, IRA and Ukiriguru, as well as NGOs such as INADES, Open Knowledge Network, Oxfam GB & Ireland, VECO, Concern Worldwide, Phelum and MS Tanzania. The last five have formed a Working Group with the following objectives;

- Advocate for a pro poor and conducive policy environment where CSO and Private Sector effectively engage with and influence Government policies and practices.
- Effective analysis of existing policies and provide alternative views/directions.
- Provide a platform for learning, sharing, networking and coalition building around best practices and key issues.
- And last but not least: Render institutional capacity support to the two farmer organizations in the Working Group.

5.5 Challenges and Constraints to Irrigation Development

Different studies and reports have identified a number of Challenges and Constraints to Irrigation Development in the country. Several national Project Cycle Management (PCM) workshops were held in 2002 to review these challenges and constraints. It has been established that they are related to insufficient ownership; insufficient institutional capability; and inadequacy in technology and finance. More specifically they relate to the following:

- Farmers' organization
- Application/adoption of research findings
- Broader participation
- Information management and dissemination
- Economic and financial issues, including investment in irrigation development

These issues are discussed briefly below.

Farmers' organization

Water Users' Associations (WUA) are not performing very well due to inadequate training in organizational management and scheme operation and management, a result of inadequate budgetary allocation for facilitation/extension services in irrigation sub sector. There is a need for effective support system to WUAs' activities.

Application/adoption of research findings

Research findings on agronomic packages, crop/water consumption relationships, on-farm water management principles and appropriate crop varieties and variety mix are not adopted by farmers at the rate that would enhance the productivity of irrigated agriculture. This has been exacerbated by the lack of a feedback system on the lessons learnt through actual experience in implementation of irrigation projects.

Broader participation

There has been limited involvement and participation of Non Governmental Organizations (NGOs), Community based Organizations (CBO) and the Private Sector due to a variety of reasons, including capacity limitations on their part. There has also been a lack of human resources and active participation of Local Government Authorities (LGA) in irrigation development.

Research and academic institutions have inadequately kept pace with development of cost effective irrigation technologies, particularly for use by smallholder farmers. Private sector actors would greatly benefit from requisite training. In view of the great number of actors involved in irrigation development in one way or another, there is need for close collaboration and coordination. However, no mechanism no comprehensive system has yet been established for this purpose.

Information management and dissemination

The Government has established a database for information on irrigation development activities. There is need for further financial support to ensure that the database is used effectively for information management and dissemination. This also applies to the availability and use of guidelines and manuals in planning, design and construction supervision.

Economic and financial issues, including investment in irrigation development

The key issues include: poor cost recovery for O&M; inadequate public funds and cost recovery from users; low financial capability for proper irrigation O&M; inadequate credit schemes as sources of funds for farmers; absence of incentives for efficient water use.

Irrigation development requires injection of appreciable financial resources. It is important to put in place favourable credit facilities that can be accessed by the private sector, including smallholder farmers.

5.6 Challenges and Constraints to Water Harvesting

Rainwater harvesting (RWH) is the process of collecting, concentrating, storing and improving the productive use of rainwater and reducing unproductive loss. This often involves collecting rainwater from a catchment area and channelling the runoff and using it to increase the water available in a relatively smaller growing area. RWH reduces the risk of rain-fed farming in arid and semi-arid areas. There is evidence that adoption of RWH in semi-arid areas can contribute to poverty eradication through the reduction of poor people's vulnerability to the effects of poor and unreliable rainfall distribution. The adoption of RWH is limited by a number of challenges and constraints, including:

Inadequate capacity

The shortage of water in semi-arid and arid areas is not caused by low rainfall as often perceived but, rather by a lack of capacity for sustainable management and use of the available rainwater. The most critical management challenge is how to deal with the poor distribution of rainwater leading to short periods of too much water and flooding, and long periods of too little water. Most of this water is not accessed and put to beneficial use. It is left to evaporate or flow into saline sinks or further to the seas and oceans.

Sustainable income and profitability is among the most important incentives for investing in any technology. Therefore, to improve effectiveness and profitable use of rainwater and other resources available in semi-arid and arid areas, these two aspects should be emphasized. Improvement of the management of rainwater has a vital role in the reduction of livelihood and enterprise risks caused by climate variability.

Inadequate support

Although in some areas of Tanzania, RWH is already widely practised, it needs support from formal organizations (government and NGOs) for its further technical development and geographic spread. The support should include farm visits and on-farm demonstrations together with dissemination of a range of knowledge-sharing information products.

Weak research-development linkage

There is poor adoption of effective techniques and technologies for RWH due to weak links between research and farmers or communities. Comprehensive communication, covering all stakeholders who have roles in the uptake and scaling-up processes is important.

6.0 FINDINGS AND RECOMMENDATIONS

The review has identified a number of constraints afflicting the agricultural sector in general. These will need to be addressed in order to enhance the effectiveness and profitability of investments in the sector. This will in turn attract further investments, leading to even greater contribution of the sector to the development of the overall economy and better living conditions for the population.

6.1 General constraints

Table 5 summarizes some the constraints that have been identified with respect to rain-fed agriculture, irrigation and rainwater harvesting. The actual constraints accrue from the absence, poor understanding, inadequate application and/or provision of the listed factors.

Table 5: Constraints to rain-fed agriculture, irrigation development and rainwater harvesting

Constraints	Rainfed agriculture	Community irrigation	Public/private irrig.	Rainwater harvesting
Principles of formation and management of Irrigators' Organizations		XXX	XX	
Irrigation scheme leadership in the villages		XXX	X	
Principles of irrigation planning and design		XXX	XX	XX
Financial management and reporting systems	X	XXX	XXX	XX
Gender issues, consideration and mainstreaming	XXX	XXX	X	XX
Conflict resolution and management in the schemes	XX	XXX	XXX	XX
Limited capital and access to credit	XXX	XXX	XXX	XXX
Information management facilitation services to the IOs		XXX	XX	XX
Preparation of project documents	X	XX	XXX	XX
Operation and Maintenance of the irrigation schemes		XXX	XXX	XXX
Water management/distribution services		XXX	XX	XX
Surveying using modern equipment		XX	XXX	X
On site construction training		XXX	XX	XXX
Inadequate capacity	XX	XX	X	XXX
Inadequate support	XX	XXX	X	XXX
Weak research-development linkage	XXX	XXX	X	XXX

Other more general constraints to the agricultural sector include the following (see also Section 3.6):

- Poor rural infrastructure, which limits farmers' access to markets for inputs and products
- Low investment in the sector both government and private sector.
- Decline in the use of improved seed, fertilizers and agrochemicals.
- Volatile and unpredictable international markets.
- Dependence on erratic rains for agricultural development
- HIV/AIDS and malaria threats that are eroding the country's manpower.

It is observed that a good number of constraints cut across the sub-thematic areas under review, albeit to different levels of intensity, and thus affecting the agricultural sector as a whole. As mentioned above, these factors become constraints when they are absent, not well understood and therefore wrongly or poorly applied – or not applied at all. The proposed recommendations are thus geared towards creating the necessary capacities to control effectively and efficiently the above mentioned factors, with a view to minimising their adverse impacts on while maximizing their positive contributions to the production systems.

According to the Implementation Completion Report (ICR) for the River Basin Management and Smallholder Irrigation Improvement Project (RBMSIIP), it has demonstrated that it is possible to increase agricultural productivity and irrigation efficiency simultaneously; and that an investment of approximately \$ 2,000 per hectare in upgrading small-scale irrigation schemes using participatory methods, when coupled with adequate agricultural advice, can bring a measurable improvement in the welfare of smallholders at acceptable rates of return.

It has further been demonstrated that limited but targeted investments in irrigation and drainage infrastructure improvement can provide an adequate incentive in terms of increased productivity as a “carrot “ to encourage farmers to reduce water wastage and to consider the water demands of other users.

It is therefore strongly recommended to seize the opportunity that has been created through the implementation of the RBMSIIP to further the development of irrigation in the country. In this connection, the following are the areas that are recommended for further consideration in terms of irrigation development.

The intervention areas recommended below are based on the findings of various studies and reports, including the Irrigation Technical Needs Assessment Report of January, 2007, in terms of constraints to the development of irrigation schemes in the country. The study recommends practical training / capacity building to the districts and communities, especially those implementing the irrigation projects, in the disciplines described below. They include actions to be considered at grassroots level to increase greater awareness and understanding on the urgent need for efficient water use and/or improved productivity.

Other intervention areas will include: studies to identify and demonstrate effective cost recovery mechanisms to finance irrigation O&M; developing and strengthening water users’ associations for irrigation system O&M; rehabilitation of irrigation infrastructure to reduce water losses; promote efficient crop selection and management practices.

6.2 Constraints to Community Managed Irrigation

The following are listed in different reports as the major constraints vis-à-vis community irrigation developments in the country:

- Principles of formation and management of Irrigators’ Organizations;
- Irrigation scheme leadership in the villages;
- Principles of irrigation planning and design;
- Financial management and reporting systems;
- Gender issues, consideration and mainstreaming; and
- Conflict resolution and management in the schemes;

These issues are discussed in more detail below.

Principles of formation and management of Irrigators’ Organizations

Inadequate farmer participation, focus on physical works, and insufficient clarity about the status of the systems and responsibility for management have been typical of the organizational culture of government-led small-scale irrigation development in the country. The formation of Irrigators’ Organizations is aimed at addressing these anomalies.

An Irrigators' Organization (IO) is very simply a group of irrigators, who pool their financial, technical, material, and human resources together for the operation and maintenance of an irrigation scheme. It is led by elected officials and has a mechanism for handling disputes, both internal and external. It may collect fees for maintenance of the scheme and the water source.

Cooperation will enhance harmony and facilitate wise decision making, especially when all users are involved. For instance, some crops need less water than others. If the IO members are aware of this then they can rationally release water to different farmers based on actual need and optimize the efficient use of the limited water. Such decisions are best made at scheme level rather than centrally.

Irrigators' Organizations are also needed because building and maintaining irrigation systems requires large amounts of money which must be pooled among farmers. A healthy IO, which is built on a participatory bottom-up concept, will result in better lives and working conditions for all its members.

The IO also have responsibilities beyond management of the irrigation scheme, these include organization of input supply and marketing of farm produce.

Other benefits include more water reliability, greater responsiveness to crop needs, quick dispute resolution on the local level, well-maintained canals, less water theft, and empowerment through participation, which creates a greater sense of ownership and interest.

Recommendation

It is recommended that the Irrigation and Technical Services Division of the Ministry of Agriculture, Food Security and Cooperatives and District Authorities should facilitate the formation of strong and effective Irrigators' Organizations (IOs), based on good governance principles of democracy, accountability and openness. Once formed, these IOs should be enabled to function effectively through various capacity building programmes.



Plate 1: Main Canal at Madibira irrigation scheme

Irrigation scheme leadership in the villages

The need for a system of water management arises from the nature of the resource. Since water supply is limited decisions must be made regarding its allocation to a number of farmers without creating conflicts in water use. In this regard it is important for the IOs to work closely with the Village Government Leaderships in the allocation of water as very often the same resource will also be required for other uses, including domestic and livestock requirements. It is thus important to have effective management structures in which clear lines of responsibility and accountability are expressed.

Recommendation

Experts from the districts need to extend technical assistance to both the IOs and village leaderships in leadership skills. The extension services may also be out-sourced from the private sector.

Principles of irrigation planning and design

Although irrigation waters may be used for other purposes, the principal aim of irrigation schemes is to supply supplementary water in order to meet the water requirements of growing plants in a manner that is socially, economically and environmentally sound. This requires the engagement of multi-disciplinary teams, comprising experts in water management, crop sciences, soils, engineering, economics and sociology working closely together. These experts would need to have skills in working with rural communities to define problems, identify solutions, develop and implement projects in a participatory manner. The ultimate aim is to construct irrigation systems that allow high cropping intensity and a well functioning infrastructure that permits and guarantees water availability.

Different manuals exist on principles of irrigation planning and design. They should be consulted accordingly. Where appropriate, sections of the design manuals may be translated into Kiswahili for better understanding of the content and in order to enhance farmers' participation in the design process. The actual design work will be carried out by the District Facilitation Teams, with necessary out-sourcing as appropriate and necessary.

Recommendation

It is recommended that requisite capacity should be built at the district level to enable the district to extend assistance in planning and design of irrigation works and for supervision of construction works. The capacity relates to training and provision of equipment and facilities.

Financial management and reporting systems

Financial expenditures and revenues constitute an important indicator of performance of any enterprise, including irrigation schemes. They indicate the likelihood or otherwise of the investment made being able to realize a positive return and at what level, and whether corrective interventions are necessary and at what stage or component. Financial management and reporting systems are thus a useful management tool in irrigation system management. It is therefore important to track these figures from construction to operation and maintenance, keeping good records all along.

With financial data available it is possible to show the profitability of the irrigation systems, and thus convince farmers to sustain and even improve the productivity of irrigated agriculture through the mobilization of their own local resources.

Recommendation

The members of the Irrigators' Organizations will need training in basic financial record keeping or book keeping. This can be done through the District Facilitation Teams and/or in cooperation with Cooperative Department. For this purpose simple formats of data collection sheets should be developed and used by the members of the Irrigators' Organizations.

Gender issues, consideration and mainstreaming

Irrigated agriculture has a number of gender dimensions, which should be taken into consideration right from design. When the irrigation scheme is for production of food crops, as is the case in most small scale community projects, the project may lead to increased work load for women because in many communities, women are usually the food producers. This was clearly demonstrated by the Women in

Agriculture (WIA) project (1988), which assessed the impact of irrigated rice production on, *inter alia*, the status of women's work load.

Recommendation

Awareness raising campaigns for both men and women should be conducted with regard to the gender implications of the planned projects. Communities should be facilitated to explore measures necessary to address any imbalances that may occur as a result of implementing the projects, such as introducing new techniques to simplify food processing and preparation.

Conflict resolution and management in the schemes

Use of the scarce resource water is often associated with conflicts amongst the users. It is therefore important to put in place clear rules and mechanisms for Conflict-resolution. Such rules and mechanisms will include specific provisions in the statutes of the Irrigators' Organizations as well as informal arrangements embedded in socially acceptable norms and behaviour. The existing national regulations may also be invoked in case of major conflicts, e.g. those involving several Irrigators' Organizations and/or village communities. There are broad pieces of legislations for regulating water use and management in Tanzania, including the Water Utilization (Control and Regulation) Act No. 42 of 1974 as amended by Act No. 10 of 1981, and written Laws (Miscellaneous) Act No. 17 of 1989 and General (Regulations) Amendment. Other relevant legislations exist, including International River Basin Treaties.

Recommendation

All members of the Irrigators' Organization should be made aware of relevant existing and new legislations with regard to water management and use. They should also participate in the formulation of relevant bye-laws and other mechanisms of conflict-resolution.

6.3 Constraints to Public Private Managed Irrigation

The public private irrigation (large scale) category of irrigation schemes has also been encountering a number of constraints. To a large extent, these constraints are similar to those that the community irrigation schemes are confronted with, although there are some more specific ones. Generally, the following are the major constraints of this category:

- Principles of formation and management of Irrigators' Organizations;
- Principles of irrigation planning and designs;
- Information management facilitation services to the IOs;
- Preparation of project documents;
- Operation and Maintenance of the irrigation schemes;
- Water management/distribution services;
- Financial management and reporting systems;
- Surveying using modern equipment (Total Stations);
- On site construction training; and
- Conflict resolution and management.

The section below discusses those category specific constraints. For the ones that are similar to category I, i.e. community irrigation, please refer to this section.

Preparation of project documents

Large scale irrigation schemes involve the preparation of elaborate and detailed project Documents, which form the basis for preparation of detailed engineering designs, negotiation of management contracts, and financing arrangements. The preparation of these documents requires the work of skilled and experienced personnel, usually working in a multi-disciplinary team. Well written Project Documents form a sound basis for project implementation. They contribute to less time and effort spent, increased cost savings, reduced project risks, more efficient monitoring, better supplier management, and higher staff performance.

Project documents spell out project objectives, goals and/or expected outcomes; project components, including training and civil works; specific activities inputs and outputs; target beneficiaries; financial and other input requirements, including financing arrangements or sources of funds; implementation and management arrangements and schedules; environmental and socio-economic impacts, if any, and mitigation measures.

Recommendation

It is important to have well prepared project documents. The preparation of project documents is one of those activities, which lend themselves to out-sourcing, including from the private sector.

Operation and Maintenance of the irrigation schemes

Lack of proper operation and maintenance is an overriding cause for the malfunctioning of many irrigation schemes. The fundamental causes for the poor performance operation of an irrigation system include:

- lack of technical skills in planning, implementing and monitoring the system;
- poor man-management, i.e. corruption, conflicts between farmers, lack of incentive for the operational personnel to do a good job; and
- technical deficiencies in the physical system due to poor maintenance or faulty design.

In the operation and maintenance of an irrigation scheme, there is a multitude of activities and functions which must be carried out in order to enable the scheme to meet its capability as designed and constructed and on a sustainable basis.

Recommendation

It is important to prepare operational manuals, which, in addition to specifying the detailed procedures on which estimates of water supply and demand should be built up, should also contain effective methods of monitoring project performance and the performance of field staff. The manuals will assist in carrying out the following three main types of maintenance, namely:

- routine or normal maintenance, which includes all work necessary to keep the irrigation system functioning satisfactorily and is normally done annually;
- special maintenance, including repairs of damage caused by major disasters, such as floods, earthquakes and typhoons; and
- deferred maintenance, including any work necessary to regain the lost flow capacity in canals, reservoirs and structures when compared to the original design. It often includes large modifications to the canal system and structures arising from important changes (cropping patterns, drainage problems, etc.) that have occurred in an irrigation scheme.

Water management/distribution services

The following are the main water distribution methods:

- **On-demand:** Water is available to the farmer any time that the intake or hydrant is opened. Therefore the amounts to be used are not limited but water consumption is usually metered and paid for by cubic metre. These are high cost systems, which need a high level technology in the construction and maintenance.
- **Semi-demand:** Water is made available to the farmer within a few days (generally 2-7 days) of his request. The amount is often limited to a certain volume per hectare.
- **Canal rotation and free demand:** Secondary canals receive water by turns, for example every 7 days, and once the canal has water farmers can take the amount they need at the time they wish.
- **Rotational system:** Secondary canals receive water by turns and the individual farmers within a given canal area receives the water at a pre-set time and generally in a limited quantity.
- **Continuous flow:** Throughout the irrigation season, the farmer receives a small but continuous flow that compensates the daily crop evapotranspiration.



Plate 2: Canal and crossing structure at Madibira irrigation scheme

Recommendation

A water distribution method should be determined, based on local conditions as well as social, technical and economic considerations. The water distribution method is normally a function of the design of the conveyance system.

The aim of optimizing the water management and distribution services is to achieve integrated water resources management (IWRM), which will ensure that there are effective and mutually agreed arrangements to use the water on a sustainable basis and for the benefit of all stakeholders.

A potential study and research area with regard to efficient water management and distribution services will relate to the recent study findings (FAO) vis-à-vis the use of a comprehensive conceptual framework, *involving the consideration of a series of sequential steps, covering both physical and biological processes, which begins with the hypothetical water drop(s) and ends with the plant (or animal) biomass produced for human use.*

This framework can be used to examine levels of efficiency along any single pathway of agricultural water use; to assess the potential improvements that may be achieved in various parts of the pathway and their impact on the overall efficiency; and to aid in the optimal allocation of resources for the improvements. It also involves an assessment of the role of biotechnology, i.e. improving the efficiency

of water use in agriculture through genetic manipulation and the use of micro-organisms (as bio fertilisers and for wastewater treatment).



Plate 3: Transplanting exercise at Madibira irrigation scheme

Surveying using modern equipment (Total Stations)

The use of modern survey equipment and instruments will tremendously increase the efficiency of survey teams. For example the Real Time Kinematic system (RTK), when used in conjunction with the GPS (RTK-GPS) will speed-up the work of survey teams considerably and facilitates data acquisition and transfer, leading to a reduction of about 50% of the job time when compared with the traditional method. Using the RTK system accompanied with GIS data-logger reduces the time and cost and cancels many stages in cadastre production.

It is strongly recommended to acquire these instruments for use by the district facilitation teams and by the staff of the Irrigation and Technical Services Division of the Ministry of Agriculture, Food Security and Cooperatives. The staff should be trained in the use of these equipment.

Recommendation

District survey teams should be equipped with the state-of-the-art survey equipment and facilities to facilitate the survey work.

6.4 Constraints to Water Harvesting

Inadequate capacity

The shortage of water in semi-arid and arid areas is not caused by low rainfall as often perceived but, rather by a lack of capacity for sustainable management and use of the available rainwater. The most critical management challenge is how to deal with the poor distribution of rainwater leading to short periods of too much water and flooding, and long periods of too little or no water. Most of this water is not accessed and put to beneficial use.

Recommendation

The farmers should be trained in efficient water use methods. Farmers should be enabled to use water more *effectively and profitably* rather than leaving it to evaporate or flow into saline sinks or further to the seas and oceans. This ability is best obtained through practical on-farm demonstrations. Improvement of the management of rainwater has a vital role in the reduction of livelihood and enterprise risks caused by climate variability.

Inadequate support

Although in some areas of Tanzania, RWH is already widely practised, little technical support is extended to farmers by professionals and other bodies.

Recommendation

For further technical development and geographic spread of rainwater harvesting, government agencies and NGOs should extend technical support to farmers. The support should include farm visits and on-farm demonstrations, together with dissemination of a range of knowledge-sharing information kits.

Weak research-development linkage

There is poor adoption of effective techniques and technologies for RWH due to weak links between research and farmers or communities. Comprehensive communication, covering all stakeholders who have roles in the uptake and scaling-up processes is important.

According to the findings of the SUA/DfID RWH research programme, access to multiple sources of information on RWH was found to be one of the key factors in its adoption by farmers, and in the capacity of field-level service providers and policy-makers and planners to be pro-active in supporting RWH development.

Recommendation

In order to enhance research uptake, the design and conduct of research on RWH should therefore build in a strong communication component, which should also provide for a strong linkage between research and policy dialogue. Communication materials, including posters, booklets and manuals are important for reference and use in extension work. Adequate funding should be provided to meet these requirements.

Another key aspect in the implementation of the research programme is the establishment of an impact monitoring and evaluation system at household level. Farm visits and on-farm demonstrations are effective tools for improving farmer and extension agent awareness on RWH.

7.0 PROJECT CONCEPT NOTE

This Chapter discusses what should be done in future to improve the agricultural sector in the country. This basically covers the requirement of addressing the constraints identified under Chapter Five and the implementation of the recommendations put forward under Chapter Six.

The following have been identified as the major constraints to the development of agriculture in the country.

- Poor rural infrastructure, which limits farmers' access to markets for inputs and products
- Low investment in the sector by both government and private sector.
- Decline in the use of improved seed, fertilizers and agrochemicals.
- Volatile and unpredictable international markets.
- Dependence on erratic rains for agricultural development
- HIV/AIDS and malaria threats that are eroding the country's manpower
- Lack of access to credit facilities
- Weak research-development linkage

Examples of specific interventions are summarized in the sections that follow.

7.1 Rural infrastructure improvement programmes

The Government should embark on rural infrastructure improvement programmes for farmers' to access markets for inputs and products. This calls for significant increases in government budgetary allocations for rural roads and other communications infrastructure. Local governments, the private sector and villages should also be encouraged to invest in this area.

7.2 Availability and use of improved seed, fertilizers and agrochemicals

The Government should ensure timely procurement and distribution of adequate quantities of improved seed, fertilizers and agrochemicals. In this regard, the Government needs to closely monitor the implementation of its policy of liberalizing the procurement, distribution and marketing of these products to ensure that it realizes the desired objectives.

7.3 Dissemination of market information

The government and other relevant agencies should conduct market research and feed farmers with the necessary market information in a timely manner.

7.4 Improving research-development linkage

The government should work on improving links between research and farmers or communities, through comprehensive communication, covering all stakeholders who have roles in the uptake and scaling-up processes. It is highly recommended that practical training / capacity building to the districts and

communities should take place through field demonstrations and experimental trails that can easily change attitudes and mind sets of farmers through hands-on observations.

7.5 Development of irrigated agriculture

In order to exploit the existing irrigation potential and decrease the Country's dependence on erratic rains for agricultural development, the Government should encourage the development of irrigated agriculture, particularly by communities and the private sector, including individual farmers. The Government needs to ensure conducive environment for this process, including for example negotiating with banks to extend credits for irrigation development.

Other measures that are necessary of the development of irrigated agriculture are discussed in detail in Chapter Six.

7.6 Disease control

It has been observed that HIV/AIDS and malaria threats are eroding the country's manpower, including the farming community. Existing disease control programs, particularly for HIV/AIDS and malaria should therefore be strengthened and their coverage expanded to include services to the farming communities in rural areas.

7.7 Establishment of farm service centers

The Government should work with the private sector towards the establishment of farm service centers to facilitate farmers' access to appropriate technology and equipment to increase the work efficiency and reduce the manual labour drudgery.

8.0 NATIONAL CENTRES OF EXCELLENCE

For integrated water resources development in the country adequate and well trained manpower is a necessary prerequisite. There are a number of institutions of higher learning that train professionals in Water Resources and Environmental Engineering. They include: the University of Dar es Salaam (UDSM), the University College of Lands and Architectural Studies (UCLAS), Sokoine University of Agriculture (SUA), and the Rwegalulira Water Resource Institute. The latter train water technicians and has a major role to play in water resources development in the country.

These institutions are potential centres of excellence in water resources management, including irrigation, in the country. There are also a number of national institutions offering diploma and certificate courses, including Ministry of Agriculture Training and Research Institutes at Ukiriguru in Mwanza; Mlingano in Tanga; Uyole and Igurusi in Mbeya; Naliendele in Mtwara; Maruku in Kagera and Tumbi in Tabora.

8.1 University of Dar es Salaam

The University of Dar es Salaam has a **Department of Water Resources Engineering**, which is part of ANSTI (The African Network of Scientific and Technological Institutions), a network charged with:

- Establishing communication with Sub-Saharan focused researchers in Water Resources Engineering & Management.
- Establishing a database on Water Resources Engineering Management expertise available in Institutions affiliated to ANSTI and details about their research project.
- Organizing conferences, research and training activities for member institutions within the Water Resources Engineering Management field.

The Department of Water Resources Engineering of UDSM was established in July 1982. The Department conducts undergraduate courses and studies as well as MSc. and Ph.D. studies. It has various research programmes, and offers consultancy services. In 1992 its curriculum was revised by taking on hydrological and environmental subjects. For more details please visit their website at: www.wrem.udsm.ac.tz/about.html

The Institute of Resources Assessment (IRA) of the University of Dar es Salaam deals with resource use and management in the country. IRA enhances sustainable capacity in human, financial and physical resources in order to excel in quality research, teaching and service provision to the community in natural resources management; and further IRA's image as a centre of excellence in knowledge creation and skills development at postgraduate level.

The overall objective of the Institute is to focus and address the whole question of sustainable development in line with environmental and policy changes that have taken place over time.

8.2 University College of Lands and Architectural Studies (UCLAS)

UCLAS is a constituent college of the University of Dar es Salaam. It conducts examinations for, and grants degrees, diplomas, certificates and other awards of the University. Since 1981/82 the College has been offering a degree course in Environmental Engineering, a four year programme leading to the award of a Bachelor of Science in Environmental Engineering (B. Sc. EE).

8.3 Sokoine University of Agriculture (SUA)

Sokoine University of Agriculture (SUA) was started in 1964 as an agricultural college offering diploma in agriculture. It was elevated to a faculty of agriculture in 1969 under the University of Dar es Salaam, offering two programmes: one leading to a diploma in agriculture, the other one leading to award of B. Sc Agriculture. It was elevated to a fully fledged university and renamed as Sokoine University of Agriculture after the late Edward Sokoine who was Prime Minister of Tanzania.

The university has 4 faculties (Agriculture, Forestry and Nature Conservation, Veterinary Medicine and Science) and 2 institutes, namely the Institute of Continuing Education (ICE) and the Institute of Development Studies (DSI). It also has a Directorate of Research and Postgraduate Studies (DRPGS).

The university's offerings that amongst others are relevant for the purpose of this assignment include degrees in Agriculture, Agronomy, and Agricultural Engineering. The university also offers training leading to awards of master of sciences and PhD in the respective fields of Agriculture.

Others are the Computer Centre, Sokoine National Agricultural Library (SNAL), SUA Centre for Sustainable Rural Development (SCSRD), and SUA Pest Management Centre (SPMC). The University offers undergraduate training, leading to the awards of degrees in BSc (Agriculture General), BSc (Agronomy), BSc (Home Economics and Human Nutrition), BSc (Horticulture), BSc (Animal Science), BSc (Food Science and Technology), BSc (Agricultural Engineering), BSc (Agricultural Education and Extension), BSc (Agricultural Economics and Agribusiness), BSc (Aquaculture), BSc (Forestry), BSc (Wildlife Management), Bachelor of Veterinary Medicine (BVM), BSc (Biotechnology and Laboratory Sciences), BSc (Environmental Sciences & Management), and BA (Rural Development).

The University also offers postgraduate training leading to the award of Master of Science and PhD in the respective fields of Agriculture, Agricultural Economics and Agribusiness, Food Science, Human Nutrition, Forestry, Management of Natural Resources and Sustainable Agriculture (MNRSA), Veterinary Medicine, Preventive Veterinary Medicine (MPVM), and Rural Development.

SUA has a research motto, which emphasizes adaptive research and on-farm testing as the key elements in the transfer of knowledge, and in solving problems afflicting the rural communities of Tanzania.

9.0 TRAINING OBJECTS/MODEL SCHEMES

In addition to regular professional training at institutions of higher learning, the trained manpower will need objects and facilities for practical hands-on training and demonstrations. There are a number of on-going irrigation projects, or centres of best practices in the country that can be used for this purpose. They include:

- Bahi irrigation scheme for Water Harvesting;
- Mombo irrigation scheme for Community Irrigation, and
- Madibira irrigation project for Public Private (large scale) Irrigation.

9.1 Bahi Irrigation Scheme

Bahi Wetland lies in Dodoma rural and Manyoni District in Dodoma and Singida regions respectively in central Tanzania. It is located within the Eastern Rift valley, which extends from the North in Manyara region, through Singida and ends in Dodoma region. Administratively Bahi swamp extends in Manyoni and Dodoma rural districts in Singida and Dodoma regions respectively. It covers an area of 125,000 ha and extends between latitudes 05°51' and 06°20' South and longitudes 34°59' and 35°21' East. The altitudes vary between 823 and 838 m a.m.s.l.

Bahi wetland receives water from various seasonal rivers, which consist of Bubu River occupying about 54% of the catchment area. The other major rivers draining into the wetland include Mponde, Lawila and Nkojigwe Rivers. Major rivers originate from the northern part of the catchment in Mbulu and Babati highlands. The wetland acts as an inland lake and has no outlet.

The communities around Bahi Wetland are entirely depending on agricultural activities, which include irrigation in the east and south, and rainfed agriculture. Other activities include fishing during wet season, livestock keeping, and salt mining. Although agriculture is the main source of income and food, it has several problems like unreliable rainfall, dependency on seasonal Rivers, soil salinity and lack of capital and knowledge. Lack of credit facilities for the communities reduces the purchasing power of inputs for crop production, which could lead to higher outputs. The area is experiencing semi arid type of climate.

The Bahi irrigation scheme is located in Bahi wetlands. The scheme operates using RWH technology to produce rice. The project has two main components.

The first component of the project was initially started with a pilot project of 20 ha in 1982 under funding from FAO/USAID. It has been expanded by farmers by themselves and now covers an area of about 550 ha.

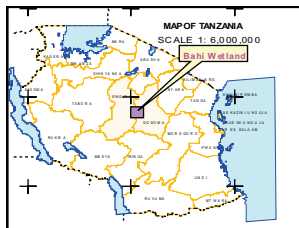
The second component is a 150 ha area which was funded by IFAD in 1990. These two components are adjacent to each other and the beneficiaries are the villagers at Bahi although some non-residents from as far as Dar es Salaam and Dodoma have farms in the village. It is considered to be one the successful RWH schemes that can be used for training and demonstrations.

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Plate 4: O & M of the canal (cleaning exercise) and rice harvesting at Bahi irrigation scheme

BAHI WETLAND



9.2 Mombo Irrigation Scheme

Mombo irrigation scheme, see Map 1, is located in the Lower Mkomazi valley in Korogwe district, Tanga region, with coordinates of 40 55'S and 38 17'E. The irrigation scheme commands a net irrigable area of 220 ha. The Soni River, which originates from the Usambara Mountains in Lushoto district, provides the water resource for the scheme.

Mombo Irrigation Scheme is close to the small town of Mombo, which is in Korogwe district. It started as a project in 1967. In 1979 the scheme was given assistance by the German International Development Agency, Deutsche Gesellschaft Fur Technische Zusammenarbeit (GTZ) and in 1980 plots were assigned to individual farmers and in the same year the scheme was registered as a Cooperative Society.

The scheme was rehabilitated in 1979 and was operating fairly satisfactorily until 1993 when a major flood event in the region (with a return period in excess of 1 in 200 years) caused major damage to a number of irrigation schemes in the locality. During this flood the diversion weir and intake to the Mombo scheme were washed away and the Soni River changed its course and started flowing down the alignment of the Mombo main canal. A massive quantity of sediment was carried into the scheme area causing partial or total siltation to many of the canals and drains, as well as significant damage to structures. At this model scheme, the Irrigation Technical Teams had demonstrated on how the technology is transferred to one another through farmer-to-farmer extension.



Plate 5: Paddy cultivation and Intake structure for Mombo irrigation scheme

9.3 Madibira Irrigation Project

The Madibira irrigation project is located in Usangu plains, Madibira ward, Madibira Division in Mbarali district of Mbeya region. It is about 68 km from Mafinga town and 83 km from Rujewa town of Mbarali district. The project uses gravity water from Ndembera and Mwima Rivers. Madibira Phase I of the project which had 3,000 ha is producing over 15,000 tonnes of paddy.



Plate 6: Paddy cultivation at Madibira farm

The project is expanding to irrigate the whole potential area of 6,600 ha without constraining the water resources. In this aspect, both the dam and river are planned to augment flows for the project area.

Madibira Phase I farm gets its power through diesel powered generators which have proven to be a very expensive endeavour. The completion of Madibira Phase I motivated more farmers in and around Madibira irrigation farm to practice rice farming.

Madibira Phase II irrigation project commenced in 1997 and was completed in 2000 which has command area of 3,600 ha. The project is operated in private entity status as the farmers have established Irrigators' Organization which takes control of farm operation and maintenance (O & M) of the project.

The project was constructed by the government and handed over to private sector under smooth transfer of management from public/government to a private entity. The management of the farm successfully reverted to a private entity with full smallholder participation.



Plate 7: Irrigation bunds and canal at Madibira irrigation scheme

10.0 CONCLUSION

The review has identified a number of constraints afflicting the agricultural sector in general; and which need to be addressed by the EWUAP project in order to enhance the effectiveness and profitability of investments in the sector. These general constraints to the agricultural sector include the following:

- Poor rural infrastructure, which limits farmers' access to markets for inputs and products
- Low investment in the sector both government and private sector.
- Decline in the use of improved seed, fertilizers and agrochemicals.
- Volatile and unpredictable international markets.
- Dependence on erratic rains for agricultural development.
- HIV/AIDS and malaria threats that are eroding the country's manpower.

In addition to the above mentioned general constraints, the study has also identified a number of more specific constraints with regard to community managed irrigation developments in the country. They include the following:

The following are listed in different reports as the major constraints vis-à-vis community irrigation developments in the country:

- Principles of formation and management of Irrigators' Organizations;
- Irrigation scheme leadership in the villages;
- Principles of irrigation planning and design;
- Financial management and reporting systems;
- Gender issues, consideration and mainstreaming; and
- Conflict resolution and management in the schemes;

The EWUAP project will need to facilitate the Irrigation and Technical Services Division of the Ministry of Agriculture, Food Security and Cooperatives and District Authorities to extend technical assistance to communities in order to overcome the above mentioned constraints and as detailed out in Chapter Six.

It has been demonstrated that it is possible to increase agricultural productivity and irrigation efficiency simultaneously; and that an investment of approximately \$ 2,000 per hectare in upgrading small-scale irrigation schemes using participatory methods, when coupled with adequate agricultural advice, can bring a measurable improvement in the welfare of smallholders at acceptable rates of return.

It has been observed in this study that public private irrigation (large scale) category of irrigation schemes has also been encountering a number of constraints; which, to a large extent are similar to those that the community irrigation schemes are confronted with, although there are some more specific ones. The additional major constraints specific to this category include:

- Preparation of project documents;
- Operation and Maintenance of the irrigation schemes;
- Water management/distribution services;
- Surveying using modern equipment (Total Stations); and
- On site construction training.

Again, strategies for addressing these constraints have been elaborated upon in Chapter Six. They include:

- The preparation of good project documents, an activity which lends itself to out-sourcing, including from the private sector;
- The preparation of operational manuals for project management and monitoring of project performance;
- Optimizing the water management and distribution services; and
- Equipping district survey teams with the state-of-the-art survey equipment and facilities to facilitate the survey and design work.

Rainwater harvesting initiatives have also been facing a number of constraints, which the EWUAP project will need to address as elaborated in Chapter Six. They include:

- Lack of capacity for sustainable management and use of the available rainwater;
- Little technical support is extended to farmers;
- Weak links between research and farmers or communities.

The EWUAP project should facilitate professionals and other bodies to extend technical support extended to farmers, in addition to building the farmers' own capacity for sustainable management and use of the available rainwater. In order to enhance research uptake, the design and conduct of research on RWH should therefore build in a strong communication component, which should also provide for a strong linkage between research and policy dialogue.

11. BIBLIOGRAPHY

- Council of Ministers of Water Affairs of the Nile Basin States. Nile Basin Shared Vision Program. 2001. Efficient Water Use for Agricultural Production – Project Document.
- DfID. 1990 – 2005. Natural Resources Systems Programme. Eastern Africa: Rainwater harvesting and management.
- Ehab NABIL NASSIF. 2002. A Radical Solution for the Cadastre Problem in Egypt Using Integrated GPS-GIS System. Washington.
- ESRF. 1997. A Framework for a National Irrigation Policy and the Economic and Social Implications for Future Irrigation Development Programmes in Tanzania, Economic and Social Research Foundation,
- FAO. Coping with water scarcity in developing countries: What role for agricultural biotechnologies?
- FAO. 1986. Organization, operation and maintenance of irrigation schemes - FAO irrigation and drainage paper 40. Rome.
- Government of Tanzania, FAO/UNDP. 1988. for Women in Irrigation Agriculture Project. Tanzania.
- Government of Tanzania, Ministry of Agriculture, Food and Cooperatives (MAFC). 2003. Agricultural Statistics.
- Ismail Mwaka, *et al.* 1999. Tanzania Study Country Report. Water Law, Water Rights and Water Supply (Africa). Cranfield University at Silsoe.
- Mahoo, H.F. 2005. Improvement of soil fertility management practices in rainwater harvesting systems. Final Technical Report for project R8115. Morogoro, Tanzania: Soil Water Management Research Group, Sokoine University of Agriculture.
- Merrey, D. J. 1996. Institutional design principles for accountability in large irrigation systems. Research Report 8. Colombo, Sri Lanka: International Irrigation Management Institute (IIMI).
- Ministry of Agriculture, Food Security and Cooperatives. 2007. Rapid Baseline Assessment (Technical Report).
- Ministry of Foreign Affairs, Sweden. 2004. Strategy for Swedish support for poverty reduction and sustainable development in the Lake Victoria Basin 2004-2006.
- Ministry of Planning, Economy and Empowerment. National Strategy for Growth and Reduction of Poverty (NSGRP) or MKUKUTA, Dar es Salaam. 2005
- National Irrigation Committee. Tanzania Country Profile.
- National Planning Commission. 2000. The Tanzania Development Vision 2025, Dar es Salaam.
- Nuhu Hatibu. 2007. Rainwater Management: Strategies for Improving Water Availability and Productivity in Semi-arid and Arid Areas
- Tanzania Chamber of Commerce, Industry and Agriculture (TCCIA). Tanzania Country Profile.
- Water user associations from **WIKIPEDIA** – *The Free Encyclopaedia*.
- World Bank. 2004. Implementation Completion Report No: 30929: River Basin Management and Smallholder Irrigation Improvement Project, Tanzania.

11.0 ANNEXES

Annex : Policy recommendations and strategies for improving the Tanzanian irrigation sector

ESRF / Economic and Social Research Foundation (ESRF), Tanzania, 1997.

Policy recommendations within the irrigation sub-sector:

- Sensitise policy-makers and stakeholders on the importance of irrigation
- Establish an autonomous National Irrigation Council
- Establish a National Irrigation Research Unit, which should ultimately become a data bank on irrigation activities
- Form water users' associations or irrigation co-operative societies to manage irrigation schemes
- Involve the stakeholders at all stages of irrigation project development and implementation
- Contract out major irrigation construction works to the private sector
- Strengthen the irrigation development supervisory capacity through specialised training and motivation of irrigation personnel
- Channel all external donor funds for irrigation projects to a "National Irrigation Fund" rather than to or through the Treasury in order to create a better framework for accountability
- Promote individual bore hole pump systems including the domestic manufacture of affordable water pump generating sets for irrigation purposes
- Introduce water service charges as a way of mobilising internal financial resources for financing irrigation schemes
- Enact laws which will enable individual to own land in order to enhance the productivity of land and of water utilisation for irrigation
- Speed up rural electrification to drive irrigation schemes
- Promote self-help schemes in ground water development to provide reliable water supplies for irrigation
- Improve rural roads in order to ameliorate accessibility of irrigators
- Restructure and privatise irrigation systems presently under public sector ownership and ownership
- Empower women to own land and to form their own farmers' organisations in rural areas
- Define more clearly the role of Donor Agencies and NGOs in the irrigation sub-sector
- Promote farmers' associations in production, distribution and financial activities in rural areas

Other recommendations (from the National Irrigation Masterplan - NIMP)

- Urgent Commencement of NIMP Implementation
- Urgent Need of Strengthening the Irrigation Section
- Legal Framework Strengthening for Irrigation Development
- Arrangement of Financial Resource for NIMP Implementation
- Irrigation Development in River basin Management
- Need of Inter-sectoral Coordination

Performance Indicators as per NIMP

Expected long-term outputs of the project and associated indicators are:

- An enhanced enabling environment for sustainable watershed management and increased productivity by improved watershed management. Key indicators are the number of improved watershed management activities identified and implemented and the related increase in productivity.
- An enhanced enabling environment for community-managed irrigation development and increased agricultural production. Appropriate performance indicators related to this output include the number of options for community-managed irrigation development towards increased agricultural production.
- A review of options for reform in publicly managed irrigation and implement appropriate pilots implemented that demonstrate improved system performance. This includes exploration of options for irrigation development. Performance indicators for this output will include the number of options for publicly managed irrigation reform towards improved system performance and increased reliability of water supply reviewed and piloted.

Annex : Possible Project Themes Based on Country Reports

- Formulate and implement appropriate government policies
- Enhance participation of water users and other private sector in development and management of water resources for
 - agriculture
- Promote capacity-building programs, both for government and private sector institutions
- Identify and evaluate options for more efficient utilization of rainfall and runoff in upper catchment areas
- Identify options for improving the productivity of rain-fed agriculture, and for decreasing year-to-year variation in production
- Identify and evaluate options to reduce water losses in irrigation systems
- Identify and promote options for enhancing quality of natural resources by addressing environmental problems of deforestation, soil erosion and sedimentation, salinity, etc.
- Identify options for decreasing water consumption in the agricultural sector.

Annex : Issues identified by the E WUAP Project Document

The Efficient Water Use for Agricultural Production Project Document identifies the following issues to be addressed in the development of irrigation in Nile Basin countries:

Technical/ Environmental

- Excessive deforestation of catchments and resulting soil erosion
- Inadequate management of watersheds: rainfall/small streams not well utilized; excessive use of agro-chemicals; deforestation and soil erosion
- Low and erratic productivity of rain-fed agriculture
- Inadequate irrigation system O&M
- Low performance of irrigation
- Mismanagement of irrigation, leading to excessive water use and losses
- High sedimentation in irrigation systems
- Increasing soil salinity
- Degradation of water quality due to urban discharges; inadequate development and use of wetlands

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- Inadequate data.

Institutional

- Low capacity of government institutions
- Low institutional capacity to address technical, institutional, and financial aspects of efficient agricultural water use
- Insufficient departmental coordination; inadequate government support services (extension, research, etc.)
- Inadequate trained personnel
- Inadequate research and extension
- Inadequate information and data for planning
- Insufficient water user/community and private sector participation in irrigation
- Low participation of water users in irrigation system O&M
- Lack of ownership rights in irrigation systems.

Economic/Financial Issues

- Poor cost recovery for O&M
- Inadequate public funds and cost recovery from users
- Low financial capability for proper irrigation O&M
- Inadequate credit sources for farmers
- Absence of incentives for efficient water use

Improved Community-Managed Irrigation Development

- Development of small-scale irrigation by harvesting rainfall and water from streams
- Identification of strengths and weaknesses of public and private sectors in promoting and supporting local community-based efforts
- Promoting private sector and local community roles in agriculture and water resources development, including formation of water users' associations
- Formulate and implement policy reforms that provide incentives for efficient and sustainable use of land and water resources (water use fees, cost recovery mechanisms, etc.)
- strengthening performance monitoring, data collection, and its use in planning and management of natural resources
- Improving agricultural land and water management in the wetlands
- Identifying proper drainage and irrigation infrastructure
- Develop and implement laws that define land ownership and procedures for using wetlands, and
- Train farmers in the use of wetlands for agriculture

Annex : Main Issues and Strategic Options Suggested in the Tanzania Country Report

Issues

- Low management capacity
- Increased demand and pollution of water resources
- Inadequate data for proper planning and management
- Inadequate trained personnel

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- Low performance of irrigation due to inappropriate design, aging infrastructure and inadequate O&M
- Deforestation of catchments, resulting in soil erosion and sedimentation in canals
- Low financial capability for proper irrigation O&M Absence of incentives for efficient water use
- Low participation of farmers

Interventions

- Improve Water Resource Management
- Strengthen government capacity
- Better data collection and use in planning
- Develop small-scale irrigation Rehabilitate aging irrigation infrastructure
- Empower WUAs Provide appropriate legal base, including cost recovery for O&M
- Build financial capability of WUAs
- Promote better watershed management
- Promote forestation through community participation
- Decentralization of authority to local government level and community.

Annex 5: Comments from the Stakeholder Workshop on the Draft RBA Report

The Following were the main comments on the Draft RBA Report made by participants at the National Stakeholder Workshop held on 5th April, 2007 in Dar es Salaam.

- The Rapid Baseline Assessment Report have not covered the whole sector of agriculture in Tanzania including the Agricultural Sector Development Programme and its strategy and funding mechanism
- The RBA report shows that the selected three (3) irrigation schemes of best practices all of them are outside the targeted Lake Victoria basin area – at least one should be within the basin
- Due consideration should be given to matters of farm power availability
- While the majority of Irrigators Associations are weak, it should be noted that in some schemes they are missing altogether
- There is need to promote participatory planning, monitoring and evaluation
- All three model/training schemes are outside the Lake Victoria Basin – at least one should be within the basin
- Technical skills are not totally lacking – they are rather inadequate
- There is need to promote technology that increases production per drop of water

It was agreed to give participants one week to read the report and submit comments to the NPC for onward transmittal to the Consultant.

Annex 6: Terms of Reference for the Consultancy

EFFICIENT WATER USE FOR AGRICULTURAL PRODUCTION (EWUAP) PROJECT

TERMS OF REFERENCE (TOR) FOR NATIONAL CONSULTANT RAPID BASELINE ASSESSMENT TO COMPLEMENT COUNTRY REPORTS BY COLLECTING ADDITIONAL INFORMATION AND IDENTIFYING OPPORTUNITIES AND NEEDS RELATED TO THE EXCHANGE OF BEST PRACTICES IN WATER HARVESTING, COMMUNITY MANAGED IRRIGATION, AND PUBLIC/PRIVATE MANAGED IRRIGATION.

1.0 BACKGROUND

The Nile riparian countries, realizing their common concerns and interests over water have made agreements towards cooperation by establishing the Nile Basin Initiative (NBI). The NBI is guided by a Shared Vision *“to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources.”* In order to translate this shared vision into action, the NBI has launched a Strategic Action Program, which includes two complementary components: 1) Shared Vision Program (SVP); and 2) Subsidiary Action Programs (SAPs). The SVP includes a series of technical, socio-economic, confidence building, and training projects to be implemented basin-wide to help establish a foundation for trans-boundary regional cooperation and create an enabling environment for investments and action on the ground. The Efficient Water Use for Agricultural Production (EWUAP) is one of eight projects of the Nile Basin Initiative’s (NBI) Shared Vision Program (SVP).

Agriculture, in general, plays a significant role in the livelihoods of households in the Nile Basin contributing greatly to economic growth and Gross Domestic Product (GDP). On the other hand, compared to the other sectors, agriculture is the main consumer of water. The riparian countries rely on the waters of the Nile River for their basic needs and economic growth, or have desires and expectations of harnessing the Nile for development activities. The agricultural sector is the dominant user of water in the basin but the luxurious and unchallenged use cannot be continued because of growing and competing demands from other sectors. There is a growing pressure to reduce the amount of water allocated for agricultural production mainly because of increasing demands from expanding urban centers, industry, mining, recreation and tourism. Agriculture is, therefore, expected to produce more crop per given volume of water if the system is to be sustained as a viable activity. Such a growing threat can best be addressed in a comprehensive way by collectively dealing on the subject at a basin level.

The EWUAP project is desired, therefore, to be a first step in bringing together the regional and national stakeholders in the riparian countries to develop a shared vision on common issues related to the increase of the availability of water and its efficient use for agricultural production. The main thrust of the EWUAP Project is to establish a forum to assist stakeholders at regional, national, and community levels to address issues related to efficient use of water for agricultural production in the Nile Basin. The forum is expected to foster exchange of experiences furthering Nile cooperation by enhancing mutual confidence and providing a critical building block to the sustainable utilization of Nile waters. The EWUAP project will provide an opportunity to develop a sound conceptual and practical basis for Nile riparian countries to increase the availability and efficient use of water for agricultural production. The EWUAP is expected to meet its project objectives by **bringing together regional and national stakeholders to have a common view and understanding on ways and means of improving water use**

in the sector and develop a shared vision on common issues. The project will create a framework to promote basin-wide cooperation and awareness, and build limited capacity by focusing on some of the common and basic issues related to water harvesting and irrigation. The project will help establish forums to discuss broad development paths for the Nile Basin with a broad range of stakeholders; improve the understanding of the relationship between water resources development and agricultural activities; enhance basin wide cooperation and raise agricultural management capacities of basin wide institutions.

Key outputs for the project as stated/defined in some of the previous studies, assessment works, and design documents are as follows:

- Establishment of regional dialogue on Water Harvesting (WH)
- Strengthening of regional consultation on Community-Managed Irrigation (CMI) and enhancement of overall awareness on efficient water-use
- Strengthening of regional consultation on Public and Private-Managed Irrigation (PMI) and the enhancement of awareness on efficient water-use
- Exploring and disseminating best practices in water harvesting, community and private-public managed irrigation
- Building national capacity for a sustainable management of water harvesting and irrigation practices and
- Providing national level support for agriculture, water harvesting and irrigation policy development.

2.0 OBJECTIVES OF THE STUDY

The main objective of the study is to undertake a quick assessment of the agricultural sector identifying opportunities, constraints, needs, and potential interventions or areas of investment with respect to the theme “Efficient Use of Water for Agricultural Production”. The Rapid Baseline Assessment (RBA) will complement information already assembled in the country reports by gathering additional information including identification of prospects related to the exchange of best practices for water harvesting, community-managed irrigation, and private and public-managed irrigation. The RBA, essentially a desk work, entails review of relevant documents and study reports in the sector (policies, strategies, technologies/best practices, and developments) including the country papers prepared during the design and development of the Shared Vision Program (SVP) of the Nile Basin Initiative (NBI). The RBA work could, if needed, be supplemented/complemented by a quick, verification like, field visits and/or interviews of stakeholders using pre-established questionnaire, to collect primary data/information.

The desk review work coupled with supplemental primary information from other sources, should lead to the identification and recommendation of the major needs of the sector, potential areas for possible interventions, and project ideas focusing on introduction of technologies and best practices in water harvesting, community managed, and public and private managed irrigation. Emphasis should be placed on interventions designed to contribute to capacity building at national and local levels when identifying/selecting potential activities.

As part of the RBA, consultant shall identify national stakeholders’ (public/private professionals, research institutions, water user representatives, associations, community groups, women groups, and NGOs) who are involved in the provision of various services in the sector. The Consultant should explore with the national stakeholders major concerns and practical options and needs to improve WH, CMI, and PMI. Information on existing institutional, technical and professional capacities in the areas of efficient water use (water productivity) will be assessed and compiled.

A list of local/national institutions (research/higher learning), associations, NGOs and think-tanks with potential to organize and conduct capacity building activities in the fields of water harvesting and irrigation shall also be compiled.

In addition, the RBA should provide data to be utilized as bench-mark in Performance Monitoring Plan in association with the three project components and see if interventions/investments are contributing to the achievement of project goals and objectives and whether implementation of activities is proceeding in accordance with approved plan.

Finally, the Consultant shall make a power-point presentation of findings and recommendations to a team of experts and leaders from the Ministries of Agriculture and Rural Development, and Water Resources, Technical Advisory Committee (TAC), World Bank, and donors in the respective country. The Consultant might be requested to travel to the Project Management Unit (PMU) office in Nairobi, Kenya, to discuss, share experiences and exchange ideas on the findings of assessment work with the other national Consultants from the other Nile Basin countries and, possibly, a regional consultant and reconcile recommendations, if need be.

3.0 STUDY LOCATION AND METHODOLOGY

The RBA will be carried out concurrently in all nine riparian countries (Burundi, D. R. Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda). In countries where the Nile Basin is only a small part, the study will focus on the part of the country that lies within the Nile Basin. However the Consultant is expected to provide an overall picture of the agricultural sector in relation to water harvesting and irrigation (small and large-scale) with greater emphasis on efficient water use and productivity of water. The assessment shall to a great extent be a desk work of reviewing sector-wide study reports, country papers, and other specific documents dealing with agriculture and water resources. It is believed that a quick assessment of the sector could be effected using existing secondary data sources. If need arises, the RBA work could be supplemented with primary data/information generated from limited and targeted verification type studies and/or interviews conducted with government officials and other stakeholders in the sector.

In order to produce a fair and balanced report identifying sector wide opportunities, constraints, needs, and areas for potential intervention reflecting national interests and existing conditions, consultation should be broadened to include government offices, research and higher learning institutions, associations, NGOs, individuals and groups involved in the agriculture and water sectors. The consultant should review/examine appropriate documents and database existing in the Ministries of Agriculture, Water Resources, and Environment, research institutions, associations, NGOs, donors and others. Reference should also be made to other relevant documents available in the national NBI office of the respective country. Some important reference materials available in the national NBI offices include but are not necessarily limited to:

- Project Appraisal Document; Efficient Water Use for Agricultural Production. World Bank, March 2005.
- Project Implementation Plan; Efficient Water Use for Agricultural Production, April 2005.
- Project Implementation Manual; Efficient Water Use for Agricultural Production.
- Country reports prepared in support of the above documents. and
- Integrated Water Resources Management strategy developed by the International Water Management Institute (IWMI), FAO and others.

Special consideration should be made to references focusing on Integrated Water Resources Management, Watershed Management, Water Harvesting, and Irrigation within the watersheds of the Nile River.

The consultant shall relate findings and/or recommendations of the rapid baseline assessment work to the recommendations described in project design documents such as the Project Implementation Plan Project Appraisal Document.

4.0 SCOPE OF WORK

Based on the background information and some of the objectives for the assessment work, the Consultant will undertake the following:

- I. Review and analyze documents and/or reports describing the agricultural sector in general and emphasizing on WH, CMI, PMI, productivity of water, and efficient use of water for agriculture;
- II. If need arises, verify important findings from desk review with primary data collected from field visits and/or interview of appropriate officials and individuals;
- III. Identify opportunities, constraints and needs of the sector by concentrating on the efficient use of water and water harvesting under rain fed and irrigated agriculture, and pinpoint some potential interventions;
- IV. Prepare a background information on the agricultural sector, identify constraints and opportunities by highlighting the prominence and role of water management practices (harvesting, storing, diversion, conveyance and utilization) in the sector;
- V. Put together information on the current state of water use in the sector showing major opportunities and drawbacks;
- VI. Based on findings of desk review, personal experiences, and knowledge on the sector, propose interventions/activities to be considered for implementation under the three project components;
- VII. Review institutional and legal framework arrangements for the sector with special emphasis on management of water resources for agriculture, and policy/strategy development with respect to the efficient water use. Identify key players in the sector and show their relationships;
- VIII. Illustrate the state of water use in relation to WH, CMI, and PMI by taking into consideration extension services, water storage and conveyance, water allocation, charges/fees, and the enforcement of guidelines and regulations;
- IX. Provide information on associations, water use groups, NGOs and others involved in the provision of services related to water use and irrigation;
- X. Identify site(s) that might qualify as center(s) of excellence for sharing information on best practices nationally and only one site per component (WH in association with watershed, CMI, and PMI);
- XI. Identify and register best practices associated with efficient use of water in the sector in relation to project components that could be shared with others in the basin;
- XII. Critically examine service provisions (extension and other inputs) and indicate if investment in staff training is something to be considered in capacity building;
- XIII. Identify and document bench marks for use as baseline data in monitoring project interventions in WH, CMI, and PMI systems;
- XIV. Observe and record, if possible, level of awareness, at all levels, on the growing and competing demands for water from other sectors and the likely scenario of fee based service in irrigated areas;

XV. Describe and/or list some actions to be considered by the project in promoting improved water productivity at all levels;

XVI. Compile and synthesize information generated as a result of the above tasks and others and produce/develop desired assessment report; identify project components (different than in the design documents); and provide some baseline data that serve as bench marks for monitoring and evaluation purposes.

5.0 DURATION OF ASSESSMENT WORK AND DELIVERABLES

The proposed rapid baseline assessment of the agricultural sector will be carried out in four weeks time (20 up to 23 working days). The Consultant, to be selected from a list supplied by TAC members, will conduct the rapid baseline assessment based on time frame shown below or an alternative to be submitted by consultant and agreed upon:

- Preparation and submission of a detailed work plan showing details of the processes and activities to be undertaken including the time frame required for the assessment work (desk review, field verification, consultation, etc): 0.5 day;
- Identification, collection, assembly and sorting out of relevant documents, study reports and other reference materials including development of questionnaire, if need arises, for field activities and/or interviews: 2 days;
- Review appropriate documents while identifying, summarizing and compiling relevant information, data and other necessary inputs required for the preparation of the baseline assessment report: 8 days;
- Sort out, analyze and compile data/information collected, detect limitations, develop methodologies and simple questionnaire, if need is felt, for the collection of additional primary data and/or field verification works, and preparation of the first draft report: 3 days;
- Undertake field activities, if found necessary and approved, to collect primary data for verification and corroboration: 2 days
- Review/revise draft report based on the nature of primary data and findings from field verification visits: 1.5 days;
- Produce and submit Draft Interim Report at the end of 19 working days to the Project Management Unit (PMU) in both hard copy and soft copies (word format in a floppy diskette or CD) for initial review and comments;
- Organize and conduct seminar to present/discuss major findings/recommendations of the assessment work within 2 days of submission of the Draft Interim Report to TAC, SC, NPC, PMU and other stakeholders in order to receive some feedback information -1 day;
- Revise the Draft Interim Report by incorporating relevant comments, suggestions and observations received from PMU, seminar participants and other stakeholders who reviewed the report: 1 day;
- Produce and submit a Final Draft Report of the Rapid Baseline Assessment work to the PMU. The Final Draft Report will be submitted to the PMU in both bound hard (five) and soft copies (word format in a floppy diskette or CD): 0.5 day;
- Request by PMU to effect certain changes and incorporations to the Final Draft Assessment Report, if found necessary, within two working days. The Contractor will incorporate necessary/requested changes and submit a final version in software only: 0.5 day.

6.0 EXPECTED OUTPUTS

A comprehensive assessment report of the agricultural sector of a riparian country comprising of:

- i. Overview of the agricultural sector in relation to efficient use of water resources for agricultural (crop, livestock, and agro-forestry) production in the country, covering legal and institutional frameworks, identifying needs, constraints and opportunities, recommending project components (new or additional) and priority areas of investments/interventions;
- ii. List of institutions or firms involved in the areas of water harvesting, community managed irrigation, and private/public managed irrigation systems and their capacities;
- iii. List of centers of excellence for the three components indicated above and/or others identified by the Consultant;
- iv. List of national stakeholders including public/private professionals, associations, research institutions, societies, higher learning, community organizations, NGOs, women groups, and others associated with the three project components and/or others identified during the assessment;
- v. Suggested/recommended interventions to be considered at grassroots level including actions to increase greater awareness and understanding on the urgent need for efficient water use and/or improved productivity;
- vi. Information/data that can be used as bench marks for monitoring and evaluation of interventions. And
- vii. The main report, including background information on the agricultural sector, should not exceed 35 pages and font sizes of 10 - 11. Consultant can provide as much information as possible in Annexes and/or Attachments for which there is no limitation. Consultant is encouraged to provide lists/rosters of stakeholders, reference materials, persons contacted, offices/sites visited, TOR, and related as part of the Annexes.

7.0 MONITORING AND SUPERVISION

This will be carried out by the PMU and the NPC. Members of the WH, CMI, and PMI Working Groups might also be on hand to offer invaluable advice and assistance.

8.0 METHODOLOGY AND STANDARDS

The Consultant will be expected to employ the most effective methodology to achieve results. This study will basically involve collection and compilation of existing information from relevant sources (Ministries of Agriculture, Water, and Environment, Research Inst., NGOs and the private sector). The Consultant will primarily focus on secondary data sources with an option to gather additional primary if found absolutely necessary in terms of verifying/substantiating secondary data. In addition the Consultant will be expected to:

- Design and use questionnaires that are realistic and capable of capturing accurate information,
- Collect most of the data from existing secondary sources,
- Use credible support staff in data and information collection,
- Prepare clear and concise reports,
- Ensure that the reports are delivered on the specified dates,

- Communicate any unforeseen deviation from the agreed consultancy plan immediately, with clear justifications and proposed remedial course of action

9.0 REFERENCE DOCUMENTS

The following documents would be availed as reference background material:

- i. Project Appraisal Document(PAD)
- ii. Project Implementation Plan(PIP)
- iii. Country reports/documents prepared in relation to the design and development of the project and available with TAC and/or national NBI office.
- iv. Integrated Water Resources Management strategy developed by the International Water Management Institute (IWMI), FAO and others.

10.0 TIME FRAME

The proposed assessment would commence o/a the beginning of the 3rd week of April 2006 and completed by the 3rd week of May 2006 (Estimated 23 working days).

11.0 RENUMERATION

The Consultant will be remunerated in accordance with the standard official UNDP rates for National Consultants. Reimbursable expenses will be made according to an agreed and approved plan.

12.0 QUALIFICATIONS OF THE CONSULTANT

- Advanced degree in water resources management, agriculture, environment, or related fields of study;
- Extensive experiences in water harvesting, irrigation (small and large scale), watershed management, crop and livestock production;
- At least ten years of experience in agricultural production, soil & water management, environment, and natural resources management;
- Excellent knowledge of the broader agriculture, efficient use of water, and general environmental issues;
- Experience working in the country, particularly in the watersheds of the Nile River is an added advantage.
- Fluency in spoken and written English; knowledge of French an added advantage.
- Excellent presentation and communication skills.
- Excellent analytical skills.
- Good computer skills.
- Experience in having worked with/for an international or donor organization is an advantage.