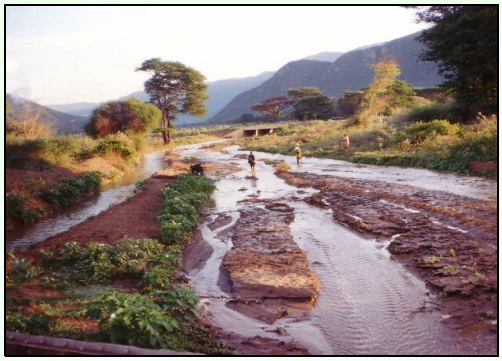
NILE BASIN INITIATIVE

Efficient Water Use for Agricultural Production (EWUAP) Project

BEST PRACTICES FOR WATER HARVESTING AND IRRIGATION

Tanzania

Philbert Rwehumbiza



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Currency and Measures

Currency equivalents: US$ 1 = TShs 1000
Weight and Measures: Metric system

List of Acronyms

AEZ	Agro ecological Zones
ASDP	Agricultural Sector Development Programme
ASDP	Agricultural Sector Development Project
ASDS	Agricultural Sector Development Strategy
ASPS	Agricultural Sector Programme Support
CHAWAMPU	Chama cha Wakulima wa Mpunga

CMI	Community-Managed Irrigation
DED	District Executive Director
DITS	Department of Irrigation and Technical Services
EIRR	Economic Internal Rate of Return
EWUAP	Efficient Water Use for Agricultural Production
FAO	Food and Agriculture Organization
FFS	Farmer Field School
GDP	Gross Domestic Product
GTZ	Germany Agency for Technical Cooperation
ISID	Institutional Support for Irrigation Development
JICA	Japan International Cooperation Agency
KADP	Kilimanjaro Agricultural Development Project
KATC	Kilimanjaro Agricultural Training Centre
KATC	Kilimanjaro Agricultural Training Centre
KTFTF	Kibena Tea Fair Trade Fund
MAFSC	Ministry of Agriculture, Food Security and Cooperatives
MATI	Ministry of Agricultural Training Institute
MKUKUTA	Mkakati wa kukuza uchumi na kupunguza umasikini Tanzania
NAFCO	National Agricultural and Food Cooperation
NBI	Nile Basin Initiative
PIDP	Participatory Irrigation Development Programme
PPMI	Public and Private-Managed Irrigation
RAS	Regional Administrative Secretary
RBA	Rapid Baseline Assessment
RBMSIIP	River Basin Management and Smallholder Irrigation Improvement Project
RWH	Rainwater harvesting
SAIPRO	Same Agricultural Improvement Programme
SUA	Sokoine University of Agriculture
SVP	Shared Vision Program
SWMRG	Soil-Water Management Research Group
SWMRP	Soil-Water Management Research Programme
TANESCO	Tanzania Electricity Supply Company
TIP	Traditional Irrigation and Environmental Development Organization
TPRI	Tropical Pesticides Research Institute
URT	United Republic of Tanzania
VECO	A Belgium Supported project
VEO:	Village Extension Office
SACCOS	Savings and Credit Co-operative Societies
UWAKICHI	Ushirika wa Umwagiliaji Kikafu Chini
CHAUMWE	Chama cha Umwagiliaji Mwega
CHAULU	Chama cha Umwagiliaji Lumuma
WH	Water Harvesting

UWAMALE	Umoja wa Wamwagiaji Maji Lekitatu

1 Introduction

1.1 Background

Agriculture, in general, plays a significant role in the livelihoods of households in the Nile Basin (Figure 1) contributing greatly to economic growth and Gross Domestic Product (GDP). In Tanzania, for example, the agricultural sector accounts for over half of the GDP and export earnings. In addition, over 80% of the population live in rural areas and their livelihood depends on agriculture (URT 2001a). However the sector is very much affected by inadequacy, seasonality, and unreliability of rainfall as well as periodic droughts. Under these conditions irrigation and water harvesting (WH) can and have significantly improved the yield and reliability of agricultural production with average irrigated crop yields being three times those of rain fed agriculture. This has enabled farmers to produce not only their own food crop needs, but also through the sale of the additional production, to increase their assets to enable them to meet school fees of their children, provide better housing for their family and to better support other members of their extended families.

In recognition of the potential of irrigation and WH to improve water availability and land productivity, efforts are being made to promote the use of the technologies in Tanzania. The government, through the Agricultural Sector Development Strategy (ASDS) and Agricultural Sector Development Programme (ASDP) aims at boosting crop production through irrigation development and improvement. Specifically, the ASDP aims to support a reduction in over dependence on rain fed agriculture through the rehabilitation and management of low cost smallholder irrigation schemes, including rainwater harvesting, to reduce fluctuations in production (URT, 2001c).

There is, however, a growing pressure to reduce the amount of water allocated for agricultural production mainly because of increasing demands from other sectors such as expanding urban centres, 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. Future development will therefore need to concentrate on improving both, productivity per unit of land and per unit of water.

The Efficient Water Use for Agricultural Production (EWUAP) is one of eight projects of the Nile Basin Initiative's (NBI) Shared Vision Program (SVP). The EWUAP project desire is to bring together regional and national stakeholders in the riparian countries and develop a shared vision to increase availability and efficient use of water for agricultural production in the Nile Basin. This requires, among other things, sharing of knowledge and information on technologies and best practices from within and/or outside of the Basin. Sharing of information could also be effected through study tours and field visits to sites of best practices with proven track record in terms of using technologies. On realising this, the EWUAP project engaged national consultants to identify and document best practices, sites and potential institutions for water harvesting, community-managed and private-managed Irrigation.

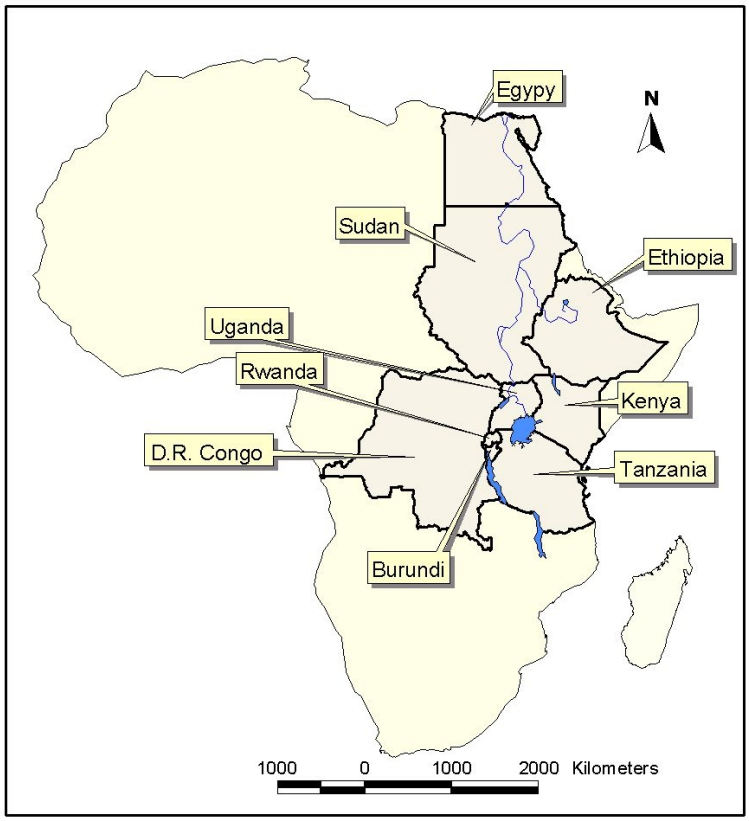

Figure 1: The Nile Basin Countries

1.2 Objectives of the Study

The main objective of the study was to identify and document best practices, sites of best practices, and list and provide a profile of potential institutions. Specifically, the study aims to:

i)identify, list, and document best practices in the areas of Water Harvesting (WH), Community-Managed Irrigation (CMI), and Public and Private-Managed Irrigation (PPMI) nationally;

ii)select few pre-eminent practices from the list of best practices and technically provide a profile or detailed description of the pre-eminent practices;`

iii)identify best practice sites for water harvesting, community managed irrigation, and public and private managed irrigation;

iv)profile the selected best practice sites with indigenous and/or modern techniques; and

v)identify and list national institutions to be considered for twinning activities and then select and recommend few and provide a detailed profile description of these institutions with potential to organize and conduct capacity building activities and implement field level demonstrations or pilot activities in water harvesting and irrigation.

1.3 Methodology

The assignment was undertaken by using a combination of desk review of documents,

consultation of experts (see a list in Appendix 6) and resource persons, and by visiting selected sites and potential institutions.

Most of the required information on best practices and associated sites was `collected from the Ministry of Agriculture, Food Security and Cooperatives (MAFSC), Zonal Irrigation Offices, Soil-Water Management Research Programme (SWMRP) from Sokoine University of Agriculture (SUA) and other sources. In order to verify some of the information, the consultant consulted some of the experts from MAFSC, SUA and Zonal Irrigation Offices.
To cover as much Agro ecological Zones (AEZ) and practices as possible within a limited allocated time, the consultant decided to visit three nearby irrigation zones: Morogoro, Kilimanjaro and Mbeya. In each Zone, after a discussion with irrigation engineers, best sites for water harvesting, community-managed and private-managed irrigation schemes were selected. Thereafter, the sites were visited (Figure 2) and details for each WH practice and irrigation scheme collected using provided template (see Appendix 2, Appendix 3 and Appendix 5). On the basis of the collected data, the WH practices and irrigation schemes were then ranked.

Potential institutions to organize and conduct capacity building activities and implement field level demonstrations in water harvesting and irrigation were selected based on consultant experience in the field of RWH and irrigation and desk review of documents.

According to NAPA (2007), Tanzania has about 88.6 million hectares of land suitable for agricultural production, including 60 million hectares of rangelands suitable for livestock grazing. Based on altitude, rainfall pattern, dependable growing seasons and average water holding capacity of the soils and physiographic features, Tanzania has 7 main agro-ecological zones (NAPA, 2007). Details of each of the AEZ are given in Table 1.

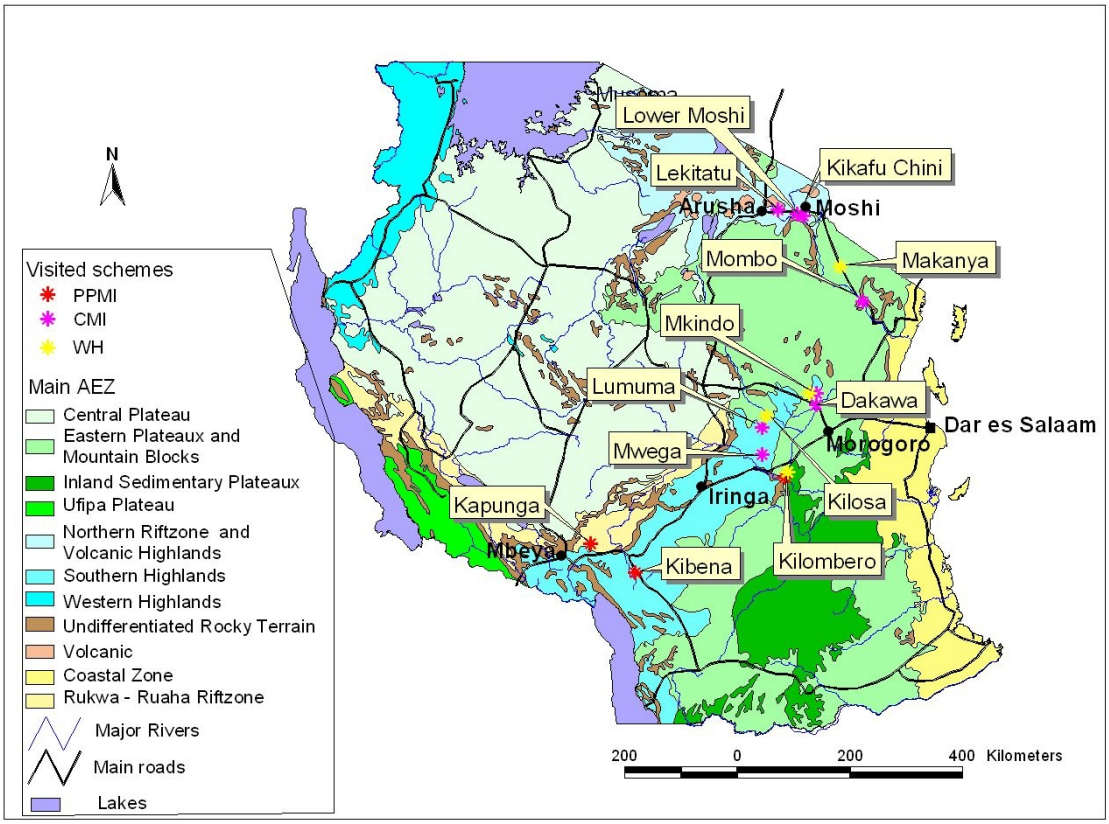

Figure 2: Main Agro-ecological zones of Tanzania and visited WH, CMI and PPMI schemes

Table 1: Main Agro-Ecological Zones of Tanzania

S/N	Zone	Altitude m/sea level	Rainfall pattern	Dependable growing season (months)	Physiographic
1	Central plateau	800 to 1800	Unimodal and unreliable	2 to 6	Composed of flat plains, undulating plains, plateau and some hills
2	Eastern plateau and mountain blocks	200 to 2000	Predominantly unimodal	From < 2 to 7	Many physiographic types, ranging from flat areas, undulating and rolling plains, hilly mountain, plateau to mountain blocks
3	Inland sedimentary plateau , Ufipa plateau and western highlands	200 to 2300	Unimodal	3 to 9	Composed of undulating plateau, strongly dissected hills, dissected hilly plateau and undulating rolling plains.
4	Northern rift valley and volcanic high lands	900 to 2500	Unimodal	< 2 to 9.5	Ranges from flat to undulating plains, hilly plateau to volcanic mountains
5	Southern highlands	1200 to 2700	Unimodal I	5 to 10	Composed of flat to undulating rolling plains and plateau, hilly areas and mountains
6	Coastal	< 100 to 500	Bimodal and unimodal	3 to 10	Combination of coastal lowlands, uplands, undulating and rolling plains
7	Rukwa-Ruaha rift zone	800 to 1400	Unimodal	3 to 9	Composed of flat terrain, rocky terrain and complex terrain

Source: AGRIFOR Consult 2006

2.0 Best Practices and Sites for Water Harvesting, Community-Managed Irrigation, and Private-Managed Irrigation

2.1 Criteria for ranking WH practices

A wide range (20) of WH technologies is practiced in Tanzania as is listed in Appendix 1. An eleven point ranking criteria was adopted to determine the best WH practices. Each criterion had three categories of score points as is listed below and shown in Table 2. The ranking criteria are explained in the next paragraph. Detailed description is given only for each of the best five practices in Appendix 2. The best five practices were: Bunded field 'jaluba', Spate irrigation, Ndiva, Ridges, Bench terraces, and Charco pond. Table 2 shows a matrix of the ranking criteria and the scores obtained under each criterion for the best WH practices.

i. Environmental impacts: Many negative impacts =1, Few negative impacts =6, No negative impacts =9)
ii. Economic benefits from the practice: low =1, medium =6, high =9
iii. Technical implementation: very complex =1, somehow complex =5, simple =10
iv. Sustainability: recently introduced =2, 10 to 30 years =6, indigenous =10
v. Flexibility with different water sources and crops: low =2, medium =6, high =10
vi. Potential for out scaling: low =2, medium =6, high =10
vii. Operation and Management requirements (O&M): high =2, medium =5, low =10
viii. Labour requirement: high =2, medium =5, low =10
ix. Social acceptability: not acceptable =2, somehow acceptable =6, highly acceptable =9
x. Acceptability by government and other institutions: not acceptable=2, acceptable=6, highly acceptable =9
xi. Multiple use of harvested water: crops only =1, crop + livestock =6, crop + livestock + domestic =9

2.2 Criteria for Ranking of irrigation practices

Ranking of irrigation best practices was based on six criteria, namely: Water use efficiency, operation and maintenance, technical requirements, labour requirements, Environmental impact, and possibility of out-scaling.

Abstraction method (gravity or pumped), conveyance (piped, semi-lined, unlined), and application method (basins, drip, and sprinkler) determine the irrigation system. Irrigation practices are thus, based on the combination of abstraction method, conveyance system, and water application technique. Among the schemes that were visited, eight practices were identified as is listed in Table 4. The best three irrigation practices based on the above criteria were: Gravity- open channel (semi-lined)-level basin was, followed by Pumped-piped-lateral drip; and Gravity-open channel (lined)-level basin.

Gravity systems are the cheapest and more sustainable compared to pumped ones. Costs for power, pipes and lining reduce the possibility of out-scaling and wide adoption of such systems despite their being efficient in the use of water. Piped conveyance and lining of water channels reduce water loses and thus increase water available for productive uses. With regard to water application systems, drip is the most efficient, followed by sprinklers, and basins are the least efficient. Initial cost is likely to be the biggest stumbling block when it comes to scaling out of the best irrigation practices. Intervention through Government investment is the only way that farmers operating at subsistence level will adopt such high initial cost irrigation practices. NGOs and District Agricultural Development Programmes (DADPs) are other possible avenues through which such investments can be undertaken.

Vandalism and theft of pipes and sprinklers is on the increase at Kilombero Sugar Company. The company has of late; decided to resort to basin/ furrow irrigation system as means of avoiding such loses. In this case, water use efficiency is not the goal as availability of water is not a limiting factor.

2.1 Best Practices and Sites for Water Harvesting

2.1.1 Best practices for water harvesting

The long list of water harvesting practices is provided in Appendix 1. The list was prepared based on details contained from various reports (see reference list). From the list, a shortlist of possible practices that could meet selected criteria was then extracted (Appendix 2) and ranked as indicated in Table 2.

Based on criteria used to rank visited WH practices (Table 2), *Majaluba* is highly ranked followed by spate irrigation and *ndiva*. *Majaluba* are widely used in many parts of Tanzania for growing different crops and in different soils. They occur in different shapes and sizes. For paddy, clay soils are most ideal because of their poor infiltration which enables them to retain water for long periods. Since clay soils are difficult to work with, e.g. hard when dry and stick when wet, they have a very narrow time window during which they can be tilled. Availability of draught power during field operations is thus vital. The occurrence of *jalubas* in large numbers in Shinyanga, Tabora and Mwanza is attributed to the high adoption of draught animal power in these regions. Bunded crop fields increase the time window for diverted and impounded water to infiltrate. In spate irrigation schemes for example, deep sandy loams, bunded plots store sufficient water for production of crops such as maize, vegetables, and beans. Once constructed, *jalubas* can be used for years with minimal annual repair. Food security and household incomes have improved in SAL as a result of stable and less risky production. Detailed description of majaluba and other visited practices is attached in Appendix 2.

Table 2: Ranking of WH practices

RWH type	Ranking Criteria											Total points	Rank
	Environmental impacts: Many -ve impacts=1, Few -ve impacts=6, No -ve impacts=9)	Economic benefits: low =1, medium=6 , high=9	Technical implementation: very complex=1, somehow complex=5, simple=10	Sustainability: recently introduced=2, 10 to 30 years=6, indigenous=10	Flexibility with different water sources and crops: low=2, medium =6, high=10	Potential for out scaling: low=2, medium =6, high=10	O&M: high =2, medium=5, low =10)	Labour requirement: high =2, medium=5, low =10	Social acceptability not acceptable=2, somehow acceptable=6, highly acceptable=9	Acceptability by government and other institutions: not acceptable=2, acceptable=6, highly acceptable=9	Multiple use of harvested water: crops only=1, crop +livestock=6, crop +livestock +domestic=9		
Bunded field 'jaluba'	9	9	5	10	10	10	10	2	9	9	6	89	1
Spate irrigation	6	9	10	10	10	10	5	5	9	9	1	84	2
Ndiva	9	6	1	10	2	2	10	10	9	9	9	77	3
Ridges	9	6	10	10	6	10	5	5	6	9	1	77	3
Bench terraces	9	9	1	2	10	6	10	10	9	9	1	76	5
Charco pond	9	9	10	2	2	6	2	2	9	9	9	69	6

2.1.2 Best sites for water harvesting

Five sites with a variety of water harvesting practices were visited and then ranked using criteria shown in Table 3. The ranking was based on eight criteria namely:

i. Diversity of adopted WH practices in the area: depending on the diversity, degree and extent of adoption, values assigned varied from 2= very few , 6= some, and 9= many
ii. A range of climatic conditions available : very limited =2, medium =5, high =9
iii. Upstream – downstream committees: absent =2, some =6, many =9
iv. WUGs and cooperative societies: absent =2, some =6, many and active =9
v. Environmental impacts: many negative impacts =1, few negative impacts =6, no negative impacts =9
vi. Accessibility to markets and inputs: poor =2, medium =6, very good =9
vii. Vicinity to supporting institutions: low =1, medium =6, high =9
viii. Evidence of impact of the practices: low =1, medium =6, high =9

2.2 Best Practices and Sites for Community-Managed Irrigation and Private-Managed Irrigation

2.4.1 Best Practices for Community-Managed Irrigation and Private-Managed Irrigation

Eight irrigation practices commonly used in Tanzania were ranked using a six point criteria namely:
Water use efficiency (very high =20, high =15, med =10, low =5), O&M (high =2, medium =5, low =10), Technical requirement (complex =1, somehow complex =5, simple =10), Labour requirement (high =2, medium =5, low =10), Environmental impact (high =2, medium =5, low =10), Possibility of up scaling (high =20, medium =15, low =10). The resulting ranked list is as shown in Table 4.

On the basis of the criteria indicated in Table 4, Lekitatu irrigation scheme scored the highest mark followed by Mwega and Mombo schemes (Table 5). Lekitatu is ranked highly due to the fact that the scheme has a strong farmer's organization called UWAMALE (Umoja wa Wamwagiliaji Maji Lekitatu). The association has three strong committees: O & M, environment and agriculture, and finance and planning. In addition, since 1996 farmers have been attending various trainings, particularly from KATC, TPRI and Arumeru District Council that have improved their agricultural production. The trainings includes; water management, use of simple farm machinery, cooperatives, agribusiness, marketing, rice agronomy and handling and use of agro-chemicals, including fertilizer, herbicides and pesticides. Furthermore, farmers and their extension officer and irrigation technician have attended various in-country workshops and seminars and sometimes abroad (e.g. Ethiopia and Zimbabwe).

Table 3: Ranking of sites for WH practices

Site	Ranking Criteria								Total points	Rank
	Diversity of adopted WH practices in the area: very few =2, some=6, many=9	A range of climatic conditions: very limited=2medium,=5, high= 9)	Upstream – downstream committees: absent=2, some=6, many =9	WUGs and cooperative societies: absent=2, some=6, many and active=9	Environmental impacts: many -ve impacts=1, few -ve impacts=6, no -ve impacts=9	Accessibility to markets and inputs: poor=2, medium=6, very good= 9	Vicinity to supporting institutions: low=1, medium=6, high= 9	Evidence of impact of the practices: low=1, medium=6, high= 9		
Makanya catchment)	9	9	9	9	9	9	9	6	69	1
Mkindo/ Dakawa	6	9	6	8	6	9	6	6	56	2
Bukangilija - Ndala catchment	6	5	6	6	6	6	6	6	47	3
Ilonga (Kilosa)	6	5	6	6	6	6	6	6	47	3
Kilombero)	6	5	6	6	6	6	1	6	42	5

Table 4: Ranking of irrigation best practices

SN.	**Irrigation practices**	**CRITERIA**						**Total**	**Rank**	**Example** Of scheme
		Water use efficiency (very high=20, high=15, med=10, low=5)	O&M (high =2, medium=5, low =10)	Technical requirement complex=1, somehow complex=5, simple=10	Labour requirement high =2, medium=5, low =10	Environmental impact high =2, medium=5, l ow =10	Possibility of up scaling high =20, medium=15, low =10			
1	Gravity, open channel (semi-lined), level basin	10	10	10	2	2	20	54	1	Mombo
2	Pumped, piped, lateral drip	20	2	1	10	10	10	53	2	Kibena Tea
3	Gravity, open channel (lined), level basin	10	10	10	5	2	15	52	3	Lower Moshi
4	Gravity, open channel (unlined), level basin	5	10	10	2	2	20	49	4	Lekitatu
5	Pumped, piped, movable sprinkler	20	2	1	5	10	10	48	5	Kilombero sugar 1
6	Pumped, open channel/ piped, pivot	15	2	1	10	5	10	43	6	Kilombero sugar 2
7	Pumped, open channel/ piped, movable sprinkler	15	2	1	5	5	10	38	7	Kibena tea
8	Pumped, open channel (unlined), level basin	5	5	5	2	2	15	34	8	Dakawa

Table 5: Ranking of community-managed irrigation schemes

Site	Ranking Criteria							Total points
	Technical factors (15)	Economic Factors (18 points)	Possibility of Environmental status factor (12 points)	Ease of implementation (5 points)	Social factors (24 points)	Regional condition (20)	Water use efficiency (6)	
Lekitatu	9	14	9	5	23	16	2	79
Mwega	9	15	8	5	21	14	3	75
Mombo	9	13	8	5	23	10	3	71
Kikafu Chini	10	13	6	3	23	14	0	69
Mkindo	7	13	6	3	21	16	0	66
Lumuma	11	14	8	1	19	8	0	61
Lower Moshi	4	17	6	5	12	11	5	60
Dakawa Rice Farm	7	8	3	3	21	12	0	54

2.4.2 Best Sites for Private-Managed Irrigation

Only three private-managed irrigation sites (Appendix 5) were visited given the fact that PPMI are few and far apart. The sites were selected to represent a variety of methods of water abstraction (pumped, gravity), on-farm irrigation practices (surface, sprinkler, centre pivot and drip) and crops, i.e. rice, sugar and tea. The sites were then ranked as shown in Table 6.

Table 6: Ranking of private-managed irrigation schemes

Scheme (Site)	Criteria							Total Points	Ranking
	Organization/ Company setup (10)	Economic Factors (15)	Possibility of Environmental impacts (15)	Accessibility (10)	Social acceptability (20)	Irrigated /potential area (10)	Water use efficiency (20)		
Kibena	8	12	13	10	17	5	17	82	1
Kilombero	6	12	12	8	15	5	12	70	2
Kapunga	3	10	8	6	10	8	8	53	3

Table 6 indicates that Kibena Tea Ltd is highly ranked private-managed scheme among the visited schemes. Apart from being well organized, the scheme is a good example of a high level management of sprinkler and drip irrigation systems (Mkoga *et.al*. 2005). Irrigation managers in the scheme collect and use the whole range of weather data required for determination of crop water requirement and irrigation scheduling together with other data for assessing farm productivity (Kibena Tea Estate, 2003). The Kibena piped irrigation system is equipped with gauges and gadgets for measuring amount of water, constantly monitoring irrigation application uniformity, yield and above all the cost of pumping water. The management gives high weight to management of water to justify water pumping bill and profit optimisation. As such they have incorporated in their management system a way to assess productivity of water because it is a very important input to the estate. In addition, the scheme has a positive image to the surrounding communities because of the employment opportunities it offers to them and its contribution to the education sector through Kibena Tea Fair Trade Fund (KTFTF).

It should be noted that there are other PPMI sites which could probably rank higher than Kapunga and Kilombero, or even Kibena on the basis of the criteria used in Table 6. Such sites include Unilever Tea Tanzania covering about 20,000 hectares in Mufindi District. However, as pointed out earlier, it was not possible to visit all potential sites because of time constraint.

Different WH and irrigation practices and sites were ranked based on the criteria adopted in this report. It should be pointed out however that, the success of a scheme and practice depends on how well it is implemented. Chapter three (3) discusses the existing technical guidelines in the implementation of WH and irrigation schemes in Tanzania.

3.0 Guidelines in Relation to Water Harvesting, Community-Managed Irrigation, and Private-Managed Irrigation

There are many relevant guidelines and manuals that have been mostly prepared in the Department of Irrigation and Technical Services (DITS) of MAFC on an individual project basis (Table 6). The documents have formed the basis for additional guidelines that have been used by projects such as RBMSIIP, PIDP and the National irrigation Master Plan Studies. Other guidelines have subsequently been prepared by the Master Plan Team (District Level Planning) and PIDP. In addition to the existing guidelines, there are still other guidelines that need to be developed (Table 7).

Table 7: Existing Technical Guidelines in Irrigation Development

Project	Date	Guideline/Title	Comments
ISID	1991 - 1994	Project Planning manual	The manual consisting of eleven sections covering all items necessary for irrigation scheme planning from survey to project evaluation. The manual was prepared to provide guidelines on investigation and studies necessary for feasibility study. Unfortunately, the manual has been hardly utilized by all concerned personnel.
ASDP	1996 -	Technical Manual for Planning and Design of Irrigation Systems, Construction Manual for Irrigation Works, Technical Manual for Operation & Maintenance of Irrigation Systems	The manual provides technical and procedural guidance to all personnel involved in planning, designing, implementation and O & M of irrigation system. However, it is still a draft, and has not been finalized.
RBMSIIP	1999 - 2000	Irrigation Design Manual	The manual consists of two volumes: guidelines and drawings. It is a well-organized outcome. The guidelines might be useful for experts with some experience in irrigation design works, but troublesome for those with less experience (such as District staff). Furthermore, the guidelines do not deal with methodology for participatory design, which is now a fundamental requirement (JICA & MAFC 2007).
PIDP	2000 - 2001	Rainwater Harvesting Design Manual for Irrigated Agriculture in Marginal Areas	A design manual consists of eleven chapters. Many parts of the manual present design methods for conventional irrigation system, and few special modalities for water harvesting scheme design.
ASPS-IC	2001 -	Irrigation Water Management Field Handbook for Extension Staff	The handbook aims to provide extension field personnel with information on irrigation water management as a quick reference manual. The handbook consists of ten chapters covering technical issues as well as formation of irrigators' association and environmental issues in irrigation systems.
		Project planning manual	Consists of eleven sections to provide guidelines on investigation and studies necessary for feasibility study. The manual focuses on medium to large scale schemes (modern irrigation schemes). The manual does not however cover planning of rainwater harvesting (RWH).
	2007	Guidelines for Irrigation Scheme Formulation for District Agricultural Development Plan	The guidelines focus on district-manageable small-scaled irrigation schemes (gravity& pump irrigation schemes or water harvesting scheme). The objective of these guidelines is to provide the district staff with a procedure for irrigation scheme formulation in the preparation of DADP.

Source: Modified from URT (2004). Irrigation Development in Tanzania

Table 8: Additional Guidelines to be developed by DITS

Guidelines	Details
River Basin Approaches	To be utilised in the awareness programmes for rural communities relating to water allocations and user rights, establishment of IOs and water right and O&M charges. This will include and centre on the benefits that will accrue from improved water management and greater involvement of beneficiary communities in the decision making process.
Establishment of Irrigation Organisations.	These would be used to facilitate the establishment of formal Irrigation Organisations (IOs) on both traditional and modernised irrigation schemes. They will include the wide range of tasks that are involved in the operation, maintenance and management of irrigation schemes. Other countries in the Region have found that module based guidelines are the most appropriate and this experience should be drawn upon.
O & M Guidelines for Farmer Managed Schemes.	Based on the PIDP and RBMSIIP manuals, these should cover both irrigation and water harvesting under farmer management. They should set out all procedures, activities and works that farmers will need to undertake or be involved in once the irrigation scheme has been rehabilitated and upgraded. It also needs to provide clear guidelines on how these should be funded and the determination of annual routine and emergency budgets.
EIA guidelines for Field Staff	Training manuals for field level staffs in the use of the national guidelines to deal with irrigation-induced negative effects (see section 9.8). This would be undertaken be the ECU within MAFS who will be supported by facilities such as lap top computers, digital cameras, desktop computers, E- mail facilities and training materials.
Use of Service Providers	Establishment of guidelines for use of contractors and consultants based on NCC criteria but integrating irrigation project experience. These will establish irrigation specific criteria for ranking and selection similar to those used under the roads programmes. This list will be maintained and regularly updated by DITS and ZIUs using data on current Contractor and Consultant performance and capacity.

Source: URT (2004). Irrigation Development in Tanzania

4.0 Impact of best Practices/technologies on overall efficiency of water use

One of the main objectives of the River Basin Management and Smallholder Irrigation Improvement Project (RBMSIIP) was to raise irrigation efficiency from below an estimated 15 percent to an average of 30 percent after scheme improvement. Irrigation efficiency on 8 schemes (Mombo, Soko, Mahenge, Nyamahana, Mangalali, Igomelo, Ipatagwa and Ruanda Majenje) was measured in 2001 and repeated in 2004, following physical improvements to diversion and control structures and conveyance and distribution systems, and training of farmers in irrigation water management. Data collection involved the measurement of canal discharges at different levels of irrigation systems (conveyance and field canals) (Table 8), using current meters.

Table 9: Results of irrigation efficiency measurements for selected CMI schemes

Season	Description	Baseline		Improved		Average Increase %
		Range	Average	Range	Average	
Wet	Conveyance	0.29 - 0.53	0.40	0.70 - 0.89	0.84	110
	Canal	0.55	0.55	0.55 - 0.80	0.65	18
	Field	0.32 - 0.40	0.34	0.32 - 0.4	0.35	3
	Overall	0.05 - 0.09	**0.08**	0.15 - 0.22	**0.19**	138%
Dry	Conveyance	0.45 - 0.73	0.60	0.72 - 0.92	0.85	25
	Canal	0.48 - 0.66	0.60	0.62 - 0.87	0.74	23
	Field	0.32 - 0.40	0.38	0.32 - 0.50	0.44	16
	Overall	0.10 - 0.16	**0.11**	0.24 - 0.26	**0.27**	145%

Source: World Bank (2004)

The results indicated that the average irrigation efficiency has improved from an average of 8 percent to 19 percent in the wet season, and from an average of 11 percent to 27 percent in the dry season. The greatest improvements were achieved in conveyance efficiencies. According to the World Bank (2004), despite the improvements in the average irrigation efficiency, there is still a significant scope for improving efficiencies at field level. This can be achieved through continued training and backstopping by the District irrigation officers and zonal irrigation offices. Long-term progressive improvement of conveyance systems in most irrigation schemes, including efficient application methods will reduce water loses and increase water productivity.

Observing recommended technical guidelines usually leads to improved performance by a scheme or practice. Apart from the technical details, there are other factors that might have positive or negative effect on the performance of a practice or scheme. Chapter (5) discusses the limitations and opportunities for the best practices.

5.0 Evaluation of limitations and opportunities of the described best practices / technologies for replication and scaling up

5.1 Some limitations and opportunities of the best practices under WH

i) Complexity: *Jabula* emerged the best practice from the ranking process. With regard to complexity, jalubas are simple in design and easy to implement. However, some farmers construct wide *jalubas* even on relatively steep land resulting in reduced efficiency of the system through failure to have evenly distributed water. Some parts may get excessive water while others are dry. Continuous pilling up of soil and weeds on the bunds may over time increase bunds to unacceptable heights. Too high a bund may cause water level to overtop the crop killing even paddy rice, the only crop that performs well under wet culture.

ii) Labour requirements: *Jalubas* have high initial labour requirement. One option is to increase the bund height gradually season after season until the desired height is finally attained. For crops other than paddy (e.g. maize), *jalubas* need not be too high and may be constructed each season. Adoption of tractor/ draught animal power in ploughing is crucial to enable timely land preparation. In regions of Tanzania where most *jalubas* are found, the soils are Vertisols that are difficult to manage with a narrow window of time when they can be worked with fewer problems. When dry, they are too hard and thus require high draught power. When wet, they are very sticky and thus clog the working tools. Availability of draught power enables completion of field operations in the shortest time possible. Adoption of animal power in Tabora, Shinyanga, and Mwanza (highest in Tanzania), is a factor in the wide use of the *jaluba* technology in the area.

iii) Availability of irrigation/ harvestable rain runoff water:

Crop production using the *jaluba* cannot be successfully undertaken entirely using rainfed system. Availability of irrigation water or runoff is vital for this technology to work. Storms that generate harvestable runoff are a necessary requirement. Identification of potential sites for WH is a necessary precondition for successful establishment of this practice. Estimation of available runoff water from a given catchment / sub-catchment is required so that opened crop land is no more than can be irrigated. Such measures are likely to prevent wastage of resources and farmers efforts. In CMI and PPMI availability of water is considered in the initial planning of the scheme. Increased demand for water from other sectors of the economy is putting pressure for such schemes to reduce water use. Lower Moshi is a good example with water being required to run hydro electric power downstream at Nyumba ya Mungu.

iv) WUAs / WUGs:

The presence of functional WUAs / WUGs is a requirement where jalubas cover a large area, but the source of water is one and same for all farmers in the area. Conveyance of water over long distances and land owned by different farmers may cause conflicts in the absence of regulatory mechanisms and WUAs / WUGs. Such arrangements are built-in for schemes established by the government or NGOs. Village governments play a pivotal role where no formal arrangements are in place.

Similarly, the presence of a working/ profitable RWH system in one village may attract implementation of a similar scheme in another nearby village. It is worthwhile noting that the three highly ranked practices (jaluba, spate irrigation, and ndiva) depend on an external source of water. Where more than one village is dependent on water from the same source/ river, it is important to have arrangements (upstream and down stream institutions) for sharing the water resource. In the absence of such arrangements, conflicts and sabotage of otherwise good initiatives can not be avoided. Consultation with Basin offices is necessary to so as to work within the overall national frame work of water management in the relevant basin.

v) Economic returns to ones investment

Whenever RWH is introduced/ practised, farmers change from planting their traditional crops to high value ones. Sorghum and millet are usually abandoned in favour of maize, paddy or vegetables. Adoption of RWH practices thus gravitates on the perceived benefits and the freedom to produce what one likes. Undue restrictive government policies on what crops should be grown (especially for the schemes they have funded), may thus prevent wider adoption of some RWH practices.

vi) Interaction of practices and factors

A combination of practices is usually employed to produce a crop. For example with spate irrigation, infield management apart from ploughing/ tillage includes use of small

bunded plots or ridging to facilitate spreading of diverted water. Use of soil fertility amendments may also help to increase crop yield over and above the effect of just water. On the other hand, without adequate water supply, one would not even contemplate use of fertilizers. The success of an introduced practice may vary from one site to another depending on synergistic practices and whether or not high inputs are used. The type of soil (clay or sand) because of its effect on water retention can affect the performance of a practice. The interaction of parameters such as rainfall, soil texture, soil depth, topography, drainage conditions, and land use or vegetation can affect the chances of success of a WH or Irrigation scheme. Soil and land characteristics are site specific and thus they interact in a unique way.

The effect of using variable amounts of FYM on rice yield is shown in Figure 3 below. More yields are realized at higher than at lower fertilizer rates.

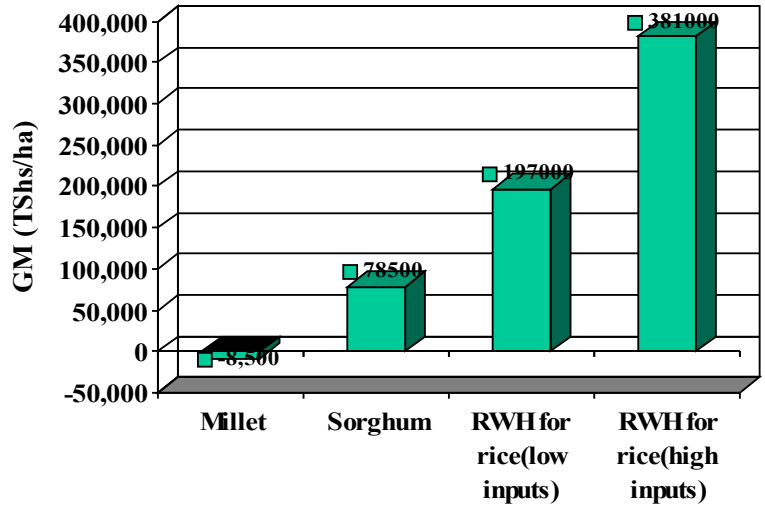

Figure 3: Improved Gross Margins (SWMRP, SUA)

vii) Implementation costs

High implementation costs may reduce wide adoption of an innovation. Spate irrigation and ndiva community schemes do for example require high initial capital outlay and thus may require government / NGO initiative to be implemented. Cheap to implement practices are likely to be taken up by individuals and thus, they stand a better chance of wider adoption than expensive ones.

viii) Environmental and safety concerns:

Environmental and safety concerns from regulatory bodies may impose restrictions on the abstraction of large volumes of water and construction of reservoirs for irrigation schemes. Thus, large schemes are best handled by the government than small WUAs/ WUGs so as to avoid unforeseen complications. Practices of the above category are thus not likely to be widely scaled up without direct government input.

ix) Suitability of practices for adoption in different AEZ

Practices ranked highly over all, are not necessarily the most suitable in all AEZ. In highland areas of Pare for example, a third ranked ndiva is the most preferred practice. The 6th ranked charco pond is for example the only available option for pastoralist at Makanya. Thus, for specific locations and environmental setting, some lowly ranked practices may be the only viable options.

x) Cultural acceptability

Practices that require women to go out and divert water at night are culturally unacceptable. Irrigation schemes such as Mwega in Kisola Morogoro region, have for example an arrangement/ by law that allocates water to female headed households only during the day. Absence of measures to address such seemingly trivial issues may limit the adoption and hence scaling up of an innovation.

5.2 Some limitations and opportunities of the best practices under CMI and PPMI

Community managed irrigation schemes are usually traditional or improved systems. In Tanzania, improved irrigation schemes are a product of Government and NGO intervention on conveyance and intakes of traditional systems to enable better control of abstraction and to reduce water loss. The command area and hence the number of people benefiting from individual schemes has increased through such improvements. The targeting of the existing traditional irrigation schemes, is based on the fact that these have survived and performed relatively well for long periods. Such schemes tend to have coherent and well organised WUGs/ WUAs. This is the key to sustainability, and thus, such schemes may not perform well in areas or locations where elaborate organisation is not in place.

The government through District Councils is training members of these groups in management, finance, use of agricultural machinery, control of pests and diseases and running of cooperative societies. Most of these WUGs have become fully registered cooperatives. This has assisted farmers in joint bargaining, marketing, procurement of inputs, and acquisition of credit. With the exception of Dakawa CMI, flow of water in all other visited CMI schemes is dependent on gravity. This is a big saving as electricity and/or petrol powered pumps are too expensive to run because of high fuel costs.

Construction of expensive irrigation or water harvesting structures is dependent on the perceived security of the land tenure systems. Farmers growing crops on hired land are reluctant to invest in most forms of WH structures for fear of losing land to the owner as soon as such improvements have been undertaken. CMI scheme require availability of large pieces of land. Availability of public land for large schemes is therefore a prerequisite for the successes of CMI. Secure land tenure is also an essential requirement for the success of PPMI schemes.

Potential sites for PPMI and CMI schemes in the country are many and not fully utilized according to the National Irrigation Master Plan. Thus, there is room for scaling out but the major limitation is lack of investment fund or capital.

Availability of reliable data is crucial for planning of WH, CMI or PPMI practices and schemes. The most important parameters include rainfall, soil texture, soil depth, topography, drainage conditions, land use and vegetation cover. Promotion and up scaling of irrigation and water management technologies depends on availability of long term weather data. Thus, the absence of data can be a hindrance to proper planning and can limit chances of success of a scheme.

6.0 Issues from Stakeholders workshop on this Country report

Key stakeholders participated in a one day feedback workshop at the headquarters of the Ministry of Agriculture and Food Security (MAFS). The country report was presented and discussed from which a number of issues emerged.

It was observed that there are relatively fewer WH technologies in the Lake Victoria basin compared to other parts of Tanzania. The most common WH technologies in the basin are Bunded fields (jaluba) and Ridges that are untied not on contour. Other practices include Spate Irrigation, Borrow pits and Earth dams.

It was recommended to introduce new practises in the Lake Victoria basin including: contour bench terraces, infiltration ditches, contour ridges, ripping, ndiva and tied ridges. The new practices have a potential of reducing erosion and associated hazards and specifically, siltation of rivers and the lake.

It emerged that, MAFS was adopting the use of solar powered pumps in new irrigation schemes where pumping is required. It is believed that eventually, high pumping costs due electricity and fuel bills will cease to be a constraint in the implementation of potential irrigation schemes. More details on what was discussed can be obtained from the National Project Coordinator who is preparing proceedings of the workshop (at the time of submitting this report, workshop proceedings were not yet out).

7.0 Potential Institutions for Capacity Building Activities and Field Level Demonstrations

Based on consultant experience in the field of RWH and irrigation and desk review of various documents, the following institutions were short listed (Not necessarily in a priority order) as potential institutions to organize and conduct capacity building activities and implement field level demonstrations or pilot activities in water harvesting and irrigation (Table 9 – Table 13).

Table 10: General description of TIP

Name of Organization	Traditional Irrigation and Environmental Development Organization (TIP)
Legal status	Registered as an NGO since 06/08/1999
Name of legal representative	Dr. I.H. Kawa- TIP Executive Director
Address	P.O. Box 8909 MOSHI, TANZANIA
Email	tip@tiptz.org, Website: www.tiptz.org
Telephones:	+255 27 2753025/ 2754232
Fax:	+255 27 2751124
Staff:	Professional staff and technicians in irrigation, agronomy
Activities/ Objectives:	The main focus of the NGO is to assist farmers improve smallholder irrigation practices based on sustainable use of land and water resources through: i) strengthening the organizational capacity of WUGs ii) improving land management practices iii) improving traditional irrigation systems iv) assisting in market access and agro-enterprise development. TIP cover selected traditional irrigation areas in four districts; Lushoto (Tanga region), Same and Mwanga (Kilimanjaro region) and Arumeru (Arusha). TIP has also undertaken design and construction of several irrigation schemes

Table 11: General description of SWMRG

Name of Organization	Soil Water Management Research Programme at Sokoine University of Agriculture
Legal status	Research Group
Name of legal representative	Prof Henry Mahoo – Team Leader
Address	P.O. Box 3003, MOROGORO, TANZANIA
Email	swmrg@yahoo.co.uk
Telephones:	+255 23 2601206/ 2604649
Fax:	+255 23 2601206/ 2604649
Staff:	Professional staff in irrigation, hydrology, soil science, agronomy, agric communication, agric and resource economics, agro met, GIS and remote sensing, S&WC, modelling soil and atmospheric conditions affecting plant growth.
Activities/ Objectives:	All issues falling under the above expertise. Production of extension and communication materials. Some of researches that have been undertaken by SWMRG include: (i) Rainwater Harvesting research project in Hombolo, Dodoma region, (ii) Evaluation and promotion of rainwater harvesting in semi-arid areas of Tanzania, (iii) Improved rain-fed cropping system incorporating rainwater harvesting, (iv) Assessment of rainwater harvesting techniques for domestic uses and crop production in the semi-arid areas of Njombe District. The on-going research activities include: (i) Improvement of soil fertility management practices in rainwater harvesting systems, (ii) Improving the management of common pool resources in rainwater harvesting systems, (iii) Smallholder system innovations in integrated watershed management (iv) Climate change adaptation for Africa Outreach activities, training of trainers, professional capacity building and consultancy services.

Table 12: General description of KATC- MOSHI

Name of Organization	Kilimanjaro Agricultural Training Centre
Legal status	Government Mid level Training Institute
Name of legal representative	Mr Shao – Principal
Address	P.O. Box 1241, MOSHI, TANZANIA
Email	Katc_mafc@yahoo.co.uk
Telephones:	+255 27 2752293
Fax:	+255 27 2752293
Staff:	Professional staff and technicians in irrigation, agric-engineering, rice agronomy, extension
Activities/ Objectives:	The centre offers specialised short courses in agriculture with special emphasis on irrigated rice farming. One scheme from each irrigation zone is used as model site whereby farmers acquire knowledge and skills in improved cultivation, water management, farming tools, cropping pattern, management of farmers' organisations, farmer-to-farmer extension, etc. KATC is recognised as the centre of excellence by MAFSC and donor.

Table 13: General description of SAIPRO TRUST FUND

Name of Organization	Same Agricultural Improvement Programme
Legal status	Registered as a TRUST FUND
Name of legal representative	Mr Medard Kahabi - Coordinator
Address	P.O. Box 1 HEDARU, KILIMANJARO, TANZANIA
Email	Kahabitz@yahoo.co.uk
Telephones:	+255 27 2757883
Fax:	-
Staff:	Professional staff and technicians in Agric-engineering, agronomy and extension
Activities/ Objectives:	Improve irrigation structures, improve land productivity, and enhance capacity of community to manage water resource in a sustainable way, promotion through training of use of draught animal power in farm activities. The NGO has collaborated with RELMA and SWMRG in construction of RWH structures. It is involved in many researches carried by SWMRG in Same District

Table 14: General description of MATI IGURUSI

Name of Organization	Ministry of Agricultural Training Institute - Igurusi
Legal status	Government Mid level Training Institute (Diploma in Irrigation)
Name of legal representative	Mr Iddi A. Kinyaga – Acting Principal
Address	P.O. Box 336, MBEYA, TANZANIA
Email	kinyagaidd@yahoo.com
Telephones:	+255 754 045950
Fax:	
Staff:	Professional staff and technicians in irrigation, agric-engineering, agronomy
Activities/ Objectives:	The institute offers diploma in irrigation (design and construction of small scale irrigation schemes, soil-plant water relationship, farming system approach, extension, etc) ; land use planning; general agriculture; and also tailor made courses to farmers (water management, paddy production, beans production, operation and maintenance irrigation scheme canals, environmental conservation, crop production, plant protection, soil and conservation issues, vegetable production, group formation and use of pedal pumps for irrigation)

8.0 Concluding Remarks and Observations

The criteria for ranking WH practices and sites was developed and used. The three highly ranked RWH practices are bunded field plots (*jaluba*), spate irrigation, and *ndiva* in first, second and third position respectively. The second and third ranked practices are well adopted in the best site. However, the best practice is utilized better in a different location. The best site is thus, not necessarily where the best practice is well adopted or carried out best, but where most practices are adopted and used. With regard to CMI, and PPMI schemes, it is important to point out that a practice and site are inseparable. Unlike WH, CMI and PPMI are fewer and located over long distances. A CMI site that is well designed, well managed and observes good practices is both a best practice and best site.

Lekitatu, Mwega and Mombo were respectively the first, second and third best CMI schemes. All three have strong and well organized farmers' organizations. At Mwega the organization is also a registered cooperative society. Thus, establishment of WUGs or cooperatives should be regarded as an essential precondition for out scaling of such schemes on other locations. Other schemes are well designed, but lack good management and adequate water supply.

Best practices, sites and schemes are a product of a combination of factors. It is therefore not proper to look at a practice as a success without associating it with enabling environment and other synergistic best factors. Such factors may exist in one location but be non-existent in another leading to failure of an innovation to be scaled up.

Compared to WH and CMI, PPMI schemes are high investment and high technology undertakings. They, for example, tend to use water pumps instead of gravity; have lined canals and piped water systems. Water application methods include sprinklers and drip technology. Most of them produce tea, and cane for their factories and thus are not constrained by the availability of markets. They are thus, generally more efficient than WH and CMI system.

It is important to mention that due to time constraint it was not possible to visit all best practices and sites. Some of these sites which were not covered by this consultancy include Bahi irrigation scheme for WH and Madibira irrigation project for PPMI. The reader is therefore referred to Rapid baseline assessment report (RBA) for some of the information about these schemes and other important information related to irrigation development in Tanzania.

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Appendices

Appendix 1: List of RWH practices in Tanzania

No.	Practice	Occurrence in Best site
1.	Bunded fields (jaluba)	x
2.	Ridges untied not on contour	x
3.	Ndiva	x
4.	Charco ponds (Lambos)-with and without tanks	x
5.	Spate Irrigation	x
6.	Roof top Water Harvesting (Domestic Use)	x
7.	Bench terraces- stone, vegetation	x
8.	Ripping	x
9.	Large planting pits-vitengo	x
10.	Earth dams embankment	
11.	Fanya juu	x
12.	Infiltration ditches	x
13.	Ngolo pits –matengo	
14.	Borrow pits	
15.	Trash lines	x
16.	Contour/ non contour stone bunds	x
17.	Contour ridges	
18.	Ladder terraces (mgeta~)	
19.	Tied ridges	
20.	Sunken beds	

Description of some WH practices

Ngolo

Another type of terraces, known locally as "Ngolo" in Tanzania, is built by collecting and arranging grass and weeds in squares. After drying, the grasses/weeds are covered with soil, which is dug from the middle of the squares. A farm will look like an egg tray due to many pits and terraces. These types of terraces control runoff, soil erosion and improve soil fertility. During weeding, weeds are thrown in the depressions where they decompose and add to soil organic matter.

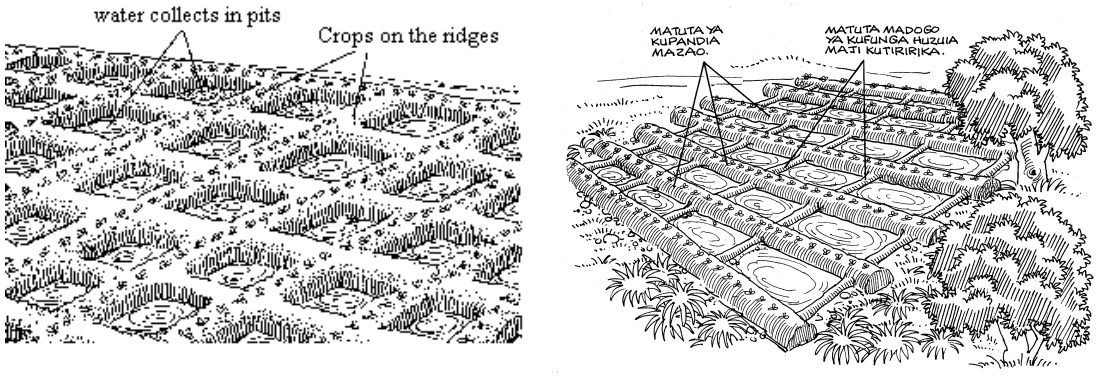


Figure A1: Big planting pits

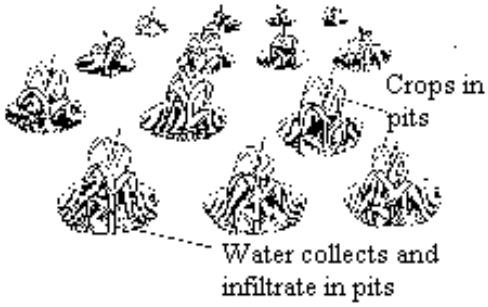


Figure A2: Pits for RWH for field crops

Big pits can also be used for growing field crops in dry areas. The pits are basin-shaped, and seeds or seedlings are planted in the middle of a pit. Water collects in the pits where it is needed.

Trash lines

In this technique, weeds, grass or tree branches are collected and arranged along the contour. So as to prevent runoff losses, the space between the lines should not be too wide. The trash lines hold water, spreading it to allow better infiltration.

Tied ridges

Tied ridges are just like normal ridges with ties at one to two metres creating basins. These encourage ponding increasing the time for infiltration to take place.

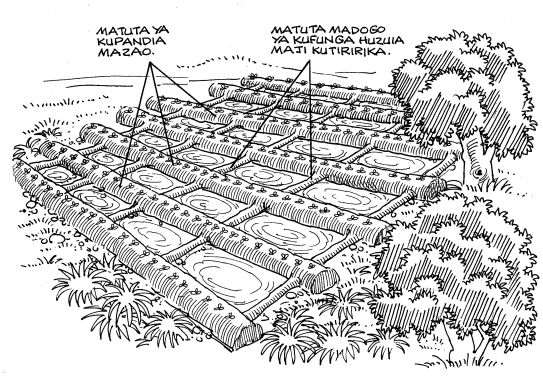


Figure A3: Tied Ridges

Appendix 2: Details of Best WH Practices in Tanzania (see Appendix 2_Details of best WH Tanzania.exl)

Appendix 3: Details of Best CMI in Tanzania (see Appendix 3_Details of best CMI_Tanzania.exl)

Appendix 4: Ranking of Best CMI in Tanzania (Appendix 4_Ranking of best CMI_Tanzania.exl)

Appendix 5: Details of Best PPMI in Tanzania (see Appendix 5_Details of best WH_Tanzania.exl)

Appendix 6: List of Persons Consulted

No.	Name	Particulars
1	A. Simba	Senior irrigation engineer, MAFC, DITS, Dar es Salam
2	Ruhangisa	Zonal irrigation engineer, Morogoro zone office
3	Kamugisha	Irrigation engineer, Morogoro zone office
4	Omary	Irrigation engineer, Kilimanjaro zone office
5	H.F. Mahoo	Head, SWMRG, SUA, Morogoro
6	M.W. Temi	Principal, Mkindo FTC, Turiani
7	B. Mushi	Irrrigation technician, Lower Moshi irrigation scheme
8	Malegese	Agricultural engineer, KATC, Moshi
9	C. Pangapanga	Scheme chairperson, Dakawa rice farm
10	C Willy	Distric Irrigation Officer, Kilosa
11	D. Mboya	Distric Irrigation Officer, Kilosa
12	H. Mfinanga	Secretary, UWAKICHI, Kikafu chini scheme
13	M. K. Saba	District irrigation technician, Arumeru, Arusha
14	Kahaya	Extension worker, Lekitatu scheme
15	A.L. Maro	Irrigation engineer, TIP
16	S. Mhando	Secretary, Mombo irrigation scheme association
17	P. Rajesh	Agronomist, Kapunga rice farm
18	M. Gembe	Operation manager, Kibena tea estate
19	B. Mwalongo	Irrigation manager, Kibena tea estate
20	Richard John Kaiza	Chief Agronomist, Kilombero sugar company
21	R Ndongwe	Farm Manager , Ruaha farm , Kilombero sugar company

Appendix 7: List of Photos

Lower Moshi irrigation scheme-CMI

Lao River intake

Transplanting

Livestock drinking water from secondary canals

Brick making near secondary canal

Mombo irrigation scheme-PMI

Dam for storing irrigation water

Main canal from the dam

Paddy fields

Lekitatu irrigation scheme

Division work

Kapunga irrigation scheme- PMI

Main intake

Main canal

Land preparation

Kibena tea company-PMI

Lihongosa tea estate

Irrigation water source (Lihongosa swamp)

Pumping station

Kilombero Sugar Company (Illovo Group) PMI

Main pumping station

Pipes carrying water main canal

Main canal from pumping station

Sub-pumping station supplying water to sprinklers

Mkindo irrigation scheme CMI

Bunded paddy fields

Weeding in progress

Spate irrigation at Makanya village, Kilimanjaro

Tied ridges at Hombolo, Dodoma

Vegetation supported bench terraces, Chome

Stone supported bench terraces, Chome

Charco pond at Makanya

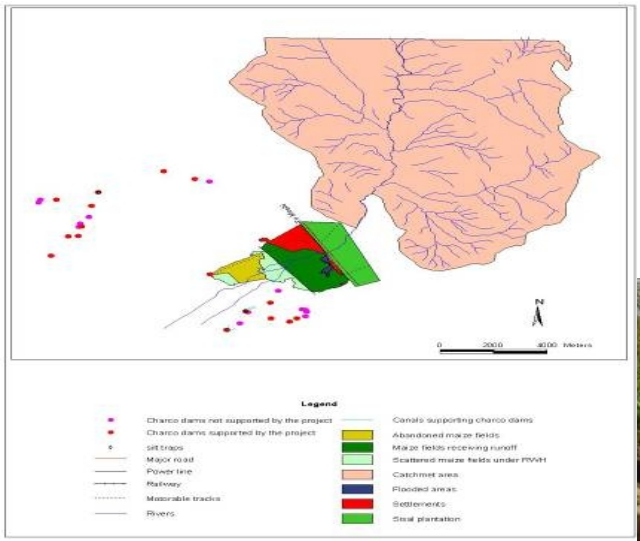
Charco pond at Makanya-fenced with brush wood)

Tank for storing water from charco to reduce evaporation loses

Appendix (Raw Data from Excel)

Appendix 1a): Water Harvesting - Use of charco ponds

Date of Visit Sept 2007	Category: WATER HARVESTING
Name of Site: MAKANYA VILLAGE- KWESASU SUBVILLAGE	Either water Harvesting; Community Irrigation or Private Public Irrigation
	Sketch Map of Site: Showing location of charco ponds
Geographic location of practice: This technology is applicable to low topographic areas in arid or semi-arid climates	
(GPS) Coordinates:	
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc Livestock keepers in Makanya village. There are >60 charco ponds in the village.	
Characteristics of the area: SAL, flat to gentle slope, acacia being the dominant vegetation with grassland. Alluvial flood plain	
Climate (AEZ) + Description:	



Sketch Map of Site: Showing location of charco ponds

Average annual rainfall (mm) 300mm or less	
Months of Short Rains:	October - December
Months of Main Rains:	March - May
Mean annual ref. crop Evapotranspiration (mm):	
Predominant soil type:	Clay to clay loam
Topography:	lowlands
Slope:	flat to gentle slope
Erosion:	not evident
Period of year during which used:	Jan, Feb, June-October
Period of year during which benefits utilized:	
Water Source: Rainwater runoff from range lands.	

Appendix 1b): Water Harvesting - terrace

Date of Visit	Category: RAINWATER HARVESTING -terrace
Name of Site: NDIVA -Champishi -Chome village	Either water Harvesting; Community Irrigation or Private Public Irrigation
	Sketch Map of Site
Geographic location of practice: SAME DISTRICT, KILIMANJARO REGION	
(GPS) Coordinates:	
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc Households owning land within the command area of the Ndiva, Champishi sub- villages in Chome	
Characteristics of the area: Slopping (15-25%) with some surface stones	
Climate (AEZ) + Description:	
Average annual rainfall (mm): Between 600 to 800 mm	
Months of Short Rains:	Oct -Dec
Months of Main Rains:	March -May
Mean annual ref. crop Evapotranspiration (mm):	
Predominant soil type:	sandy loam, silt clay loam
Topography:	Mountainous

TERACES

Slope:	Slopping (15-25%)
Erosion:	Not evident
Period of year during which used:	Throughout the year
Period of year during which benefits utilized:	Throughout the year
Water Source: small perennial stream/ spring	

Water conveyed by pipe to participating households

Cultivated area:20 to 30 ha area comprised of small plot(s) per household for total or supplementary irrigation.

Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.).The Ministry of Agriculture, TIP and SAIPRO have been promoting a range of S&WC measures in the Pare Mts including bench terraces. They have funded the construction of small community projects in irrigation. Such projects are usually preceded by elaborate planning. Training of local staff so that they can train others in the art of making stone terraces has taken place.

Useful in: Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc. In mountaneous areas, practicing seasonal cropping. In areas where adoption of S&WC measures is important to prevent soil erosion. .	Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider application: Stones are central in the construction of bench terraces. Absence of stones/ construction materials can thus be a hindering block. Terraces based on hedge plants take long to attain desired size.
Geographical extent of use: The areas of the study country where it is found and the sort of areas where it could be used within the Nile Basin Highland areas with perennial rivers to supply water for off season production of high value crops.	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths of the practice and whether it has in fact achieved what it set out to do. Year round production of high value vegetable crops grown off season has successfully stabilized and increased household incomes lifting people out of poverty following the collapse of the coffee market.
Other Sites where used:	
Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.) Find out from TIIP/ SAIPRO on ndiva. Construction of terraces is mostly by shared	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc) The Traditional Irrigation Improvement Project (TIIP), and NGOs such as SAIPRO, MIFIPRO have assisted in training village artisans who supervise the construction of terraces.

group labour, or hired labour.	
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock: Water for both crop production and meeting domestic needs.	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details). Terraces are individually managed, however the source of water is management through a committee recognized by the village government.
Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users. How and why are they involved in the practice? Actual level of beneficiary involvement under operation: Individual farmers Who are the main beneficiaries	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.) The technology was introduced to the area. beneficiary involvement
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). TIP trains artisans	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this). O&M is done individual farmers / members themselves. Extension services only in relation to crop production issues.
Environment benefits: (Whether it has been completed as part of part of watershed development or intergated management approach, how it fits in, visible benefits achived in terms or water avaialability, reduction in erosion, vegetative growth etc). Bench terraces in ones crop field are for efficient use of water to prevent likelihood of erosion. Sustainability economic aspects cultural environmental aspects technical	Social/Cultural acceptability: It has no social-cultural preconditions in its use- highly acceptable
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and replicable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.).It is self sustaining because it its highly paying 9high returns).	Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.).High cost and labour requirements in the construction of terraces may discourage some people from adopting/ participating.
Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;) Availability of water to allow intensive vegetable production year round. Good accessibility to reliable markets.	What is potential for applying all/parts of initiative elsewhere?
	(Score from 1 to 10 on list below with 10 being highly applicable)
	I [7] Transfer of practice to another group/culture/land-use system, etc.
	II [5] Easy to transfer the practice, but with minor adaptations for local conditions
	III [61] Transfer possible, but significant modifications/prerequisites to consider.
	IV [7] Difficult to transfer the practice. Need experienced support.
	V [1] It would be impossible to transfer the practice. Too site specific.
	Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.) Use of pipes to

	convey water reduces possible friction caused by construction of network of canals through land of uninterested people.
Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be conidered best Practice - name them and give reasons why and provide any Conclusion and Recommendations). Management of a river course undertaken There is shortage of land. Vegetable production using bench terraces has improved family income in the area. Collapse of the coffee market negatively affected most people in the Pare mts.	
Contact Organisation: (For further information; site visits' etc)	TIP, SAIPRO
Type of organisation:	Mr Kahabi
[ ] government organization	Contact details (see those for SAIPRO coordinator in country report)
[ ] private organization	
[x] NGO &/or CBO	
[ ] international agency	
[ ] other:	
Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon future similar interventions)	
Planning: Location of ndiva relative to agricultural land.	
Design Local capacity exists in the construction through training artisans with assistance of NGOs and TIIP.	
Construction Labour exchange arrangements within the village	
Implementation Family labour and local artisans	
O&M This is usually undertaken family members	
Beneficiary involvement: Individual farmers and TIP/ SAIPRO	
Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc).Reliable markets in cities and good accessibility have helped.	
Other Remarks or observations:	
Contact person completing form: Farmer Richard -Chome village	
Contact details	
Legend for Water harvesting schemes	
1. Open Pond - excavated in natural conditions	
2. Haffir/ crescent shaped dam/Water Ponds/Pans	
3. Small Dam - earth embankment	
4. Sub-Surface Dam	
5. Sand Dam	

6. Well - shallow hand dug - with SSI		
7. Well - Deep hand dug - with SSI		
8. Spring Development for SSI and/or other uses		
9. Roof Water Harvesting (Domestic Use)		
10. Runoff Water Harvesting (Domestic Use)		
11. Runoff Water Harvesting (Agricultural/Homestead Use)		
12. Rock and other surface catchment systems		
13. River water harvesting (diversions) for small scale irrigation		
14. Spate Irrigation		
15. Recharge Structures		
16. Insitu Water harvesting Measures/ Soil and Water Conservation techniques on arable rainfed lands		a. Conservation tillage
		b. Planting Pits
		c. Katumani Pit
		d. Semi-Circular Bunds
		e. Negarim
		f. Tied Contour ridges
		g. Contour Stone Bunds
		h. Fanya Juu
		i. Earth Bunds with external catchment
		j. Contour ridges with external catchment

Appendix 1c)**: Rain Water Harvesting** (Ndiva)

Date of Visit		**Category: RAINWATER HARVESTING ndiva**
Name of Site: NDIVA Mgungani/ Manolo		Either water Harvesting; Community Irrigation or Private Public Irrigation
		Sketch Map of Site
Geographic location of practice: SAME DISTRICT, KILIMANJARO REGION		
(GPS) Coordinates:		
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc HHs owning land within the command area of the Ndiva, # HHs, Mgwasi and Hedaru villages		
Characteristics of the area: Slopping (10-20%) with surface stones (20%)		
Climate (AEZ) + Description: Semi-arid, rainfall		
Average annual rainfall (mm): Between 300 to 600 mm		
Months of Short Rains:	Oct dec, March -May	
Months of Main Rains:	March -May	
Mean annual ref. crop Evapotranspiration (mm):		
Predominant soil type:	sandy loam, silt clay loam	
Topography:	Slopping (10-20%)	
Slope:	Slopping (10-30%)	
Erosion:	Not evident	
Period of year during which used:	Throughout the year	
Period of year during which benefits utilized:		
Water Source: Perennial river		

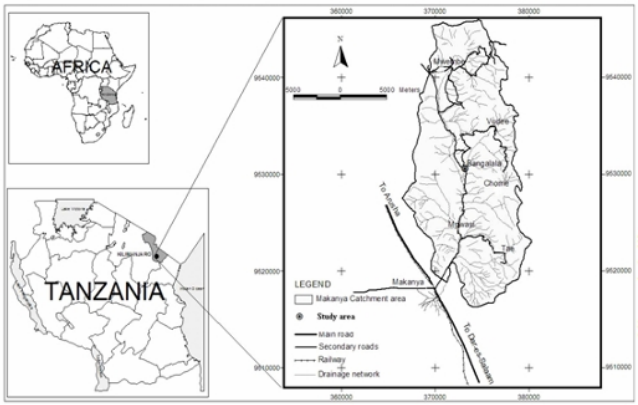
Cultivated area:20 to 50 ha area decreases during dry season due to total irrigation vs supplementary during rain season	
Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.). Ndiva is a traditional irrigation technology among the Pare people. It is believed to have been in existence as early as the 18th century.	
Useful in: Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc. Ndiva is suitable in mid slopes of mountainous areas, or where the slope is adequate to enable flow of water by gravity. Water should be easily diverted without need for a pump. Because of the slope, adoption of S&WC measures is important to prevent soil erosion,	Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider application: Rivers flowing in very deep gorges and thus water can't be diverted without use of pumps. Absence of suitable/ cultivable land in the vicinity of the river. Stones are central in the construction of ndiva. Absence of stones/ construction materials can be a hindering block.
Geographical extent of use: The areas of the study country where it is found and the sort of areas where it could be used within the Nile Basin Perennial rivers on slopping land for off season production of high value crops. Other Sites where used:	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths of the practice and whether it has in fact achieved what it set out to do. Reduces risk of crop failure in SAL by providing supplementary irrigation during dry spells within rain season. High value crops grown off season leading to increased income in the households.
Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.) Find out from SAIPRO	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc) Day to day management, operation and maintenance of the ndiva are the responsibility of the members. Until very recent past, the construction has mainly depended on the farmers with cultivable land within the command area of the ndiva. The Traditional Irrigation Improvement Project (TIIP), and NGOs such as SAIPRO, MIFIPRO have assisted in the improvement and construction of new ndiva. TIIP and NGOs have provided technical expertise and funds mainly for the purchase of cement.
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock: I	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details). Each ndiva has got its management committee selected from amongst its members. Each such committee is recognized by the village government and especially 'the village social services committee'.
Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users? How and why are they involved in the practice? Actual level of beneficiary involvement under operation: Stakeholders are farmers in the area, village government(s) and ward officials. Members of a ndiva may come from different villages due to small and fragmented holdings. The involvement of both village and ward government officials is thus crucial in conflict management. Who are the main beneficiaries	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.) The technology is Indigenous to the area. beneficiary involvement

	demand based interventions
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). None	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this). O&M is done by the farmers / members themselves.
Environment benefits: (Whether it has been completed as part of part of watershed development or integrated management approach, how it fits in, visible benefits achieved in terms or water availability, reduction in erosion, vegetative growth etc). Every member should have S&WC measures in his/ her crop field to prevent undue demand for water in terms of frequency and duration of watering. Sustainability economic aspects cultural environmental aspects technical	Social/Cultural acceptability: It has no social-cultural preconditions in its use- highly acceptable
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and replicable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.). An indigenous technology to the area and thus self sustaining with or without external assistance.	Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.).
Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;)	What is potential for applying all/parts of initiative elsewhere?
	(Score from 1 to 10 on list below with 10 being highly applicable)
	I [7] Transfer of practice to another group/culture/land-use system, etc.
	II [9] Easy to transfer the practice, but with minor adaptations for local conditions
	III [1] Transfer possible, but significant modifications/prerequisites to consider.
	IV [1] Difficult to transfer the practice. Need experienced support.
	V [ ] It would be impossible to transfer the practice. Too site specific.
	Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.) The network of canals requires that members agree to part with portions of their land for this purpose. Technical problems can't be avoided if big pieces of land of non interested people existed within the command area of the ndiva
Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be considered best Practice - name them and give reasons why and provide any Conclusion and Recommendations). Management of a river course undertaken	
Contact Organisation: (For further information; site visits' etc)	
Type of organisation:	Contact person:
[ ] government organization	Contact details
[ ] private organization	
[ ] NGO &/or CBO	

[ ] international agency	
[ ] other:	
Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon future similar interventions)	
Planning: Location of ndiva relative to agricultural land.	
Design Ndivas come out in different shapes and sizes. Local capacity exists in the construction of masonry work. Knowledge in constructing intakes has been aquired from the NGOs and TIIP.	
Construction Labour is provided by the members for example excavation, and the supply of stones and sand. External agents e.g. NGOs usually provide only cement and technical backstopping.	
Implementation Local artisans are used in the construction, labour is provided by members ofis and	
O&M This is usually undertaken by members on self help basis called "msalagambo" in Pare. Major damage to the walls of the ndiva may call for a major intervention and NGOs have been in the fore front in providing financial and technical assistance. However, it's the responsibility of the ndiva member to oversee all activities relating to O&M.	
Beneficiary involvement	
Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc).	
Other Remarks or observations:	
Contact person completing form:	
Contact details	
Legend for Water harvesting schemes	
1. Open Pond - excavated in natural conditions	
2. Haffir/ crescent shaped dam/Water Ponds/Pans	
3. Small Dam - earth embankment	
4. Sub-Surface Dam	
5. Sand Dam	
6. Well - shallow hand dug - with SSI	
7. Well - Deep hand dug - with SSI	
8. Spring Development for SSI and/or other uses	
9. Roof Water Harvesting (Domestic Use)	
10. Runoff Water Harvesting (Domestic Use)	
11. Runoff Water Harvesting (Agricultural/Homestead Use)	
12. Rock and other surface catchment systems	
13. River water harvesting (diversions) for small scale irrigation	
14. Spate Irrigation	
15. Recharge Structures	
16. Insitu Water harvesting Measures/ Soil and Water Conservation techniques on arable rainfed lands	a. Conservation tillage
	b. Planting Pits
	c. Katumani Pit
	d. Semi-Circular Bunds
	e. Negarim
	f. Tied Contour ridges
	g. Contour Stone Bunds

		h. Fanya Juu
		i. Earth Bunds with external catchment
		j. Contour ridges with external catchment

Appendix 1c: Spate Irrigation

Date of Visit	Category: RAINWATER HARVESTING spate irrigation
Name of Site: Makanya village	Either water Harvesting; Community Irrigation or Private Public Irrigation
Geographic location of practice:	Sketch Map of Site 
(GPS) Coordinates:	
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc More than 780 households have crop fields in the area. Both male and female headed households in Makanya village benefiting.	

Characteristics of the area: SAL, flat to gentle slope, acacia being the dominant vegetation with grassland	
Climate (AEZ) + Description: SAL	
Average annual rainfall (mm) 300 or less	
Months of Short Rains:	oct - dec
Months of Main Rains:	march - may
Mean annual ref. crop Evapotranspiration (mm):	
Predominant soil type:	sandy loam , loamy sands
Topography:	Foot slope of Pare mts
Slope: ,	flat to gentle slope
Erosion:	not evident
Period of year during which used: only during rain seasons	
Period of year during which benefits utilized:	
Water Source: Run-off from the mountains, built up areas, road/ rail infrastructure drainage systems	
Cultivated area:700 acres	
Technical Description: (Please describe in about 250 words the background of the practice, how it is used, details of how the site is used, its components, how it achieves its objectives and its main purpose - For example if it is used for drinking water, or the watering of livestock and community drinking, or irrigation etc.) Simple (irrigation) system, No permanent infrastructure for diversion, Exploiting concentration of water from drainage works, Entirely farmers efforts. Runoff from the Pare Mts concentrated by road culverts and railway bridge is diverted into crop fields using temporary diversion structures (see Annex for pictures). 700 acres benefiting, more than 780 households benefiting.	

<table>
<tr><td colspan="2">Maize yield increased to 2.5-5t/ha x2 per year - Nothing without RWH (300 mm of poorly distributed rainfall). A network of canals distributes water to crop fields (5 main canals) Flood flows, with appreciable discharges usually for only a few hours, and with recession flows lasting for a day or two. A maximum of 3 to 4 such flows are received per season.</td></tr>
<tr><td colspan="2">Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.). The Makanya spate irrigation 'scheme' dates back to the 1940s. There were no initial studies prior to the implementation. Over time the 'scheme' has expanded as people from the mountains have settled and acquired land in the area. A few studies have since taken place. The canal network and its management, extent of area benefiting from the system were studied by SWMRG ( ). WARFSA, The Small System Innovations is currently looking at aspects of water productivity. SSI ( ) The amount of discharge that arrives at Makanya from the mountains.</td></tr>
<tr><td>Useful in: Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc. Gentle to flat areas, where adequate and reliable runoff from surrounding watershed/ catchment, can be easily diverted from relatively shallow gully/ water course. Deep/ alluvial soils with high water holding capacity capable of storing water for long period</td><td>Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider application. Water flowing in very deep gullies relative to the surrounding cultivable area complicates diversion. Severe erosion from the watershed bringing infertile soils that may cover productive surface soils and thus putting land out of use. Excessive flows may destroy the temporary infrastructure. Absence of a coherent WUG and thus-lack of good management. More command area/ crop fields than available runoff.</td></tr>
<tr><td>Geographical extent of use: The areas of the study country where it is found and the sort of areas where it could be used within the Nile Basin Wide spread Kilimanjaro, Morogoro, Dodoma, Mwanza, Shinyanga, Tabora….
Other Sites where used:</td><td>Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths of the practice and whether it has in fact achieved what it set out to do. The 'scheme' has brought food security to participating farmers. Crop (maize) failure is never experienced within the scheme bearing in mind that it is impossible to grow maize outside the scheme due to low rainfall of <300mm. On the other hand two crops are grown per year. Maize yield increased to 2.5-5t/ha x2 per year - Nothing without RWH (300 mm of poorly distributed rainfall)</td></tr>
<tr><td>Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.) It is difficult to determine the cost, as the entire scheme is based on self help labour provided by members. De-silting</td><td>Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc) Day to day management, operation and maintenance of the scheme is the responsibility of the members. The main canal is cleaned by all members of the scheme by participating in agreed activities- e.g. removing logs, branches, litter, and sediments as and when required. There are subcommittees for all secondary canals drawn from respective members. The subcommittees are responsible for O&M of their canal.</td></tr>
</table>

and mending the main and secondary canals are the major preoccupations and cost items.	
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details). The Makanya scheme is run by WUG. It has a democratically elected main/ apex committee (Chairperson, Secretary, Treasurer and four elected members- who form the executive committee). The subcommittees are a mirror image of the main committee. The general meeting is supreme where issues originating from the subcommittees are discussed and agreement reached/ solution found. The village government has vested interest in the scheme which is considered a line for the village. It may intervene in case of conflict(s) which are not resolved.
Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users? How and why are they involved in the practice? Actual level of beneficiary involvement under operation: The scheme is 100% farmer -initiated, implemented and managed. The stakeholders and beneficiaries are thus, members of the scheme who are Makanya villagers. Who are the main beneficiaries	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.) The scheme was/ is demand driven. It developed spontaneously as people from the mountains settled at this semi-arid area. At the moment, scheme members have approached the MAFS&C for assistance to construct a storage dam upstream of Makanya, so that they can regulate the flow and prevent damage to their irrigation infrastructure which is 100% of temporary nature. beneficiary involvement demand based interventions
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). Soil Water Management Research Program at Sokoine University has carried out on -farm studies on soil fertility improvement strategies in the 'scheme'. A booklet on soil fertility management options was produced and distributed. On field water distribution techniques.	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this). There is an agricultural village extension officer (VEO) based in the village. Services provided include packages of normal agronomic practices.
Environment benefits: (Whether it has been completed as part of part of watershed development	Social/Cultural acceptability: Socially and culturally acceptable as the entire 'scheme' originated in the village without external influence.

or integrated management approach, how it fits in, visible benefits achieved in terms or water availability, reduction in erosion, vegetative growth etc). Has nothing to do with environmental issues. Sustainability economic aspects cultural environmental aspects technical	
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and reliable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.). It is unlikely that the scheme will be abandoned since it has been in existence for more than 60yrs and it originated in the village without external influence.	Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.). Heavy flows usually damage diversion canals leading to high demand of repair time/ labour. Development of RWH schemes upstream of Makanya may reduce the amount of runoff received at Makanya. It is labour intensive and very involving and especially infield spreading of water. Farmers have to be physically present to manage the follow even at night. Excess water beyond what can be immediately utilized cannot be stored.
Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;) The coherence of the scheme is based on the desire by members to be food secure in this SAL. It is thus likely to flourish elsewhere under similar climatic conditions.	What is potential for applying all/parts of initiative elsewhere?
	(Score from 1 to 10 on list below with 10 being highly applicable)
	I [8] Transfer of practice to another group/culture/land-use system, etc.
	II [8] Easy to transfer the practice, but with minor adaptations for local conditions
	III [2] Transfer possible, but significant modifications/prerequisites to consider.
	IV [2] Difficult to transfer the practice. Need experienced support.

	V [0] It would be impossible to transfer the practice. Too site specific.
	Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.) There are no Intellectual Property Rights in relation to this RWH technique. Cross village/ district/ basin study tours have been organized by SWMRG where farmers from different areas learn from each other.

Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be considered best Practice - name them and give reasons why and provide any Conclusion and Recommendations). Its has been in existence for >60yrs. There is self sufficiency for maize a major staple in the village. Households with crop fields in the scheme are food secure.

Contact Organisation: (For further information; site visits' etc)

Type of organisation:	Contact person: SWMRG Makanya office/ Makanya village government officials/ Village Extension Officer
[x] government organization	Contact details Tele: +255 27 2758108/ +255 23 2601206, swmrg@yahoo.co.uk
[ ] private organization	
[ ] NGO &/or CBO	
[ ] international agency	
[x] other:	

Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon future similar interventions)

Planning: Stable home-grown organizational structure with full support of village government.

Design Simple low cost temporary structures. Diversion made out of wooden stakes, brush wood, maize stoker and soil. Susceptible to damage by heavy flow

Construction Implemented by farmers/ members own labour.

Implementation Farmers own labour.

O&M By members /farmers through established self help schedules.

Beneficiary involvement All round involvement by scheme members in planning/ design/ construction/ implementation/ O&M

Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc).

Other Remarks or observations:

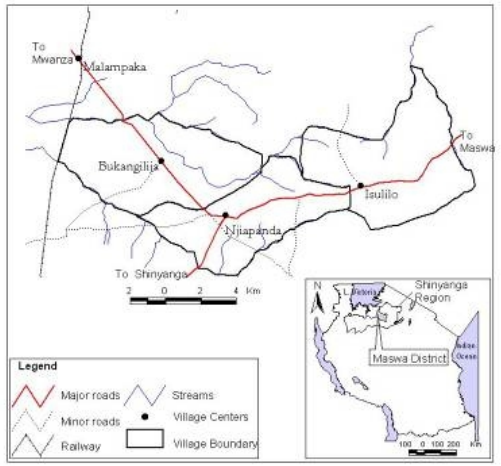
Contact person completing form:

Contact details Filbert B.R. Rwehumbiza; Sokoine University of Agriculture; P.O. Box 3001, Morogoro, TANZANIA. Tele Fax +255 23 2604649; +255 23 2601206

Legend for Water harvesting schemes	
1. Open Pond - excavated in natural conditions	
2. Haffir/ crescent shaped dam/Water Ponds/Pans	
3. Small Dam - earth embankment	
4. Sub-Surface Dam	
5. Sand Dam	

6. Well - shallow hand dug - with SSI		
7. Well - Deep hand dug - with SSI		
8. Spring Development for SSI and/or other uses		
9. Roof Water Harvesting (Domestic Use)		
10. Runoff Water Harvesting (Domestic Use)		
11. Runoff Water Harvesting (Agricultural/Homestead Use)		
12. Rock and other surface catchment systems		
13. River water harvesting (diversions) for small scale irrigation		
14. Spate Irrigation		
15. Recharge Structures		
16. Insitu Water harvesting Measures/ Soil and Water Conservation techniques on arable rainfed lands		a. Conservation tillage
		b. Planting Pits
		c. Katumani Pit
		d. Semi-Circular Bunds
		e. Negarim
		f. Tied Contour ridges
		g. Contour Stone Bunds
		h. Fanya Juu
		i. Earth Bunds with external catchment
		j. Contour ridges with external catchment

Appendix 1d: Rainwater Harvesting at Bukangilija / Njiapanda villages

Date of Visit in 05/10/2007	Category: RAINWATER HARVESTING
Name of Site: Bukangilija / Njiapanda villages	Either water Harvesting; Community Irrigation or Private Public Irrigation
	Sketch Map of Site 
Geographic location of practice: Ndala catchment, Maswa districf Shinyanga region an	
(GPS) Coordinates:	
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc All villagers in Bukangilija irrespective of gender benefit from the system. Each household own several 'bounded fields' locally called "*majaluba*". It is impossible to grow paddy rice (preferred crop) without using the *jaluba* system.	
Characteristics of the area: Undulating high altitude plateau	
Climate (AEZ) + Description:	

Average annual rainfall (mm) 600-900	
Months of Short Rains:	
Months of Main Rains:	
Mean annual ref. crop Evapotranspiration (mm):	
Predominant soil type:	Vertisols
Topography:	Undulating
Slope:	
Erosion:	
Period of year during which used:	Rain season
Period of year during which benefits utilised:	Year round
Water Source:Gulleys, ephemeral rivers, range land, built up areas, and road drainage systems	
Cultivated area:	

Technical Description: (Please describe in about 250 words the background of the practice, how it is used, details of how the site is used, its components, how it achieves its objectives and its main purpose - For example if it is used for drinking water, or the watering of livestock and community drinking, or irrigation etc.) Jalubas are constructed by digging the field to a depth of about 20cm and the scooped soil is used to build a bund around a rectangular field perimeter. Jalubas are located such that diverted water can flow by gravity into the system. Water is directed first into the upper slope jaluba to fill it before releasing it to sequentially flood jalubas located down slope. Leveling is crucial to enable an even spread of water. As the general slope increases, the width of a jaluba is reduced to maintain an even spread of water within the bounded area. Thus, jalubas tend to be large on flat landscape than on slopes. Bunds are repaired annually by pulling weeds removed from the cropped area or scooped soil incase of a major breach. Jalubas are for growing crops with high water demand for water. In most cases the impounded water is used to grow paddy. In non paddy soils, jalubas are used to increase chances for infiltration before planting maize or other crops.

Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.). There are no records on design of jalubas as practiced in Maswa. Research studies have mainly focused on fertility management of paddy (Kajiru, 2006, SWMRG, 2006a, b).	
Useful in: Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc. Valley bottoms, natural topographic depressions are ideal locations for jalubas. In many situations, such areas have heavy clay soils (black cotton soils, known as 'mbuga' soils in sukuma language). Scientifically, these are vertisols that expand when wet and shrink when dry. The high clay content makes them suitable in retention of water an environment suitable for paddy production. Also used in not too sandy soils for non flooded crops.	Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider application Practice depends on availability of runoff water. May not work in very dry areas where water for use in the jalubas is unavailable.
Geographical extent of use: The areas of the study country where it is found and the sort of areas where it could be used within the Nile Basin Jaruba system if found almost in all regions of Tanzania wherever paddy rice is grown. In Mwanza, Shinyanga and Tabora, crop production is highly dependent on the jaluba system.	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths of the practice and whether it has in fact achieved what it set out to do. Shinyanga and Mwanza are producing surplus rice by using the jaluba system. Other semi-arid areas of the country are producing rice by using the jaluba system where it would otherwise be impossible.
Other Sites where used: In sukumaland, jalubas can be found wherever runoff rainwater can be conveniently harvested. Most road drainage systems in Mwanza and Shinyanga are opportunistically used to harvest water for crop production using jalubas.	
Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.) Rwehumbiza and Mahoo (2002) reported a construction cost of about US $ 250 per 0.2 ha jaluba. Hiring a jaluba of that size per season did cost US $ 30. Due to the depreciating TSh against the dollar, the quoted costs have probably doubled by now.	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc). Depending on the source of water (see Water Source section above) and therefore the absence or presence of elaborate conveyance system, O&M may be an individual issue or for the community /WUG getting water from the same source. A small scheme at Bukangilija was for example funded by the Government to construct an intake but O&M remain the responsibility of scheme members.
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock A net profit of US $650 / ha was obtained for studies based on rice production in Maswa district (SWMRG, 2005)	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details). WUG with democratically elected leadership -guided by group bylaws and regulations. Work very closely with village government. It must be emphasized here that most jaluba systems get water from individual water sources and thus are managed individually.

Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users. How and why are they involved in the practice? Actual level of beneficiary involvement under operation: Farmers are the main initiators/ actors. The government is also a stakeholder in the sense that it endeavors to have food secure communities by supporting the extension services. Who are the main beneficiaries	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.) Jalubas have been in existence as far back as the introduction of paddy cultivation (>80) in Sukumaland (Shinyanga, Tabora and Mwanza). Fall in price of seed cotton (the former main cash crop in the area) has propelled increased cultivation of paddy rice. Paddy production is more attractive to farmers for rice has a reliable local and regional market, commands better prices and is also a food crop. beneficiary involvement demand based interventions
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). SWMRG has trained extension staff from the regions as Trainers of Trainers in RWH. A training guide in RWH was published and distributed in 2000 as were booklets on different RWH topics.	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this). Support has been in relation to rice agronomy through the agricultural extension department and research projects such as those by Kajiru, 2006; and SWMRG, 2006a; and management of common pool resources (SWMRG, 2006b),
Environment benefits: (Whether it has been completed as part of part of watershed development or integrated management approach, how it fits in, visible benefits achieved in terms or water availability, reduction in erosion, vegetative growth etc). Unintended benefits include -Control and use of runoff water in *jalubas* reduces likelihood of erosion. Impounded water contributes to the recharge of underground water reserves. Sustainability economic aspects cultural environmental aspects technical	Social/Cultural acceptability: The technology is well accepted by the farmers/ different communities and widely adopted in arid and semi-arid areas. The government is actualy promoting this technology in other parts of the country. National Water Resources Management Policy specifically is implementing construction of demonstration rainwater harvesting schemes at strategic locations in the country.
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and reliable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.). It is easy to implement and maintain even by an individual or a single household. Once established it can be used for years with very limited annual repair.	Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.). It requires soils with high water holding capacity. Options for mechanization limited in very small / short jalubas. Livestock should not be grazed in the system as they destroy bunds necessitating repair. This may be difficult as most farmers are agro-pastoralists.
Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice	What is potential for applying all/parts of initiative elsewhere?

elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;) None.	
	(Score from 1 to 10 on list below with 10 being highly applicable)
	I [9] Transfer of practice to another group/culture/land-use system, etc.
	II [9] Easy to transfer the practice, but with minor adaptations for local conditions
	III [1] Transfer possible, but significant modifications/prerequisites to consider.
	IV [1] Difficult to transfer the practice. Need experienced support.
	V [1] It would be impossible to transfer the practice. Too site specific.
	Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.)
Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be considered best Practice - name them and give reasons why and provide any Conclusion and Recommendations). Most areas of Mwanza, Shinyanga, Dodoma and Tabora have for a very long time been prescribed as suitable to drought tolerant crop (sorghum, cassava, millet) due to inadequate and poor ly distributed rains. With RWH *jaluba* technology, crops with high water demand eg 'paddy' are being successfully produced meeting local demands and surplus.	
Contact Organisation: (For further information; site visits' etc)	
Type of organisation:	Contact person: Team Leader, SWMRG- SUA; DALDO -Maswa District/ SAIPRO Same
[x] government organization	Contact details : SWMRG, P.O. BOX 3003, MOROGORO Tele: +255 23 2601206, swmrg@yahoo.co.uk
[ ] private organization	
[ ] NGO &/or CBO	
[ ] international agency	
[x] other:	
Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon future similar interventions)	
Planning: Necessary so as to allocate adequate resources -labour/ funds and fit it within the cash flow of the household.	
Design Narrow jalubas on steep slopes are required to enable even distribution of water within the bunds. Too short jalubas limit use of animal draft power commonly used in Mwanza, Shinyanga and Tabora region.	
Construction Due to high cost and labour needs, jalubas may be constructed gradually eg one or two per year until the required number is obtained/ the intended area is covered.	
Implementation No construction material required apart from labour and working tools	
O&M Entirely household labour/ hired labour for those who can afford.	
Beneficiary involvement Government or NGO may be involved initially in the construction of intake and conveyance system where a water source belongs to the whole community so as to ensure that standards and safety issues are observed. O&M thereafter is by the WUG while construction including O&M of individual jalubas is the responsibility of a household or individual.	
Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc). The jaluba system has opened up opportunities for growing preferred high value crops in SAL. Production of rice which can be marketed easily instead of sorghum/ millet is a typical example	
Other Remarks or observations:	
Contact person completing form:	

Contact details: SWMRG, P.O. BOX 3003, MOROGORO Tele: +255 23 2601206, swmrg@yahoo.co.uk		
Legend for Waterharvesting schemes		
1. Open Pond - excavated in natural conditions		
2. Haffir/ crescent shaped dam/Water Ponds/Pans		
3. Small Dam - earth embankment		
4. Sub-Surface Dam		
5. Sand Dam		
6. Well - shallow hand dug - with SSI		
7. Well - Deep hand dug - with SSI		
8. Spring Development for SSI and/or other uses		
9. Roof Water Harvesting (Domestic Use)		
10. Runoff Water Harvesting (Domestic Use)		
11. Runoff Water Harvesting (Agricultural/Homestead Use)		
12. Rock and other surface catchment systems		
13. River water harvesting (diversions) for small scale irrigation		
14. Spate Irrigation		
15. Recharge Structures		
16. Insitu Water harvesting Measures/ Soil and Water Conservation techniques on arable rainfed lands		a. Conservation tillage
		b. Planting Pits
		c. Katumani Pit
		d. Semi-Circular Bunds
		e. Negarim
		f. Tied Contour ridges
		g. Contour Stone Bunds
		h. Fanya Juu
		i. Earth Bunds with external catchment
		j. Contour ridges with external catchment

Appendix 2 Details of CMI in Tanzania

Date of Visit 11/11/2007			Category: Community irrigation
Name of Site: Dakawa Rice Farm			Either water Harvesting; Community Irrigation or Private Public Irrigation
			Sketch Map of Site
Geographic location of practice: Mvomero District, Morogoro			
(GPS) Coordinates: 6°25' - 6°304 S and 37°30' - 37°35'E			
Description of the Community: Wami Dakawa village has the population of 4574 people of which children are 2530 and others are 2044. Out of the population men are 2100 while female are 2474. The farm is cultivated by Farmers who are the members of the Farmers cooperative society. Total numbers of farmers is 465 from which 175 are female and 290 are men. Wami Dakawa is surounded by seven other villages namely Wami Ruhindo, Mabawa, Milama, Kambala (dominated Livestock keepers), Mkindo, Dihomba and Hembeti. Wami Dakawa villagers are the main source of manpower for agricultural activities carried out at the scheme at the ratio of 3/2 for women and men respectively. Transplanting, weeding, fertilizer application and harvesting cost 150,000/= per acre. Therefore farmers earn approximately TShs 750,000,000/= for doing the mentioned farm management practices for the whole scheme.			
Characteristics of the area:			
Climate (AEZ) + Description: Semi-arid, Eastern plateaus and mountain block			
Average annual rainfall (mm): 800 -1000			
Months of Short Rains:	October - December		
Months of Main Rains:	March - May		
Mean annual ref. crop Evapotranspiration (mm): 142			
Predominant soil type:		Vertisols (clay)	
Topography:		Generally flat	
Slope:		0.5 - 2%	
Erosion:		Along the irrigation and drainage canals	
Period of year during which used:		December- May	
Period of year during which benefits utilized: throughout the year			
Water Source: Apart from rainfall, the main water source is river Wami.			
Irrigated area: 2000 ha			
Method of water abstraction: Water is abstracted from the Wami river using 6 Pumps and is directed to the main channel from which is further divided into secondary/distribution channels			
Water delivery infrastructure: Water is delivered into the plots through unlined open channels.			

Type of water distribution: Water distribution is demand oriented. The main channel has water available all the time and the distribution channels get water at an interval of 6, 3 and 2 days depending on the water need and farm size owned by individual farmer	
Predominant on-farm irrigation practice: The major on-farm irrigation practice is level basin surrounded by borders	
Major crops (with percentages of total irrigated area): 100% of the area is under rice cultivation	
Average farm size: Majority of farmers are smallholder who own between 1-2 acres and few farmers own up to 12 acres	
Type of management: Community-managed scheme	
Technical Description: The Dakawa rice farm was established in 1975 with the overal objectives of reducing rice imports and increasing regional employment. The survey and design works were undertaken with the assistance from The People's Republic of Korea. The project was intended for paddy cultivation on 2000 ha with double cropping on about 700 ha. Levelling and canals construction started in 1979 and completed in 1982. Rice production begun in 1983. Initially the farm started as a project under NAFCO. Later it was incorporated under the company ordinance in March 1978. Dakawa Rice Farm has a title deed of the estate, which was offered for 33 years tenure from 1978 for agricultural purposes. This title deed was, however seize by the Nation's Bank of Commerce as a result of failure by the Farm to repay the borrowed money from the Bank. As for infrastructure including an intake diversion weir, the main and distribution canals, a rice mill, and other supporting facilities were deteriorating as time goes and were not in good condition due to the lack of repair and maintenance and the farm stopped production since 1997/1998 due to the lack of working capital. In order to revive the farms through privatization Dakawa Rice Farm was handling to the District Council and was distributed to famers in the year..... . Update the schemes is operated by community including people from Wami Dakawa village and the nearby villages as previous mentioned.	
Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.). The survey and design works were undertaken in..... with the assistance from The People's Republic of Korea.	
Useful in: (Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc.) The practice is possible in flat terrain with permanent water source. The area should have good power supply for water pumps. As a result, the practice is more appropriate for financially well-off individuals who can meet initial and O & M costs.	Limitations: Poor performance of the scheme is attributed to various reasons including poor land leveling, lack of good farm machinery, old and damaged irrigation infrastructures (canals, intake diversion weir), soil problems, poor management, weed problems, vermin and lack of working capital. Other problems are higher cost of electricity as the scheme water abstraction method is the pump that includes 6 pump. A monthly bill for water pumping is averaged at TShs 15,000,000/= that amount to TShs 75,000,000/= for the 5 months cultivation period. People sometimes do not contribute for electricity that make pumping of water to be not effective. The water pumps need maintenance. The scheme road infrastructure is damaged and makes the farm accessibility difficulty especially during wet season. Livestock keepers graze their livestock in the scheme rice plots soon after harvesting; the livestock damage the unlined canals banks. The canals expand and are filled with silt and sediments hence their width is expanded while their depth becomes shallower with time and some canals are damaged completely. This has resulted into poor water supply especially for the plots which are at the most far end of the farm and poor drainage problems. Sometimes the drainage canals contains more water than the water distribution canals eventually some farmers irrigate their rice using water from the drainage canals. Water also get lost through percolation as the scheme main and distribution canals are not lined. The estimated total water lost is 70% of the water supplied. This problem of water supply has led into poor production especially when

	rainfall is not sufficient to allowed production. Therefore some farmers do not harvest at all and their invested capital is lost as the results of lack of water. And some parts of the scheme have been abandoned as they cannot get water at all. The de-silting costs are higher which reduce farmer benefits. These problems make it difficult to replicate the practice some whereas as the input and management costs are too high for the small holder farmers to manage cultivation at benefit.
Geographical extent of use: The areas of the study country where it is found and the sort of areas where it could be used within the Nile Basin: The practice is widely used in Tanzania. Examples include Coastal, Morogoro, Kagera and Mbeya Regions. The practice is also used in several locations in the Nile Basin Countries.	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths of the practice and whether it has in fact achieved what it set out to do.) The scheme did achieve its objectives when it was a parasitical farm however not in a good way. The scheme aimed at providing employment and reduces rice import; however it managed to meet these objectives for some years. The government could not manage the scheme properly, the scheme stopped production in the year 1997/1998. After privatization, the scheme has managed to achieve its objective. It has provided employment to the Wami Dakawa villagers and people from the nearby villages and some people from Morogoro town. Farmers with plots within the scheme manage to cultivate and harvest rice for sell and for consumption, this is the major employment. The scheme employ people from the nearby villages especially women as women and men are employed at the ratio of 60/40 to work in the farm. They are employed for transplanting, weeding, fertile application and harvesting. Their employment can give them an average total income of TShs 700,000,000/= per season. The scheme now produces rice for sell within the regional, national and local markets and for consumption. Farmers who own plots within the scheme and those who are employed have benefited from the scheme and their living standard has a least change however not much. Therefore the scheme has achieved its objectives. The major strength of the practice is; the scheme has 6 pumps with the pumping capacity of 3600 litres/sec each. Therefore water supply is not a liming factor especially when the pump is regularly maintained. The scheme has farmer's organization that coordinates and organizes farming, water management, input supply and good crop husbandry. Markets especially local, regional and national markets are available; this helps farmers to cultivate at the profit. The scheme used the modern rice variety (SARO 306). This has assured farmers of good harvest. The scheme has the potential for expansion as it has the potential area of 1000 ha which is available for expansion for rice production and culture. The scheme has got an investor who will invest in milling; this will give the farmers chance to add value to their rice product for sell and export. The scheme has the potential to increase production if the canals will be lined to reduce water loss from percolation.
Other Sites where used: Bagamoyo irrigation scheme, Ruvu irrigation scheme, Mvuleni irrigation scheme, etc (See also URT 2002)	
Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.)	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc).The O&M is overseen by the O&M committee of the society. Each farmer contributes TShs 50,000/= per acre for electricity and maintenance of

	irrigation infrastructure. Currently there is no any financial assistance from the government or other donors.
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock: For each hectare, the total average cost from land preparation to harvesting is about TShs 400,000/= and 380,000/= for transplanting and broadcasting practices, respectively. Under good management, farmers practicing transplanting harvest 35 to 40 bags while those practicing broadcasting harvest 15 to 20 bags of 80 kg each. The farm gate price is TShs 25,000/=. Therefore, benefits obtained for farmers who transplant is TShs 600,000/= and while for the who broadcast is TShs 300,000/=	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details). The scheme is operated by the Dakawa Rice Irrigation Farming Cooperative Society which is registered and operated by the Board of 5-9 people. The Board consists of the Chairperson, Vice Chairperson, Secretary, and Treasurer. The Board leaders must be members of the society and are democratically elected by the annual general meeting. The Board has the following committees: O & M, Finance and planning, environment and agriculture.
Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users? How and why are they involved in the practice? Actual level of beneficiary involvement under operation: Initially the scheme was established by the Government and currently is managed by farmers. The main beneficiaries are the individual farmers who own plots within the scheme and villagers around the scheme who get employed. Others beneficiaries are people living within Morogoro municipality and nearby cities who are supplied with rice. The main stakeholders are the Farmers, TANESCO (The Tanzania Electricity Supply Company) who supply electricity to run the pump, Input suppliers (Mfuko wa Pembejeo) under the Ministry of Agriculture, Food Security and Cooperative, The Mvomero District Council which is the major controller of the Farmers Organization and the Village Government that manages disputes/conflict that occur within the scheme. Who are the main beneficiaries	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.) The irrigation scheme was introduced by the government under the management of NAFCO that was controlling agency of all parasitatal farms. There exists design and manuals that made the concept possible as mentioned under technical details section of this sheet. The idea was also supported by the Government t policies that favor the irrigation schemes establishment including the National water policy, National irrigation policy, National development policies and strategies which include the national Poverty Eradication strategy (1997),Agricultural sector development stratergy (1998) , Agriculture and livestock policy of 1997, beneficiary involvement
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). No details available on training carried out before, during and after construction. No training which has been conducted to train farmers after the scheme was handed over to farmers. However it has been indicated that trainings are highly required in order to improve rice production, marketing, water management, leadership, operation and management and conflict resolution.	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this). Extension support is provided by the Government extension agent who is employed by the Mvomero District Council. However the service provided is inadequate. The O & M needs are assessed by the O& M committee.
Environment benefits: (Whether it has been completed as part of part of watershed development or integrated management approach, how it fits in, visible benefits achived in terms or water availability, reduction in erosion, vegetative growth etc). The scheme is part of the Wami/Ruvu Basin project	Social/Cultural acceptability. In Tanzania, use of pumps for water abstraction in irrigation schemes is common in private-managed irrigation schemes such as Kilombero Sugar Company and Mtibwa Sugar Company. However, the technology is also used by local communities in small-scale irrigation projects like Kahama irrigation Scheme in Mwanza, Rubana farm in Bunda District and Miwaleni B/holes 2 & 3 in Moshi (See URT,2002).

that deals with watershed management. The scheme has water right from the Wami/Ruvu Basin Office cultural environmental aspects technical	
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and reliable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.). The water supply is reliable. The scheme has improved food security and household income and has provided employment opportunities to the nearby communities.	Disadvantages (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.). • • Applicable only in flat areas with high percentage of clay •High operation (pumping) costs due to electricity charges • Construction costs are relatively high. • The risk of damaging infrastructures as a result of too much rainfall • The risk of negative environmental impacts such as Malaria, Bilharzias' and environmental problems related to use of fertilizer, herbicide and pesticides.
Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;): Availability of permanent water source, reliable power supply and labour are essential requirements	What is potential for applying all/parts of initiative elsewhere?
	(Score from 1 to 10 on list below with 10 being highly applicable)
	I [3] Transfer of practice to another group/culture/land-use system, etc.
	II [9] Easy to transfer the practice, but with minor adaptations for local conditions
	III [2] Transfer possible, but significant modifications/prerequisites to consider.
	IV [8] Difficult to transfer the practice. Need experienced support.
	V [1] It would be impossible to transfer the practice. Too site specific.
	Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.)
Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be considered best Practice - name them and give reasons why and provide any Conclusion and Recommendations). The site is considered to be the best practice because the reported paddy yield (7 t/ha) is on the higher side compared to the national average 2.5 t/ha.	
Contact Organisation: (For further information; site visits' etc)	
Type of organisation:	Contact person: Mr. Charles Pangapanga (Scheme Chairperson)
[ ] government organization	Contact details: Mobile: +255 784 307 182

[ ] private organization	
[ ] NGO &/or CBO	
[ ] international agency	
[ ] other:	
Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon future similar interventions)	
Planning: During planning, the participatory approach was not take care, the actual cost to establish the irrigation facility was not well estimated that is why the construction was no completed as the lining of canals from main to distribution canals were not done and they are leading to the critical water loss. Another problem is that the O&M cost were not foreseen in the planning period as the as the O & M almost stopped when the farm wan under NAFCO and stopped production in the year 1997/1998. One of the limiting problems that were encountered is the lack of working capital that resulted into the failure to properly manage the scheme resulting in its collapse. Therefore the planning was not well done.	
Design: The designed irrigation infrastructure was not effective as some part of the rice plots do not get enough water for irrigation due to poor land leveling and flooding with the irrigation canals	
Construction: The construction was not completed as the main and secondary canals were not lined. Probably was due to the poor budgeting during planning stage or misallocation of the construction funds.	
Implementation: The implementation period faced a number of problems which included the incomplete completion of the construction of the irrigation scheme, poor land leveling, and lack of farm machinery, soil problems, poor management and lack of working capital that led to the failure of the scheme to operate.	
O&M: The operation and maintenance were not properly done since the establishment of the scheme especially when the scheme was under NAFCO control, the irrigation infrastructure were deteriorating with time and production stopped in the year 1997/98 as there was the lack of repair and maintenance. However in recent days O&M are managed by individual farmers who contribute for repair and maintenance and for cleaning of the irrigation canals. This will improve the irrigation infrastructure and allow the continued profitable use of the scheme.	
Beneficiary involvement: Community generally works together to support and promote the established irrigation schemes. Different beneficiaries are involved in different ways that include cultivation of different farm plots in the scheme; some are employed to work in the farm to perform different farm management activities including operation and maintenance. The input supply is done by some individual farmers who own plots within the scheme. Other beneficiaries are the business men/women who buy and sell rice products.	
Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc). The benefits realized include better return (money), availability of local and national markets and employment	
Other Remarks or observations:	
Contact person completing form:	
Contact details	

Date of Visit:15/11/2007		Category:
Name of Site: Lower Moshi		Either water Harvesting; Community Irrigation or Private Public Irrigation
		Sketch Map of Site
Geographic location of practice: Rural Moshi District, Kilimanjaro		
(GPS) Coordinates:		
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc: The scheme has 2000 registered farmers mainly from four villages namely Mabogini, Rau River, Oria and Chekereni		
Characteristics of the area:		
Climate (AEZ) + Description: (Sets the climatic context - Arid; semi-arid; humid tropics; Mediterranean - Influences the types of crops that can be grown).• Northern rift zone and volcanic highlands		
Average annual rainfall (mm)		
Months of Short Rains:	October- December	
Months of Main Rains:	March - April	
Mean annual ref. crop Evapotranspiration (mm): 168		
Predominant soil type:	Clay, clay loam, sandy clay loam	
Topography:	Gentle slope	
Slope:		
Erosion:	No erosion	
Period of year during which used: January - May and May - January		
Period of year during which benefits utilized: throughout the year		
Water Source: (Storage on river; groundwater; run-of-the river; conjunctive use of surface and groundwater - Describes the availability and reliability of irrigation water supply). Apart from rainfall, the main water sources are Mabogini and Rau Rivers		
Irrigated area: (Total annual and then by season (ha)): 1300 ha		
Method of water abstraction: (Pumped; gravity; artesian - Influences the pattern of supply and cost of irrigation water). Gravity		
Water delivery infrastructure: (Open channel; pipelines; lined; unlined - Influences the potential level of performance.): Water is delivered into the plots through main, secondary and tertiary open and lined channels.		
Type of water distribution: (Demand; arranged on-demand; arranged; supply orientated - Influences the potential level of performance.): 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.		
Predominant on-farm irrigation practice: (Surface: furrow, level basin, border, flood, ridge-in-basin; Overhead: rain-gun, lateral move, centre pivot; drip/trickle - Influences the potential level of		

performance).The major on-farm irrigation practice is level basin surrounded by borders/ bunds	
Major crops (with percentages of total irrigated area): (Sets the agricultural context. Separates out rice and non-rice schemes, monoculture from mixed cropping schemes). 1100 ha cultivate paddy and 1200 ha cultivate upland crops	
Average farm size: (Important for comparison between schemes, whether they are large estates or smallholder schemes). The standard farm has 0.3 ha	
Type of management: (Government agency; private company; joint government agency/farmer; farmer-managed - Influences the potential level of performance).Community-managed scheme	
Technical Description: (Please describe in about 250 words the background of the irrigation development, how it is used, how it achieves its objectives and its main purpose - For local markets; home consumption; regional or national markets; export: The scheme was formerly traditionally managed with local canals. It was upgraded to modern scheme after construction completed in 1984 and 1987 for Mabogini and Rau production systems, respectively. The scheme was intended for production of paddy and upland crops and it has been producing paddy, maize and Beans since it was upgraded. The produced paddy is used for home consumption and for sell. Paddy/rice is usually purchased at the farm gate and milling machines where paddy is taken by farmers for processing. Most of the purchased paddy/rice is transported to Arusha and Moshi at the Namanga and Himo borders.	
Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.). The feasibility study was conducted from 1978 and completed in 1980. The construction was completed in 1984 and 1987 for Mabogini and Rau River systems, respectively. The relevant reports which contain feasibility studies, design data and major calculations include the following: Japan International Cooperation Agency (JICA), Ministry of Agriculture and Cooperatives, The United Republic of Tanzania, The Feasibility Study of Lower Moshi Integrated Agricultural and Rural Development Project in The United Republic of Tanzania, Progress Report -II, Vol. 1, January 1998, NIPPON KOEI CO., LTD, PASCO INTERNATIONAL INC Japan International Cooperation Agency (JICA), Ministry of Agriculture and Cooperatives, The United Republic of Tanzania, (January 1998),The Feasibility Study of Lower Moshi Integrated Agricultural and Rural Development Project in The United Republic of Tanzania, Progress Report -II, Vol. 2, January 1998, NIPPON KOEI CO., LTD, PASCO INTERNATIONAL INC United Republic of Tanzania, Regional Development Director, Kilimanjaro Region, Lower Moshi Agricultural Development Project (Rau River System), Contract for Civil Works Vol-I, (General Specification, Technical Specification), April 1983, NIPPON KOEI CO., LTD, CONSULTING ENGINEER, TOKYO United Republic of Tanzania, Regional Development Director, Kilimanjaro Region, Lower Moshi Agricultural Development Project (Mabogini River System), Contract for Civil Works Vol-II, (General Specification, Technical Specification), April 1983, NIPPON KOEI CO., LTD, CONSULTING ENGINEER, TOKYO	
Useful in: Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc. The practice is possible in flat terrain with permanent water source.	Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider application: The scheme cannot perform well under limited water supply, poor soils like sandy soils and irregular terrain
Geographical extent of use: The areas of the study country where it is found and the sort of areas where it could be used within the Nile Basin: The practice is widely used in Tanzania. Examples include Iringa, Morogoro, kigoma, Tabora and Mbeya Regions. The practice is also used in several locations in the Nile Basin Countries, example in the Kotido District in Uganda.	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths of the practice and whether it has in fact achieved what it set out to do. The scheme has achieved its objectives including provision of employment, food security and reduction of rice import.. The water loss by deep percolation in the scheme is minimal due to its excellent lined irrigation infrastructure from the intake to the tertiary canals.
Other Sites where used: Mwamapuli irrigation scheme, Kitivo irrigation scheme, Ruvu basin-small scale rice farm (See also URT, 2002)	
Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.): The total cost for the establishment of the : The total cost ($ 30,391,421.44) -feasibility studies and	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc): The O&M is supervised by the government. Through KADP or CHAWAMPU using contributions from each

construction had support from JICA.	farmer of $20 per 0.3 ha. KADP or CHAWAMPU maintain and clean water intakes, main and secondary canals, grade farm and trank roads and maintain tractors. The tertiary canals and water courses are cleaned through labour sharing "MSALAGAMBO).
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock For each hactare, the total average cost from land preparation to harvesting is about $ 1,603. Under good management, farmers practicing transplanting harvest 47 bags of paddy with 170 kg each. The farm gate price is $ 47.5 per bag. Thus, benefits obtained by farmers who transplant is $ 629.5.	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details). The scheme is operated by CHAWAMPU "Chama cha Wakulima wa mpunga Lower Moshi'(Lower Moshi paddy farmers Cooperative Society), however the water user associations are to be established as CHAWAMPU is underperforming.
Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users? How and why are they involved in the practice? Actual level of beneficiary involvement under operation: The idea was initiated by farmer who started traditional irrigation canals which were improved to modern irrigation scheme. The main beneficiaries are farmers who have plots within the scheme, Villagers around the scheme who get employed, people living within Moshi municipality and Arusha City who are supplied with rice. The main stakeholders are the Farmers, Input suppliers, DED, KADP, CHAWAMPU and KATC. Who are the main beneficiaries	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.):The scheme formerly operated using traditional irrigation canals and was upgraded to modern scheme. There exists design and manuals that made the concept possible as mentioned under technical details section of this sheet. The idea was supported by the Government policies including: 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 beneficiary involvement demand based interventions
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). The first training was conducted in 1981 by Kilimanjaro Agricultural Development Centre that was established with the aim to prepare farmers to properly use the irrigation scheme to be constructed. In recent years, farmers have been trained in the aspects of water management, rice agronomy, cleaning of canals and seed quality at KATC	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this). Extension support is provided by three sections under CHAWAMPU including irrigation, Agronomy and tractor hire sections
Environment benefits: (Whether it has been completed as part of part of watershed development or integrated management approach, how it fits in, visible benefits achieved in terms or water availability, reduction in erosion, vegetative growth etc). The scheme is part of the Pangani Basin that deals with watershed management and has water right from the Basin Office for 1939 litres /sec. Sustainability economic aspects cultural	Social/Cultural acceptability: In Tanzania, gravity irrigation schemes are widely used by local communities in small-scale irrigation projects almost in all regions (URT, 2002).

environmental aspects technical	
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and reliable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.).The scheme has improved food security and household income and has provided employment opportunities to the nearby communities.	Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.). Applicable only in flat areas with high percentage of clay Construction costs are relatively very high. The risk of damaging infrastructures as a result of too much rainfall The risk of negative environmental impacts such as Malaria, Bilharzias and environmental problems related to use of fertilizer, herbicide and pesticides. Water shortage, poor soils such sandy soils and saline soils
Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;) Availability of permanent water source, accessibility and labour are essential requirements	What is potential for applying all/parts of initiative elsewhere?
	(Score from 1 to 10 on list below with 10 being highly applicable)
	I [9] Transfer of practice to another group/culture/land-use system, etc.
	II [8] Easy to transfer the practice, but with minor adaptations for local conditions
	III [4] Transfer possible, but significant modifications/prerequisites to consider.
	IV [7] Difficult to transfer the practice. Need experienced support.
	V [1] It would be impossible to transfer the practice. Too site specific.
	Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.)
Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be considered best Practice - name them and give reasons why and provide any Conclusion and Recommendations). The site is considered to be the best practice because the reported paddy yield (7.9 t/ha) is on the higher side compared to the national average 2.5 t/ha.	
Contact Organisation: (For further information; site visits' etc)	
Type of organisation:	Contact person: Mr. Benson Mushi (KADP)
[ ] government organization	Contact details: +255 775 695 764
[ ] private organization	
[ ] NGO &/or CBO	
[ ] international agency	

[ ] other:
Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon future similar interventions)
Planning: The scheme was adequately planned because the construction was completed and canal were lined as initially planned
Design: The design included the man made river from the Mabogini system that join and stabilize the Rau system which depend on seasonal river
Construction: The construction was adequately done as the irrigation system was lined from the intake to the tertiary canals.
Implementation: The implementation of the scheme was associated with changing managements. The scheme was first controlled by water user association which were under KADC, as the KADC collapsed the scheme was supervised by the Moshi Regional office from which the CHAWAMPU took over. CHAWAMPU collapsed in 1996 and the scheme was taken and administered by office of Regional administrative Secretary (RAS). Recently the scheme is administered by the DED office from RAS while water user associations are formulated to make the scheme typical community owned. This unstable management has reduced the efficiency of the scheme.
O&M: The O & M have not been done adequately, linings of the main, secondary and tertiary canals are damaged and the government is looking for the fund to rehabilitate the irrigation infrastructure.
Beneficiary involvement:
Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc). The benefits have been realized including income, markets and food security
Other Remarks or observations:
Contact person completing form:
Contact details

Date of Visit: 08/11/2007		Category: Community irrigation
Name of Site: Mwega		Either water Harvesting; Community Irrigation or Private Public Irrigation
Geographic location of practice: Western most of basin 220 km Morogoro town in Kilosa district, Morogoro		
(GPS) Coordinates:		
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc both male and female benefit from the project. The villages benefiting from the scheme are Malolo A and B, Mgogozi and Nyinga with the total population of 5265 t 740 households.		
Characteristics of the area:		
Climate (AEZ) + Description: (Sets the climatic context - Arid; semi-arid; humid tropics; Mediterranean - Influences the types of crops that can be grown). •Eastern plateaus and mountain blocks + the semi arid climate		
Average annual rainfall (mm): 362		
Months of Short Rains:	November- December	
Months of Main Rains:	March - May	
Mean annual ref. crop Evapotranspiration (mm): 142		
Predominant soil type:	Eutric Cambisols, Eutric flvisols and Eutric Greysols	
Topography:	flat to gentle sloping	
Slope:	1/150 to 250	
Erosion:	Water erosion	
Period of year during which used:	throughout the year	
Period of year during which benefits utilised:	throughout the year	
Water Source: (Storage on river; groundwater; run-of-the river; conjunctive use of surface and groundwater - Describes the availability and reliability of irrigation water supply). Mwega River.		
Irrigated area: 580 ha, the area has been expanded to 640 ha downstream		
Method of water abstraction: (Pumped; gravity; artesian - Influences the pattern of supply and cost of irrigation water): Gravity;		
Water delivery infrastructure: delivered through the open channels. The main and secondary channels (12 km length) are lined ,distribution channels are not lined		
Type of water distribution: (Demand; arranged on-demand; arranged; supply orientated - Influences the potential level of performance.). Water distribution is based on irrigation scheduling. The mwega river irrigation systems have 15 turnouts. From one turnout to another form the Block. Each block takes water for three days, and within a block, each farmer takes water in turn depending on the farm size. Farmers get water at an interval of 4 to 6 days for 4 to 2 hours during dry season.		

Predominant on-farm irrigation practice: (Surface: furrow, level basin, border, flood, ridge-in-basin; Overhead: rain-gun, lateral move, centre pivot; drip/trickle - Influences the potential level of performance). The level basins with borders dominate for rice and sunken beds for upland crops and vegetables.	
Major crops (with percentages of total irrigated area): Paddy and Maize during rainy season and Onions, Cabbage, Potatoes, and Pulse during dry period.	
Average farm size: (Important for comparison between schemes, whether they are large estates or smallholder schemes). Farmers own an average of 0.8 ha with 0.4 ha being the minimum and 1.2 ha the maximum.	
Type of management: (Government agency; private company; joint government agency/farmer; farmer-managed - Influences the potential level of performance): Farmer-managed	
Technical Description: (Please describe in about 250 words the background of the irrigation development, how it is used, how it achieves its objectives and its main purpose - For local markets; home consumption; regional or national markets; export/: The irrigation scheme consists of the three sub-schemes with adjoining land namely the Nyinga, Mgogozi-Mwega and Malolo sub-schemes. The Nyinga scheme was constructed before the 1920 and was completely damaged by flood in the 1920's. in the 1940's the canal was reconstructed. The construction of Malolo sub-scheme was completed in 1980's and the Mgogozi-Mwega was constructed and completed in the 1994. The scheme is used for paddy production and cultivation of upland crops and vegetables.	
Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.). The studies, designs, manual and guidelines that were used for implementation the reader is referred to (URT, 1998) and URT (2002)	
Useful in: Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc. The practice is possible in flat terrain with permanent water source and fertile soils with high percentage clay content	Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider application: The scheme cannot perform well under limited water supply, poor soils like sandy soils and irregular landscape
Geographical extent of use: The areas of the study country where it is found and the sort of areas where it could be used within the Nile Basin: The practice is widely used in Tanzania. Examples includeTanga, Mbeya, Arusha etc. The practice is also used in different location of the Nile Basin.	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths of the practice and whether it has in fact achieved what it set out to do. The scheme has achieved the objectives by providing employment, food security and household income and contributed to the reduction of rice import. The major strength of the practice is the availability of abundant water supply for irrigation.
Other Sites where used: Kigongoni, Karamu coffee Estates, Mwamapuli , and Kitivo schemes and Ruvu basin-small scale rice farm (See also URT, 2002)	
Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.): The Total budget for the best practice was $ 6418428.804	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc). Farmers are responsible for operation and maintenance. The O &M committee assess and prepare the operation and maintenance cost. The main channels are cleaned by community based labour "MSALAGAMBO". Farmers clean secondary and distribution channels from which they get water for irrigation.
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock: For one hectare, the total average cost	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details).The scheme operate under CHAUMWE (Chama the Umwagiliaji Mwega or Mwega Irrigation Association). The Association is operated by the Board that consists the chairperson, assistant chairperson, secretary,

from land preparation to harvesting is about $ 1,133.00 Under good management, farmers practicing transplanting harvest 80 bags of paddy with 80 kg each. The farm gate price is $ 30.7 per bag. Therefore, benefits obtained for farmers who transplant is $ 1323. Who are the main beneficiaries	Treasurer and 15 members representing 15 blocks. Leaders are elected democratically by the General meeting. The organization structure consists of the General meeting and Water user groups. The Board operate under the general meeting. Each block elects the chairman and secretary. The leadership approach of the scheme has seemed to be the best as problems from every corner of the scheme are very well represented to the Board. beneficiary involvement demand based interventions
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). Farmers get trainings on scheme operations, water management, crop husbandry, organization strengthening, marketing systems, food processing from the irrigation and agriculture departments under the District Council and from KATC	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this).Farmers gets extension support on rice agronomy and used of Agro-chemicals given by the village extension agent. The irrigation Technician assess the repair and spareparts required for O & M needs.
Environment benefits: (Whether it has been completed as part of part of watershed development or integrated management approach, how it fits in, visible benefits achieved in terms or water availability, reduction in erosion, vegetative growth etc).The scheme is part of the Wami /Ruvu Basin and has water right from the Basin Office. There is water right without land, farmers can cultivate together and share water available. Sustainability economic aspects cultural environmental aspects technical	Social/Cultural acceptability: The practice is widely distributed in Tanzania and ranges from small-scale to large irrigation projects (URT, 2002).
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and reliable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.).The scheme has improved food security and household income and employment opportunities to the	Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.). Irrigation scheme require the availability of land with the proper topography, and generally consume valuable agricultural land when the water supply is sufficient. Applicable only in flat areas with high percentage of clay The risk of damaging infrastructures as a result of too much rainfall The risk of negative environmental impacts such as Malaria and environmental problems related to use of fertilizer, herbicide and

nearby communities.	pesticides.
Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;): Availability of permanent water source, accessibility and labour are essential requirements	What is potential for applying all/parts of initiative elsewhere?
	(Score from 1 to 10 on list below with 10 being highly applicable)
	I [8] Transfer of practice to another group/culture/land-use system, etc.
	II [7] Easy to transfer the practice, but with minor adaptations for local conditions
	III [6] Transfer possible, but significant modifications/prerequisites to consider.
	IV [3] Difficult to transfer the practice. Need experienced support.
	V [1] It would be impossible to transfer the practice. Too site specific.
	Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.)
Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be conidered best Practice - name them and give reasons why and provide any Conclusion and Recommendations)..The site is considered to be the best practice because the reported paddy yield (6.4t/ha) is on the higher side compared to the national average of 2.5 t/ha	
Contact Organisation: (For further information; site visits' etc)	
Type of organisation:	Contact person: Mr. Chisengo Willy (District Irrigation Officer, Kilosa)
[ ] government organization	Contact details: +255 784 664 031
[ ] private organization	
[ ] NGO &/or CBO	
[ ] international agency	
[ ] other:	
Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon future similar interventions)	
Planning: Planning was good	
Design; The design seem perfect as the water distribution is good and efficiency	
Construction: construction was good (main and secondary canals completed)	
Implementation: Well implemented	
O&M: community based	
Beneficiary involvement:: High	
Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc). Relatively high	
Other Remarks or observations:	

Contact person completing form:
Contact details

Name of Site: Lumuma Date of Visit: 12:11/2007

Category:	Either water Harvesting; Community Irrigation or Private Public Irrigation	
	r	
Geographic location of practice: Located in Kilosa District, Morogoro and some parts of Mpwapwa District.in Dodoma		
(GPS) Coordinates: WGS84 239779, 9241033		
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc:The scheme serves 6 villages including Msowero, Odole, mkungh'ulu, Mafene, Kidete and Kitati -K. The total population of the benefiting villages is 5444 and the households are 11702.		
Characteristics of the area:		
Climate (AEZ) + Description: (Sets the climatic context - Arid; semi-arid; humid tropics; Mediterranean - Influences the types of crops that can be grown). The scheme is under semi arid climate: • Eastern plateaus and mountain blocks		
Average annual rainfall (mm): 1,045		
Months of Short Rains:	October - December	
Months of Main Rains:	March -May	
Mean annual ref. crop Evapotranspiration (mm): 142		
Predominant soil type:	Eutric Fluvisols	
Topography:	Gentle to flat slope	
Slope:	0.5 - 3%	
Erosion:	No erosion	
Period of year during which used:	Throughout the year	
Period of year during which benefits utilised: cultivation is through the year		
Water Source: (Storage on river; groundwater; run-of-the river; conjunctive use of surface and groundwater - Describes the availability and reliability of irrigation water supply).Main water source is Lumuma River		
Irrigated area: (Total annual and then by season (ha)) 980 ha		

Method of water abstraction: (Pumped; gravity; artesian - Influences the pattern of supply and cost of irrigation water). Gravity	
Water delivery infrastructure: (Open channel; pipelines; lined; unlined - Influences the potential level of performance.): The Main, secondary and tertiary channels are open and unlined, only water distribution boxes are lined.	
Type of water distribution: (Demand; arranged on-demand; arranged; supply orientated - Influences the potential level of performance.): Water is distributed based on the number of farmers and not farm size. The maximum time each farmer can use water to irrigate is four hours	
Predominant on-farm irrigation practice: (Surface: furrow, level basin, border, flood, ridge-in-basin; Overhead: rain-gun, lateral move, centre pivot; drip/trickle - Influences the potential level of performance). The level basin with borders dominates for rice and sunken birds are dominant for upland and vegetable crops.	
Major crops (with percentages of total irrigated area): (Sets the agricultural context. Separates out rice and non-rice schemes, monoculture from mixed cropping schemes). Paddy, maize, and Beans are cultivated during rainy season and onion, cabbage and tomatoes during dry season	
Average farm size: (Important for comparison between schemes, whether they are large estates or smallholder schemes).Farmers own an average farm of 0.6 ha, and not more than 2 ha.	
Type of management: (Government agency; private company; joint government agency/farmer; farmer-managed - Influences the potential level of performance). farmer-managed	
Technical Description: (Please describe in about 250 words the background of the irrigation development, how it is used, how it achieves its objectives and its main purpose - For local markets; home consumption; regional or national markets; export):Lumuma valley has been used traditionally for most of the last century for irrigated agriculture. Arabs were involved in the initiation of the irrigation activities in the area. In 1925 Gillings reported an irrigation in Lumuma. Smallholder farmers were digging irrigation canals for household level use. Through community work, Chief Mlima Abdallah managed to build large canals in the 1960s that traversed Msowero and Kidete villages, for a reported length of some 20 kms. The community organized itself, selecting leaders and canal management terms. In the 1990s the scheme got a fund from DANIDA which was used to upgrade it into the modern scheme. However the improvement of the scheme was not properly completely. The scheme is very useful for cultivation of rice, maize, beans and vegetable crops.	
Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.). The studies carried out before implementation, design manuals and guidelines are reported in URT (2001) and URT (1998).	
Useful in: Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc. The practice is possible in flat terrain with permanent water source and fertile soils with high percentage clay content	Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider application: The scheme cannot perform well under limited water supply, poor accessibly, poor soils like sandy soils and irregular terrain and limited working capital.
Geographical extent of use: The areas of the study country where it is found and the sort of areas where it could be used within the Nile Basin: The practice is widely used in Tanzania. Examples include Iringa, Tabora, kigoma, Mara and Mbeya Regions. The practice is also used in several locations in the Nile Basin Countries.	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths of the practice and whether it has in fact achieved what it set out to do. The scheme has achieved the objectives by providing employment, food security and household income. The main strength of the scheme is the availability of potential land however water is the limiting factor.
Other Sites where used: Kigongoni, ,Kakese, Bukangilija, Karamu coffee Estates, Mwamapuli , and Kitivo schemes and Ruvu basin-small scale rice farm (See also URT, 2002)	

Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc: The scheme was rehabilitated from the traditional scheme at the cost of $ 1318855.234, the support from DANIDA.	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc): Farmers are responsible for operation and maintenance. The O & M committee assess and prepare the operation and maintenance cost. Main, secondary and lateral channels are cleaned by farmers close to the canals. Water distributors are responsible for greasing of metallic materials at the distribution boxes.
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock: For one hectare, the total average cost from land preparation to harvesting is about $ 1,132.00 Under good management, farmers practicing transplanting harvest 75 bags of paddy with 80 kg each. The farm gate price is $ 30.00 per bag. Therefore, benefits obtained for farmers who transplant is $ 1118	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details).The scheme operate under CHAULU (Chama the Umwagiliaji Lumuma or Lumuma Irrigation Association). The Association is operated by the Board that consists the chairperson, assistant chairperson, secretary, Treasurer. Leaders are elected democratically by the General meeting. The association has four committees namely agriculture, marketing, irrigation and gender and operation and maintenance
Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users? How and why are they involved in the practice? Actual level of beneficiary involvement under operation: The main stakeholders are the Famers, District councils, District engineers who approve the irrigation design and construction, community development office, the Ministry of Agriculture and Cooperatives, the zone irrigation offices. Natural resources section which advice on trees planting for environmental conservation. **Who are the main beneficiaries**	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.): The scheme was a traditional irrigation with locally made canals which were upgraded to modern scheme. The design standards and manual details are reported in URT (2001) and URT (1998). The idea was supported by the Government policies including: 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 beneficiary involvement demand based interventions
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). Farmers get trainings on scheme operations, water management, crop husbandry, organization strengthening, marketing systems, food processing from the irrigation and agriculture departments under the District Council.	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this).Farmers gets extension support on rice agronomy, water management, fertilizer, pesticides and herbicides given by village extension officer. .The irrigation Technician assesses the repair and spare parts required for O & M needs.
Environment benefits: (Whether it has been completed as	Social/Cultural acceptability:: Traditional schemes which have been improved/upgraded are widely distributed in Tanzania as

part of part of watershed development or integrated management approach, how it fits in, visible benefits achieved in terms or water availability, reduction in erosion, vegetative growth etc).The environment benefits through water catchment management, cutting of trees have been stopped, Farmers have been argued to not to cultivate close the river banks	reported in (URT, 2002).
Sustainability economic aspects cultural environmental aspects technical	
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and reliable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.). The scheme has improved food security and household income, has provided water for livestock and domestic use and employment opportunities to the nearby communities.	Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.). Applicable only in flat areas with high percentage of clay The risk of damaging infrastructures as a result of too much rainfall The risk of negative environmental impacts such as Malaria, Bilharzias and environmental problems related to use of fertilizer, herbicide and pesticides. Water loss due to unlined canals may be very high and reduce water productivity Poor accessibility of the site
Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;): The availability of water, fertile soils, markets and labour are the essential requirements	What is potential for applying all/parts of initiative elsewhere?
	(Score from 1 to 10 on list below with 10 being highly applicable)
	I [9] Transfer of practice to another group/culture/land-use system, etc.
	II [8] Easy to transfer the practice, but with minor adaptations for local conditions
	III [2] Transfer possible, but significant modifications/prerequisites to consider.
	IV [1] Difficult to transfer the practice. Need experienced support.
	V [1] It would be impossible to transfer the practice. Too site specific.
	Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.)
Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can	

be considered best Practice - name them and give reasons why and provide any Conclusion and Recommendations). The site is considered to be the best practice because the reported paddy yield (6.00 t/ha) is on the higher side compared to the national average 2.5 t/ha.	
Contact Organisation: (For further information; site visits' etc)	
Type of organisation:	Contact person: Mr. Chisengo Willy (District Irrigation Officer, Kilosa)
[ ] government organization	Contact details/ +255 784 664 031
[ ] private organization	
[ ] NGO &/or CBO	
[ ] international agency	
[ ] other:	
Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon future similar interventions)	
Planning: The ideas was initiated by farmers indicating that it is important for them to participate in the planning stage	
Design: The initial design was that done by farmers however it was later improved. This indicates that farmers may also have input in designing of schemes	
Construction: The scheme had locally made canals. The lesson may be learning during the upgrading stage that the construction was planned well as the lining of canals was not completed.	
Implementation	
O&M: O & M activities are managed by farmers themselves. Their constant repair, contributions for repair and other maintenance have been crucial for the development of this scheme	
Beneficiary involvement: Farmers, District councils, District engineers, community development office, the Ministry of Agriculture and Cooperatives, the zone irrigation offices and Natural resources sections have played different roles to make this scheme achieve its main objectives.	
Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc). Better return including food security and household income have increased. Local and National markets are available.	
Other Remarks or observations:	
Contact person completing form:	
Contact details	

Name of Site: KIKAFU CHINI Date of Visit: 5/11/2007

Category:	Either water Harvesting; Community Irrigation or Private Public Irrigation
	Sketch Map of Site
Geographic location of practice: Rural Moshi District,Kilimanjaro	
(GPS) Coordinates: UTM 310674, 9620715	
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc: The scheme serves the population of 4501 people from five villages namely Mkarama, Longoi, Mijongweni, Kibosho and Kiboroloni	

Characteristics of the area:		
Climate (AEZ) + Description: Northern rift zone and volcanic highlands		
Average annual rainfall (mm)		
Months of Short Rains:	October- December	
Months of Main Rains:	March - May	
Mean annual ref. crop Evapotranspiration (mm): 168		
Predominant soil type:	clay , clay loam and sandy clay loam	
Topography:		
Slope:	Gentle slope	
Erosion:	Not serious	
Period of year during which used: throughout the year		
Period of year during which benefits utilised: throughout the year		
Water Source: (Storage on river; groundwater; run-of-the river; conjunctive use of surface and groundwater - Describes the availability and reliability of irrigation water supply). The main water source is the Kikafu River		
Irrigated area: (Total annual and then by season (ha)): 326.8 ha		
Method of water abstraction: (Pumped; gravity; artesian - Influences the pattern of supply and cost of irrigation water).Gravity		
Water delivery infrastructure: (Open channel; pipelines; lined; unlined - Influences the potential level of performance.): Water is delivered through open and unlined channels. Only water distribution gates are lined and slabs at water intake weir.		
Type of water distribution: (Demand; arranged on-demand; arranged; supply orientated - Influences the potential level of performance.): Water is distributed every Monday by farmers' meeting which allocate 4 hours to irrigate 0.4 ha to each farmer . Therefore farmers with big plots get more water compared to farmers with small plots.		
Predominant on-farm irrigation practice: (Surface: furrow, level basin, border, flood, ridge-in-basin; Overhead: rain-gun, lateral move, centre pivot; drip/trickle - Influences the potential level of performance). Level basin with borders for rice, sucken beds and furrow for other upland crops,		
Major crops (with percentages of total irrigated area): (Sets the agricultural context. Separates out rice and non-rice schemes, monoculture from mixed cropping schemes). The main crops are rice cultivated on 24 ha, beans, banana, and vegetables cultivated on 302.8 ha		
Average farm size: (Important for comparison between schemes, whether they are large estates or smallholder schemes). The minimum and maximum farm sizes for a farmer are 0.1 and 2 ha, respectively.		
Type of management: (Government agency; private company; joint government agency/farmer; farmer-managed - Influences the potential level of performance). farmer-managed		
Technical Description: (Please describe in about 250 words the background of the irrigation development, how it is used, how it achieves its objectives and its main purpose - For local markets; home consumption; regional or national markets; export: The scheme was initially a traditional irrigation system. The scheme was upgraded using funds from UNDP between 1992-1998. The funds were used to construct the main intake and water distribution gates. The scheme is mainly used for crop production (paddy, maize, banana and vegetables) mainly for home consumption and selling in the local and national markets. The scheme is operated by a registered irrigators' cooperative (Not association) called UWAKICHI (Ushirika wa Umwagiliaji Kikafu Chini) with constitution and by-laws. There is also a SACCOs which provides loan to farmers (cash or contract buying). .		
Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implantation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.). No information		
Useful in: Describe the types of area where it can be used,	Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider	

the conditions where it produces good results, Sites of applications, etc. The practice is possible in flat terrain with permanent water source and fertile soils	application: The scheme cannot perform well under limited water supply, poor soils like sandy soils and irregular landscape
Geographical extent of use: The areas of the study country where it is found and the sort of areas where it could be used within the Nile Basin: The practice is widely used in Tanzania. Examples include Iringa, Morogoro, Mara, Mwanza and Mbeya Regions. The practice is also used in several locations in the Nile Basin Countries.	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths of the practice and whether it has in fact achieved what it set out to do. The scheme has achieved its objectives including provision of employment, food security and reduction of rice import. The general strength of the scheme is the presence of good Cooperative Society and sufficient water supply for irrigation
Other Sites where used: several sites including Kivulini, Ilonga, Lituhi irrigation schemes (See also URT, 2002)	
Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.) No information	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc): The O & M operations are managed by all villagers of Kikafu Chini village irrespective of plot ownership in the scheme because the villagers use the same water for domestic and livestock. The community clean all canals through labour sharing "MSALAGAMBO" and pay $ 3.5 and 5 per season for O & M for UWAKICHI and non UWAKICHI members who cultivate in the scheme, respectively. Other farmers from different parts of Moshi pay $ 17.60 for O & M because they don't physically participate in O & M activities. The Cooperative Society maintain parts of the irrigation infrastructure which need spare parts or cements using the contributions from UWAKICHI
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock: For one hectare, the total average cost from land preparation to harvesting is about $ 1,143.00 Under good management, farmers practicing transplanting harvest 81 bags of paddy with 80 kg each. The farm gate price is $ 30.8 per bag. Therefore, benefits per ha obtained for farmers who transplant is $ 1349.64	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details). The scheme is operated by UWAKICHI (USHIRIKA WA UMWAGILIAJI MAJI KIKAFU CHINI) KIKAFU CHINI irrigation Cooperative Society which is registered and operated by the Board of 9 people. The Board consists of the Chairperson, Vice Chairperson, Secretary, and Treasurer. The Board leaders must be members of UWAKICHI and are democratically elected by the Society members. The Board has the following committees: O & M , Finance and planning, environment and agriculture.
Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users? How and why are they involved in the practice? Actual level of beneficiary involvement under operation: The idea was initiated by farmers who started traditional irrigation which was improved to modern irrigation scheme. The main beneficiaries are farmers who cultuvate plots within the scheme, villagers around the scheme who get employment opportunities, food	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.): The scheme was a traditional irrigation with locally made canals which were upgraded to modern scheme. The design standards and manual details were not available however may exist. The idea was supported by the Government policies including: 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

for consumption, water for domestic and livestock use, people living within Moshi municipality and Arusha City who are supplied with rice. The main stakeholders are the farmers, UWAKICHI, Input suppliers, DED, Zonal Irrigation offices, KATC and the village government. **Who are the main beneficiaries**	**beneficiary involvement** **demand based interventions**
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this).The first farmers were selected for training on irrigation to prepare them to manage the scheme under upgrading conducted in 1998 by KATC and Zimbabwe .Other trainings offered by KATC to farmers include Cooperatives, water management, Conflict management, used and maintenance of irrigation infrastructure, agribusiness and marketing.	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this).Extension support is provided by the Village Extension Office (VEO). The O & M needs and its related costs are assessed and prepared by O & M committee.
Environment benefits: (Whether it has been completed as part of part of watershed development or integrated management approach, how it fits in, visible benefits achived in terms or water availability, reduction in erosion, vegetative growth etc).The scheme is part of the Pangani Basin that deals with watershed management and has water right from the Basin Office for 700 litres/sec that cost $ 5 and 7 for UWAKICHI and non UWAKICHI member per season, respectively. Sustainability economic aspects cultural environmental aspects technical	Social/Cultural acceptability: The Schemes which were traditional, abstract water by gravity which were upgraded to moderns scheme are widely distributed in the Tanzanian community and ranges from small-scale to large irrigation projects (URT, 2002).
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and reliable, will the community continue to operate, maintain	Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.). Applicable only in flat areas with high percentage of clay The risk of damaging infrastructures as a result of too much rainfall

and use it after outside assistance has gone and reasons for this etc.).The scheme has improved food security and household income, has provided water for livestock and domestic use and employment opportunities to the nearby communities.	The risk of negative environmental impacts such as Malaria, Bilharzias and environmental problems related to use of fertilizer, herbicide and pesticides. Water loss due to unlined canals may be very high and reduce water productivity
Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;) Availability of permanent water source, accessibility and labour are essential requirements	What is potential for applying all/parts of initiative elsewhere?
	(Score from 1 to 10 on list below with 10 being highly applicable)
	I [9] Transfer of practice to another group/culture/land-use system, etc.
	II [9] Easy to transfer the practice, but with minor adaptations for local conditions
	III [2] Transfer possible, but significant modifications/prerequisites to consider.
	IV [2] Difficult to transfer the practice. Need experienced support.
	V [1] It would be impossible to transfer the practice. Too site specific.
	Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.)

Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be considered best Practice - name them and give reasons why and provide any Conclusion and Recommendations).The site is considered to be the best practice because the reported paddy yield (6.5t/ha) is on the higher side compared to the national average of 2.5t/ha.	
Contact Organisation: (For further information; site visits' etc)	
Type of organisation:	Contact person: Mr. Hussein Mfinanga (Secretary, UWAKICHI)
[ ] government organization	Contact details: +255 754 251 576
[ ] private organization	
[ ] NGO &/or CBO	
[ ] international agency	
[ ] other:	
Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon future similar interventions)	
Planning: Farmers initiatives can contribute significantly in planning of irrigation schemes	
Design: Farmers initiatives can contribute significantly in planning of irrigation schemes	
Construction:	
Implementation:	

O&M: effective farmers' participation through their organization is important to scheme success and general oversee of O & M activities
Beneficiary involvement: This item is very important to the success of a scheme
Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc). SACCOS are very useful in this item.
Other Remarks or observations: Training and exposure to farmers (through farmer to farmer visits and contact with researchers) is also very important aspect
Contact person completing form:
Contact details

Name of Site:Mombo: Date of Visit 17/11/2007

Category		
	Either water Harvesting; Community Irrigation or Private Public Irrigation	
	Sketch Map of Site	
Geographic location of practice:, Mombo town,Korogwe District, Tanga		
(GPS) Coordinates:UTM 418789, 9459299, 40°55' Sand 38°17'E		
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc: The scheme serve four villages namely, Mlembule, Mwisho wa Shamba, Jitengeni and Mombo. Scheme has 429 farmers.		
Characteristics of the area:		
Climate (AEZ) + Description: (Sets the climatic context - Arid; semi-arid; humid tropics; Mediterranean - Influences the types of crops that can be grown). Northern rift zone and volcanic highlands and Semi arid climate		
Average annual rainfall (mm)		
Months of Short Rains:	October - December	
Months of Main Rains:	March- May	
Mean annual ref. crop Evapotranspiration (mm):168		
Predominant soil type:	Vertisols (Clay)	
Topography:	Generally flat to gentle slope	
Slope:	0.3 to 2%	
Erosion:	little erosion problems	
Period of year during which used:		
Period of year during which benefits utilized:		
Water Source: (Storage on river; groundwater; run-of-the river; conjunctive use of surface and groundwater - Describes the availability and reliability of irrigation water supply).The water source is Soni River originating from the Usambara mountains		

Irrigated area: (Total annual and then by season (ha)): 220 ha	
Method of water abstraction: (Pumped; gravity; artesian - Influences the pattern of supply and cost of irrigation water): Gravity;	
Water delivery infrastructure: (Open channel; pipelines; lined; unlined - Influences the potential level of performance.). Water is delivered from the intake to the storage dam through the lined and open channels. From the storage dam the water is delivered through another main channel that is unlined. From the main channel water is distributed through secondary and tertiary unlined channels.	
Type of water distribution: (Demand; arranged on-demand; arranged; supply orientated - Influences the potential level of performance.): Farmers get water at an interval of 7 to 12 hours or for the whole day.	
Predominant on-farm irrigation practice: (Surface: furrow, level basin, border, flood, ridge-in-basin; Overhead: rain-gun, lateral move, centre pivot; drip/trickle - Influences the potential level of performance).Level basin with borders	
Major crops (with percentages of total irrigated area): (Sets the agricultural context. Separates out rice and non-rice schemes, monoculture from mixed cropping schemes).The scheme mainly cultivate rice	
Average farm size: (Important for comparison between schemes, whether they are large estates or smallholder schemes).Every farmer own 0.5 ha	
Type of management: (Government agency; private company; joint government agency/farmer; farmer-managed - Influences the potential level of performance). Farmer managed scheme	
Technical Description: (Please describe in about 250 words the background of the irrigation development, how it is used, how it achieves its objectives and its main purpose - For local markets; home consumption; regional or national markets; export: The scheme started as the project in 1967, In 1979 the scheme was given assistance by the Germany International Development Agency (GTZ) and in 1980 the plots were assigned to individual farmers and in the same year the scheme was registered as the Cooperative Society. The scheme was rehabilitated in 1979 and was operating fairly satisfactory until 1998 when a major flood (EL NINO) event in the region caused a 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 into cause and started flowing down the alignment of the Mombo main canal. The massive quantity of sediments was carried into the scheme area causing the partial to total siltation to many canals and drains and damaged the structures. In 2000 the Government improved the scheme after the major destruction due to flooding through the RBMSIIP. The scheme produces rice for consumption, local and regional markets.	
Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.).	
Useful in: Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc. The practice is possible in flat terrain with permanent water source and fertile soils with percentage clay.	Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider application: The scheme cannot perform well under limited water supply, poor soils like sandy soils and irregular terrain
Geographical extent of use: The areas of the study country where it is found and the sort of areas where it could be used within the Nile Basin: The practice is widely used in Tanzania. Examples include Iringa, Tabora, kigoma, Mara and Mbeya Regions. The practice is also used in several locations in the Nile Basin Countries.	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths of the practice and whether it has in fact achieved what it set out to do. The scheme has achieved its objects by increasing rice production, provision of employment and income generation. The general strength of the practices is presence of water storage dam that reserve the little water supplied from River Soni.

Other Sites where used: Kitanda,Kakese, Bukangilija schemes etc (See also URT, 2002)	
Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.)	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc): The operation and maintenance worked are managed by farmers. Farmers contribute $ 38.70 per season for O &M, administration and tillage. The money budgeted for O &M is used to buy cements, stones and grease to lubricate water distribution gates and to pay repair costs. Channels are cleaned though the community based labour "MSALAGAMBO".
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock: Farmers harvest 80 to 100 bags per ha of 80kg during the August-December season and 62.5 to 70 bags per ha for the March- August season. The total production costs are averaged to $ 527.54 per ha. The farm gate price per 1 bag is $ 20. The obtained benefits ranges from $ 722.46 to $ 1472.46 per ha.	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details). The scheme is operated by USHIRIKA WA WAKULIMA WA WAMWAGILIAJI MOMBO "Mombo water user association". The association is registered and members elect leader democratically. The association is operated by the Executive committee. The leaders are Executive Manager, Assistant Manager, secretary (employed) and treasurer. Under the Executive Committee are Maintenance and irrigation canals, Agriculture and environment and Finance committees.
Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users. How and why are they involved in the practice? Actual level of beneficiary involvement under operation: The main stakeholders are farmers, DED as the employer of the extension officer and irrigation technician, The zone irrigation office, KATC for training, and The Ministry of Agriculture, food Security and Cooperatives. **Who are the main beneficiaries**	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.): The idea was introduced by the government. Design standards and manuals exists however were not accessed during this survey. The idea was supported by the Government policies including: 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 **beneficiary involvement** **demand based interventions**
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). Trainings are provided by KATC mainly on rice agronomy, use of simple farm machinery, water management, marketing and agribusiness.	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this). Farmers get extension support on rice agronomy, used of Agro-chemicals given by the village extension agent. The irrigation Technician assess and prepare the cost for O&M needs of the scheme
Environment benefits: (Whether it has been completed as part of part of watershed development or integrated management approach, how it fits in, visible benefits	Social/Cultural acceptability: The technologies of this type are widely distributed in Tanzania and ranges from small-scale to large irrigation projects (URT, 2002).

achieved in terms or water availability, reduction in erosion, vegetative growth etc).The scheme is part of the Pangani Basin and has water right from the Basin Office for 260 litres/sec that cost $ 264 per year **Sustainability** **economic aspects** **cultural** **environmental aspects** **technical**	
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and reliable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.): The scheme has improved food security and household income and employment opportunities to the nearby communities.	Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.). Applicable only in flat areas with high percentage of clay The risk of damaging infrastructures as a result of too much rainfall The risk of negative environmental impacts such as Malaria and environmental problems related to use of fertilizer, herbicide and pesticides. Water loss due to unlined canals may be very high and reduce water productivity
Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;); Availability of permanent water supply, accessibility and labour are essential requirements	What is potential for applying all/parts of initiative elsewhere? (Score from 1 to 10 on list below with 10 being highly applicable) I [9] Transfer of practice to another group/culture/land-use system, etc. II [8] Easy to transfer the practice, but with minor adaptations for local conditions III [3] Transfer possible, but significant modifications/prerequisites to consider. IV [1] Difficult to transfer the practice. Need experienced support. V [1] It would be impossible to transfer the practice. Too site specific. Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.)
Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be considered best Practice - name them and give reasons why and provide any Conclusion and Recommendations). The site is considered to be the best practice because the reported average paddy yield ranging between 5.0 - 8.0 t/ha is on the higher side compared to the national average of 2.5 t/ha.	

Contact Organisation: (For further information; site visits' etc)	
Type of organisation:	Contact person: SHUFAA MHANDO (Secretary of the Scheme Association)
[ ] government organization	Contact details: +255 784783 012
[ ] private organization	
[ ] NGO &/or CBO	
[ ] international agency	
[ ] other:	
Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon future similar interventions)	
Planning: Not good as lining of channels were not completed and water supply does not meet the water demand for paddy production	
Design: The design was good as it considered the presence of storage facility that reserve water to allow irrigation of the large area at once as direct irrigation from the intake can not meet the water demand of the farm.	
Construction: Not complete as the channels were not lined	
Implementation: Implementation was not successful when the scheme was the government project however after farmer's owner the scheme is doing fine.	
O&M : The community manage their irrigation infrastructure	
Beneficiary involvement: Farmers cultivate and maintain the scheme, DED employ the VEO and Irrigation technician, KATC provide trainings etc.	
Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc).: The markets available include local, and national : Markets are available, farmers have realize increase in income and food for consumption.	
Other Remarks or observations:	
Contact person completing form:	
Contact details	

Name of Site: Mkindo

Date of Visit: 14/11/2007	Category:
	Either water Harvesting; Community Irrigation or Private Public Irrigation
	Sketch Map of Site
Geographic location of practice: Mkindo, Turian, Mvomero District, Morogoro	
(GPS) Coordinates: UTM 339054, 9308282	
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc: Two villages Mkindo A and B benefit from the scheme. The scheme have 500 people who can work however no more land available therefore only 400 people own plots in the scheme.	
Characteristics of the area:	

Climate (AEZ) + Description: Eastern plateaus and mountain block	
Average annual rainfall (mm): 800 -1000	
Months of Short Rains:	Ocrober - December
Months of Main Rains:	March - May
Mean annual ref. crop Evapotranspiration (mm):	142
Predominant soil type:	Clay (Vertisols), clay loam
Topography:	Gentle to flat slope
Slope:	
Erosion:	No erosion
Period of year during which used:	December - May
Period of year during which benefits utilised: throughout the year	
Water Source: (Storage on river; groundwater; run-of-the river; conjunctive use of surface and groundwater - Describes the availability and reliability of irrigation water supply). The Main water source is Mkindo River	
Irrigated area: (Total annual and then by season (ha)): 500 ha	
Method of water abstraction: (Pumped; gravity; artesian - Influences the pattern of supply and cost of irrigation water): Gravity;	
Water delivery infrastructure: (Open channel; pipelines; lined; unlined - Influences the potential level of performance.) Open and unlined channels	
Type of water distribution: (Demand; arranged on-demand; arranged; supply orientated - Influences the potential level of performance.): Water supply is abundant; therefore all farmers get water when released from the intake.	
Predominant on-farm irrigation practice: (Surface: furrow, level basin, border, flood, ridge-in-basin; Overhead: rain-gun, lateral move, centre pivot; drip/trickle - Influences the potential level of performance).The level basin with borders is predominant however furrow exists.	
Major crops (with percentages of total irrigated area): (Sets the agricultural context. Separates out rice and non-rice schemes, monoculture from mixed cropping schemes). Only rice produced.	
Average farm size: (Important for comparison between schemes, whether they are large estates or smallholder schemes). Each farmer own 0.4 ha	
Type of management: (Government agency; private company; joint government agency/farmer; farmer-managed - Influences the potential level of performance): Farmer-managed	
Technical Description: (Please describe in about 250 words the background of the irrigation development, how it is used, how it achieves its objectives and its main purpose - For local markets; home consumption; regional or national markets; export: The scheme was originally traditional. Rehabilitation of the scheme was supported by the Netherland Embassy/FAO who constructed the intake at the Mkindo River source from 1983 to 1985. The scheme mainly produced rice before and after the improvement for home consumption and selling in the local and national markets.	
Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data	

used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.).	
Useful in: Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc. The practice is possible in flat terrain with permanent water source and fertile soils with high percentage clay content	Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider application: The scheme cannot perform well under limited water supply, poor soils like sandy soils and irregular terrain
Geographical extent of use: The areas of the study country where it is found and the sort of areas where it could be used within the Nile Basin: The practice is widely used in Tanzania. Examples include Iringa, Morogoro, kigoma, Tabora and Mbeya Regions. The practice is also used in several location in the Nile Basin Countries, example in the Kotido District in Uganda and Kianguni in Kenya	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths of the practice and whether it has in fact achieved what it set out to do. The scheme has achieved the objectives by providing employment, food security and household income and contributed to the reduction of rice import. The major strength of the practice is the availability of abundant water supply for irrigation.
Other Sites where used: , Kigongoni, Karamu coffee Estates, Mwamapuli , and Kitivo schemes and Ruvu basin-small scale rice farm (See also URT, 2002)	
Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.)	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc): The O&M is overseen by the O&M committee of the water user association. Each farmer contributes $ 1 = per 0.4 ha for O & M activities and cleaning of canal inclusive.
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock; The total average cost for one hactare from land preparation to harvesting is about $ 923.20. Under good management, farmers practicing transplanting harvest 63 bags of paddy with 100 kg each. The farm gate price is $ 20 per bag. Therefore, benefits obtained for farmers who transplant is $ 184.64	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details). The scheme has water user association (Mkindo Water User Association) under the leadership of the board of 10 people who are democratically elected. Leaders include Chairperson, Deputy Chairperson, Secretary, Treasurer and Water Distributors. Under the Board are the O & M , Finance and planning, environment and agriculture committee.
Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users. How and why are they involved in the practice? Actual level of beneficiary involvement under operation: The main beneficiaries are farmers who cultuvate plots within the scheme, Villagers around the scheme who get employed, food for consumption, water for domestic and livestock use, people living within Morogoro municipality. The main stakeholders are the	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.). The scheme was a traditional irrigation with locally made canals which were upgraded to modern scheme. The design standards and manual details were not available however may exist. The idea was supported by the Government policies including: 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

Farmers, Input suppliers, DED, Zonal Irrigation offices, Mkindo Farmers Training Center and the village government. Who are the main beneficiaries	beneficiary involvement
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). Farmers have got training in the area of Best fertilizer use and management, soil management, seed quality, pesticides use their limitation and the use of alternative local pesticides like *Azadrachita indica "Muarobaini" tree,* rice agronomy and water management from Mkindo Farmers Training Centre. Other farmers got trainings from Indonesia on similar aspects.	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this). The scheme use farmer to farmer extension through Farmer Field School approach.
Environment benefits: (Whether it has been completed as part of part of watershed development or integrated management approach, how it fits in, visible benefits achieved in terms or water availability, reduction in erosion, vegetative growth etc).The scheme is part of the Wami/Ruvu Basin has water right from the Basin Office for 500 litres/sec that cost $ 4.40 per 0.4 ha per season, respectively. **Sustainability** **economic aspects** **cultural** **environmental aspects** **technical**	Social/Cultural acceptability: In Tanzania scheme which were traditional, abstract water by gravity and were upgraded to moderns scheme are widely distributed in the Tanzanian community and ranges from small-scale to large irrigation projects (URT, 2002).
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and reliable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.).The scheme has improved food security and household income, has provided water for livestock and domestic use and employment opportunities to the nearby communities.	Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.). Applicable only in flat areas with high percentage of clay The risk of damaging infrastructures as a result of too much rainfall The risk of negative environmental impacts such as Malaria, Bilhazia and environmental problems related to use of fertilizer, herbicide and pesticides. Water loss due to unlined canals may be very high and reduce water productivity
Scaling Up: (Are there specific conditions or obstacles which	What is potential for applying all/parts of initiative elsewhere?

make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;) Availability of permanent water source, accessibility and labour are essential requirements	
	(Score from 1 to 10 on list below with 10 being highly applicable)
	I [9] Transfer of practice to another group/culture/land-use system, etc.
	II [9] Easy to transfer the practice, but with minor adaptations for local conditions
	III [2] Transfer possible, but significant modifications/prerequisites to consider.
	IV [2] Difficult to transfer the practice. Need experienced support.
	V [1] It would be impossible to transfer the practice. Too site specific.
	Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.)

Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be considered best Practice - name them and give reasons why and provide any Conclusion and Recommendations).The site is considered to be the best practice because the reported paddy yield (6.4t/ha) is on the higher side compared to the national average of 2.5 t/ha.

Contact Organisation: (For further information; site visits' etc)	
Type of organisation:	Contact person: Mr. Temi. M. W (Principal, Mkindo Farmers Training centre)
[ ] government organization	Contact details: +255 784 418 065
[ ] private organization	
[ ] NGO &/or CBO	
[ ] international agency	
[ ] other:	
Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon future similar interventions)	
Planning: The Farmers initiated the plan	
Design: The community designed the scheme, the only support received was construction of the intake	
Construction: The construction during improvement did cover the irrigation canals	
Implementation:	
O&M: The farmers maintain their own scheme	
Beneficiary involvement: The beneficiaries' involvement is good.	

Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc). The benefits including markets, income, food for consumption have been realized
Other Remarks or observations:
Contact person completing form:
Contact details

Ranking of Best CMI sites in Tanzania

		RANKING OF VISITED BEST PRACTICES/SITES COMMUNITY-MANAGED IRRIGATION SCHEMES									
			Dakawa Rice Farm	Lekitatu	Kikafu Chini	Lower Moshi	Mombo	Mkindo	Mwega	Lumuma	
Technical factors (15)	**1.Slope (4 points)**										
	a) Flat (< 0.5%)	**3**									
	b) Mild (0.5-2%)	**2.00**	**2.00**	**2.00**		**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	
	c) Moderate (2.0 – 4.0%)	**1.00**			**1.00**						
	2.Salinity and Alkalinity of soils (7 points)										
	a) Low	**7.00**									
	a) Medium	**5.00**	**5.00**	**5.00**	**5.00**		**5.00**	**5.00**	**5.00**	**5.00**	
	b) High	**0.00**				**0.00**					
	3.Damage by flood (2) points										
	a) Observed	**0.00**	**0.00**				**0.00**	**0.00**			
	b) Not observed	**2.00**		**2.00**	**2.00**	**2.00**			**2.00**	**2.00**	
	4. Drainage problems (2)										
	a) Observed	**0.00**	**0.00**	**0.00**		**0.00**		**0.00**	**0.00**		
	b) Not observed	**2.00**			**2.00**		**2.00**			**2.00**	
Economic Factors (18 points)	**1. Size of potential area (5 points)**										
	a) less than 500ha	**1.00**			**1.00**		**1.00**	**1.00**			
	b) 500-1000ha	**2.00**	**2.00**	**2.00**						**2.00**	
	c) 1000-2000ha	**3.00**							**3.00**		
	d) More than 2000ha	**5.00**				**5.00**					
	2. Water abstraction method (8)										
	a) Gravity	**7.00**		**7.00**	**7.00**	**7.00**	**7.00**	**7.00**	**7.00**	**7.00**	
	b) pump	**1.00**	**1.00**								
	3. EIRR (NA)										
	a) Less than 8.0%	**0.00**									
	b) 8.0-12.0%	**0.00**									
	c) 12.0-16.0%	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
	d) 16.0-20.0%	**0.00**									
	e) More than 20.0%	**0.00**									
	4.Financial viability (5 points)	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	

Possibility of Environmental status factor (12 points)	**1.Sedimentation (6 points)**										
	a)Serious	**0.00**	**0.00**								
	b) Fair	**2.00**			**2.00**	**2.00**		**2.00**			
	c) Little	**4.00**		**4.00**			**4.00**		**4.00**	**4.00**	
	d) None	**6.00**									
	2. Water-borne diseases (3 points)										
	a) Serious	**0.00**									
	b) Fair	**2.00**	**2.00**		**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	
	c) None	**3.00**		**3.00**							
	3. Water quality (3 points)										
	a) Serious	**0.00**									
	b) Fair	**1.00**	**1.00**								
	c) Little	**2.00**		**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	
	d) None	**3.00**									
Ease of implementation (5 points)	**1. Accessibility to site(5)**										
	a) Serious	**1.00**								**1.00**	
	b) Fair	**3.00**	**3.00**		**3.00**			**3.00**			
	c) Little	**5.00**		**5.00**		**5.00**	**5.00**		**5.00**		
Social factors (24 points)	**1.Organization set-up (5 points)**										
	a) Strong	**5.00**		**5.00**	**5.00**		**5.00**		**5.00**		
	b) Weak	**3.00**	**3.00**					**3.00**		**3.00**	
	b) Not yet established	**0.00**				**0.00**					
	2.Establishment of O & M committee (2 points)										
	a) Organization set-up	**2.00**	**2.00**	**2.00**	**2.00**		**2.00**	**2.00**	**2.00**	**2.00**	
	b) Not yet established	**0.00**				**0.00**					
	3. Linkage with village (1 point)										
	a) Good	**1.00**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**	**1.00**		
	b) Poor	**0.00**				**0.00**				**0.00**	
	4. Operation body of the scheme (3 points)										
	a) Farmers organization	**3.00**	**3.00**	**3.00**	**3.00**		**3.00**	**3.00**		**3.00**	
	b) Other bodies	**1.00**				**1.00**			**1.00**		
	5.Training for O & M (2 points)										
	a) Satisfactory	**2.00**		**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	
	b) Not satisfactory	**1.00**	**1.00**								
	6.Maintenance of the scheme (1)										
	a) By Farmers' organization	**1.00**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**	**1.00**	**1.00**	
	b) By other bodies	**0.00**				**0.00**					
	7. Existence of water right (8)										
	a) Existence	**8.00**	**8.00**	**8.00**	**8.00**	**8.00**	**8.00**	**8.00**	**8.00**	**8.00**	
	b) Non-existence	**0.00**									
	8. Average farm size (2 point)										

	a) 0 – 1.0 ha per housed hold	**1.00**		**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**0.00**	
	b) > 1.0 ha per household	**2.00**	**2.00**								
Regional condition (20)	**1. Existing irrigated area/potential area (3)**										
	a) Less than 30%	**3.00**							**3.00**		
	b) 30-60%	**2.00**				**2.00**					
	c) More than 60%	**1.00**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**		**1.00**	
	2. Food security assurance in scheme villages (10 points)										
	a) Very high	**10.00**		**10.00**				**10.00**			
	b) High	**8.00**			**8.00**						
	c) Medium	**6.00**	**6.00**						**6.00**		
	d) Low	**4.00**				**4.00**	**4.00**			**4.00**	
	3. Poverty index (BHN) (7 points)										
	a) More than 40	**7.00**									
	b) 30-40	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**		
	c) 20-30	**3.00**								**3.00**	
	d) Less than 20	**1.00**									
Water use efficiency (6)	**1.Lining of irrigation canals (6)**										
	a) Lined main and secondary canal	**6.00**				**5.00**					
	b) only secondary canals lined	**3.00**		**3.00**			**3.00**		**3.00**		
	C) None of the canals are lines	**0.00**	**0.00**		**0.00**			**0.00**		**0.00**	
			0.00	**3.00**	**0.00**	**5.00**	**3.00**	**0.00**	**3.00**	**0.00**	
			54.00	**79.00**	**69.00**	**60.00**	**71.00**	**66.00**	**75.00**	**61.00**	
	Potential area:										
	Lower Moshi Scheme has big unutilized land but the possibility of getting more water right is very limited due to higher demand from upstream uses, e.g. Nyumba ya mungu dam for hydropower										
	Economic Internal Rate of Return (EIRR)										
	no enough information on EIRR, hence omitted in the ranking										
Source (URT, 2002)											

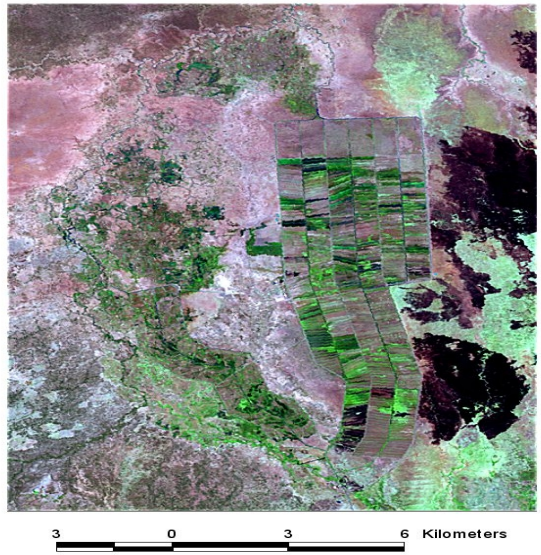
Ranking of Visited Best Practices/Site
Community Managed Irrigation Schemes

	Technical factors (15)	Economic Factors (18 points)	Possibility of Environmental status factor (12 points)	Ease of implementation (5 points)	Social factors (24 points)	Regional condition (20)	Water use efficiency (6)	Total Points	Ranking
Lekitatu	9	14	9	5	23	16	2	79	1
Mwega	9	15	8	5	21	14	3	75	2

Mombo	9	13	8	5	23	10	3	71	3
Kikafu Chini	10	13	6	3	23	14	0	69	4
Mkindo	7	13	6	3	21	16	0	66	5
Lumuma	11	14	8	1	19	8	0	61	6
Lower Moshi	4	17	6	5	12	11	5	60	7
Dakawa Rice Farm	7	8	3	3	21	12	0	54	8

Ranking of PPMI Sites in Tanzania

Date of Visit: 06/12/2007	Category:
Name of Site: Kapunga Rice Project Ltd	Either water Harvesting; Community Irrigation or Private Public Irrigation
	Sketch Map of Site
Geographic location of practice: Chimala, Mbarali District, Mbeya Region	
(GPS) Coordinates: 8.7°S, 33.9°E	
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc: It is run privately by Export trade. It, however, serves as well communities surrounding the scheme by leasing part of its farm. The villages include Mapogolo, Site one, Ihai, Matebete and Mwashikimile	
Characteristics of the area:	
Climate (AEZ) + Description: (Sets the climatic context - Arid; semi-arid; humid tropics; Mediterranean - Influences the types of crops that can be grown): Rukwa-Ruaha Rift zone	
Average annual rainfall (mm)	
Months of Short Rains:	na
Months of Main Rains:	November - May



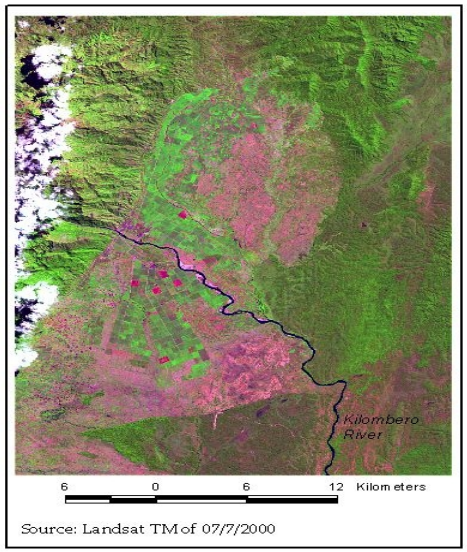
Mean annual ref. crop Evapotranspiration (mm):		
Predominant soil type:	clay loam and sandy clay loam	
Topography:		
Slope:	Gentle slope	
Erosion:	No Erosion	
Period of year during which used:	throughout the year	
Period of year during which benefits utilized:	throughout the year	
Water Source: (Storage on river; groundwater; run-of-the river; conjunctive use of surface and groundwater - Describes the availability and reliability of irrigation water supply). Apart from rainfall, the main water source is River Ruaha		
Irrigated area: (Total annual and then by season (ha)): 1200 ha		
Method of water abstraction: (Pumped; gravity; artesian - Influences the pattern of supply and cost of irrigation water). Gravity		
Water delivery infrastructure: (Open channel; pipelines; lined; unlined - Influences the potential level of performance.) Unlined open channel		
Type of water distribution: (Demand; arranged on-demand; arranged; supply orientated - Influences the potential level of performance.) As per rotational schedule		
Predominant on-farm irrigation practice: (Surface: furrow, level basin, border, flood, ridge-in-basin; Overhead: rain-gun, lateral move, centre pivot; drip/trickle - Influences the potential level of performance). Level basin		
Major crops (with percentages of total irrigated area): (Sets the agricultural context. Separates out rice and non-rice schemes, monoculture from mixed cropping schemes). 1200 ha paddy and 800 ha wheat		
Average farm size: (Important for comparison between schemes, whether they are large estates or smallholder schemes). 6 ha		
Type of management: (Government agency; private company; joint government agency/farmer; farmer-managed - Influences the potential level of performance). Private company		
Technical Description: (Please describe in about 250 words the background of the irrigation development, how it is used, how it achieves its objectives and its main purpose - For local markets; home consumption; regional or national markets; export: Privatized since August 2006 (formerly NAFCO farm). It is owned by a company called Export trade, which is also involved with gold mining (Shanta mine) and farming in other regions. The main purpose of the farm is rice and wheat production for both local and external markets. Beginning next season, the company is planning to introduce Jatropha for bio-fuel		
Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.).		
Useful in: Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc. The practice is possible in flat terrain with reliable water source	Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider application: The practice cannot perform well under limited water supply, poor soils like sandy soils and irregular terrain	
Geographical extent of use: The areas of the study country where it is found and	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and	

the sort of areas where it could be used within the Nile Basin: The practice is widely used in Tanzania. Examples include Iringa and Morogoro Regions. The practice is also used in several locations in the Nile Basin Countries.	the general strengths of the practice and whether it has in fact achieved what it set out to do. The time, i.e. one year, is too short to assess whether the scheme/company has achieved its objectives
Other Sites where used: Mbarali Rice farm	
Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.) Not available	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc): The Company, through O&M unit
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details). Not applicable, it is privately managed
Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users. How and why are they involved in the practice? Actual level of beneficiary involvement under operation: The main beneficiary and user is the owner (Export trade). Villages around the farm do also benefit by getting employment in the farm, O&M unit and company offices. They are also allowed to use portion of the farm (750 ha) for paddy production. Who are the main beneficiaries	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.) the idea was introduced by the Government beneficiary involvement demand based interventions
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). The plan is there, but not yet implemented. The main focus now is to rehabilitate the farm (irrigation infrastructures, farm equipments)	Extension support: (Details of any extension services provided and whther any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this). Only in-house. The company uses its own staff.
Environment benefits: (Whether it has been completed as part of part of watershed development or integrated management approach, how it fits in, visible benefits achieved in terms or water availability, reduction in erosion, vegetative growth etc).The scheme is part of the Rufiji Basin that deals with watershed management and has water right from the Basin Office (4.8 mcu/sec).	Social/Cultural acceptability: In Tanzania, gravity irrigation is widely used in both small and large-scale irrigation schemes. However, at Kapunga, there are some conflicts with surrounding communities who used to get company land freely.

Sustainability	economic aspects cultural environmental aspects technical	
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and reliable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.). The scheme is providing employment and leasing farm land to the surrounding communities		Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.).Damage of irrigation infrastructures and crops by livestock, deficiency of phosphorus and micro-nutrients in soils, weed and conflict with the communities
Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;) Availability of permanent water source, accessibility and labour are essential requirements		What is potential for applying all/parts of initiative elsewhere?
		(Score from 1 to 10 on list below with 10 being highly applicable)
		I [5] Transfer of practice to another group/culture/land-use system, etc.
		II [3] Easy to transfer the practice, but with minor adaptations for local conditions
		III [8] Transfer possible, but significant modifications/prerequisites to consider.
		IV [8] Difficult to transfer the practice. Need experienced support.
		V [1] It would be impossible to transfer the practice. Too site specific.
		Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.)
Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be considered best Practice - name them and give reasons why and provide any Conclusion and Recommendations). Is among very few big private rice schemes in Tanzania. The new administration seems to be very determined to revive the farm by rehabilitating the infrastructures and introducing new crops. With this tempo, the farm is expected to be very successful in some years to come.		
Contact Organisation: (For further information; site visits' etc)		
Type of organisation:	Contact person: Patel Rajesh	
[ ] government organization	Contact details: Mobile 0755537174	
[x] private organization		
[ ] NGO &/or CBO		

[ ] international agency	
[ ] other:	
Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon fture similar interventions)	
Planning:	
Design	
Construction	
Implementation	
O&M	
Beneficiary involvement	
Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc).	
Other Remarks or observations: Some of the information could not be obtained / not relevant because the scheme is just one year old under the new administration	
Contact person completing form:	
Contact details	

Kilombero Sugar Company

Date of Visit: 12/11/2007	Category:
Name of Site: Kilombero Sugar Company	Either water Harvesting; Community Irrigation or Private Public Irrigation
	Sketch Map of Site
Geographic location of practice: Kilombero, Kilombero District, Morogoro	
(GPS) Coordinates: UTM 259972, 9625626	
Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc: The scheme is operated by a foreign company from South Africa (ILLOVO) and ED & FMAN company from UK. The main beneficiaries are the foreigners, the Tanzanian community through sugar supply, direct employment and payment of tax. Villagers at nearby villages benefit through the out growers system. The system allows farmers living in villages surrounding the scheme to cultivate rainfed canes which is finally sold to the sugar processing plant.	

Characteristics of the area:		
Climate (AEZ) + Description: (Sets the climatic context - Arid; semi-arid; humid tropics; Mediterranean - Influences the types of crops that can be grown). Eastern plateaus and mountain blocks + sub-humid climate		
Average annual rainfall (mm): 800 - 1000 mm		
Months of Short Rains:	October -December	
Months of Main Rains:	March - May	
Mean annual ref. crop Evapotranspiration (mm): 140		
Predominant soil type:	Clay soil, clay loam	
Topography:	Flat to gentle sloping	
Slope:	0.2 to 3%	
Erosion:	No erosion experienced	
Period of year during which used: July - December and December- May		
Period of year during which benefits utilised: throughout the year		
Water Source: (Storage on river; groundwater; run-of-the river; conjunctive use of surface and groundwater - Describes the availability and reliability of irrigation water supply).The great Ruaha River is the main water source. Water is very reliable, the River flow throughout the year however during dry season water supply may decrease as the large amount of water is used for Hydro electric power production in Kidatu. However the reduction of water supply resulting due to drought has no any serious limitation on cane production.		
Irrigated area: (Total annual and then by season (ha)): The scheme is divided into two parts, the K1 and K2. It has five farms namely Simba, Iwembe, Nyambisi, Ruaha and Msolwa. The area are 1452.7ha, 1735.8 ha, 1634.8, 1711.6 ha and 2169.8ha for the Simba, Iwembe, Nyambisi, Ruaha and Msolwa respectively. The total area of cultivated		

in the irrigation scheme is 8604.7ha.	
Method of water abstraction: (Pumped; gravity; artesian - Influences the pattern of supply and cost of irrigation water). Pumps	
Water delivery infrastructure: (Open channel; pipelines; lined; unlined - Influences the potential level of performance.): Pumping take water from the Great Ruaha River through a system of pipes. This system delivers water into the main lined canal. Water is then distributed into secondary lined canal. The canals deliver water by gravity. The secondary canals supply water into small dams connected to the sub-pressure pumping systems. The sub-pressure pumping system pumps water through series of pipes which irrigate canes through overhead sprinkler network.	
Type of water distribution: (Demand; arranged on-demand; arranged; supply orientated - Influences the potential level of performance.): Water is not limiting, therefore every farm gets sufficient water without need for irrigation scheduling.	
Predominant on-farm irrigation practice: (Surface: furrow, level basin, border, flood, ridge-in-basin; Overhead: rain-gun, lateral move, centre pivot; drip/trickle - Influences the potential level of performance). Generally overhead irrigation however only 125 ha are under furrow.	
Major crops (with percentages of total irrigated area): (Sets the agricultural context. Separates out rice and non-rice schemes, monoculture from mixed cropping schemes). 100% cane production	
Average farm size: (Important for comparison between schemes, whether they are large estates or smallholder schemes). Whole farm (8604.7 ha) is owned by the ILLOVO and AD &FMAN companies at 75 % and 25 by the government of Tanzania.	
Type of management: (Government agency; private company; joint government agency/farmer; farmer-managed - Influences the potential level of performance). Privately managed.	
Technical Description: (Please describe in about 250 words the background of the irrigation development, how it is used, how it achieves its objectives and its main purpose - For local markets; home consumption; regional or national markets; export.. The kilombero sugar company started operations in 1961 after the construction started in 1959 and completed in 1961. It was privately managed by the Dutch from The Netherland and was known as K1. After independency in 1970's, the scheme was put under the management of NAFCO. In the years 1973/1974 the scheme was put under the management of SUDECO (Sugar Development Cooperation). In 1976 the second part of the Kilombero sugar company (K2) was constructed. On 1st April, 1998 the scheme was privatized under the Public Sector Reform Commission (PSRC) and was sold to ILLOVO and AD & FMAN companies from South Africa and UK respectively. To date the scheme is under private management with 25 % share of the government of Tanzania.	
Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.). Feasibility studies were conducted from 1956 to 1957 for K1 and 1973 to 1974 for K1 respectively (Richard Ndongwe, Personal communication). The design manuals, reports, design data and calculations are kept by the irrigation department of the scheme.	
Useful in: Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc. The practice fits well in areas with sufficient water supply, fertile soils, flat terrain and availability of labour.	Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider application: The scheme cannot perform well under limited water supply, shallow water table, poor soils like sandy and saline soils and irregular landscape and the establishment of such scheme require heavy capital investment,
Geographical extent of use: The areas of the study country	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths

where it is found and the sort of areas where it could be used within the Nile Basin: The practice is widely used in Tanzania. Examples include Kagera, Iringa, Morogoro and Kilimanjaro. The practice is also used in different location of the Nile Basin.	of the practice and whether it has in fact achieved what it set out to do. The scheme has achieved its objectives; These include provision of employment, increase in household income of the nearby community and has increase the Government revenue through taxes. The general strength of the scheme is the presence of sufficient water supply for irrigation, well knowledgeable technical staff and potential area for expansion and good market for sugar.
Other Sites where used: Other cane production schemes are Mtibwa, Kagera and Tanzania Planting Company (TPC) (See also URT, 2002). Other Private-Managed Irrigation Schemes are those irrigating tea and coffee. Examples are Kibena tea estates, and Burka Coffee estate	
Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.): Information not available.	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc): The O & M operations of the irrigation infrastructure, sugar processing, tractors, vehicles and other related machineries are undertaken by technicians under the irrigation and civil departments and workshop. The costs for O & M activities are funded by the private companies who are the owner of the cane growing irrigation scheme.
Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock: 1 ha produce 80 tons of canes . The estimated total operation costs per ha is $ 3050 . The sugar/cane ratio is 1/10. Ten (10) tones of cane produce 1 tons of Sugar. 80t of canes produce an average of 8t of Sugar which is equivalent to 160 bags of 50 kg each. Average price of 50 kg of sugar is $ 34.5. Eight (8) tones of sugar are sold at $ 5520. The average benefit is therefore estimated per ton is $ 2470.	
Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users? How and why are they involved in the practice? Actual level of beneficiary involvement under operation: The initiators of the scheme were people from The Netherland. The main stakeholders are the scheme owners who include ILLOVO, AD & FMAN companies and the Tanzanian Government. Others are villagers who have market for the canes, the Rufiji river basin project which provide water right bill, Ministry of Agriculture, Food Security and Cooperative and the Tanzanian community in general as they benefit from sugar supply and employment.	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.): The scheme is privately owned and the ideal originated from people from the Netherland, Design standards and manuals exists however were not accessed during this survey. The idea is supported by the Government policies including: 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 and Public Sector Reform act.
Who are the main beneficiaries	beneficiary involvement

	demand based interventions
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). Trainings are mainly given to professional workers. There is on-job training, manpower development, in-house training. Short courses and seminars are also offered.	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this).No need for the extension support as the scheme has the agronomy section. The section has specialists in cane agronomy who advice on agronomic practices. The irrigation and civil departments and workshops assess the damages and estimate the cost required for O & M operation.
Environment benefits: (Whether it has been completed as part of part of watershed development or integrated management approach, how it fits in, visible benefits achieved in terms or water availability, reduction in erosion, vegetative growth etc). The scheme is part of the Rufiji Basin and has water right from the Basin Office for 6100 litres/sec. Sustainability economic aspects cultural environmental aspects technical	Social/Cultural acceptability: Such technologies are widely distributed in Tanzania however they are practiced at large scale (URT, 2002).
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and reliable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.).The scheme has mainly improved household income especially for cane out growers and the scheme owners and has provided employment opportunities to the nearby communities and Tanzania community at large. Tanzanian professionals are employed in agriculture, sugar processing factory, workshops etc. Others are employed as unskilled laborer for cane cutting. The scheme has increased Government revenues through taxation and dividends given as share holder of 25 %	Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.) The practice need the large, flat land with fertile soils The risk of damaging infrastructures as a result of too much rainfall The risk of negative environmental impacts such as Malaria and environmental problems related to use of fertilizer, herbicide and pesticides. Water loss due to unlined canals may be very high and reduce water productivity The scheme is need heavy investment for establishment and operations

Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;): Availability of permanent water supply, accessibility, labour and market for produced sugar are essential requirements.	What is potential for applying all/parts of initiative elsewhere?
	(Score from 1 to 10 on list below with 10 being highly applicable)
	I [8] Transfer of practice to another group/culture/land-use system, etc.
	II [8] Easy to transfer the practice, but with minor adaptations for local conditions
	III [5] Transfer possible, but significant modifications/prerequisites to consider.
	IV [7] Difficult to transfer the practice. Need experienced support.
	V [1] It would be impossible to transfer the practice. Too site specific.
	Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.)

Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be considered best Practice - name them and give reasons why and provide any Conclusion and Recommendations).The site is considered to be the best practice because the reported average cane yield (80t/ha) is on the higher side compared to the national average of 60t/ha

Contact Organisation: (For further information; site visits' etc)

Type of organisation:	Contact person: br. Richard Ndongwe (Farm Manager , Ruaha farm)
[ ] government organization	Contact details: +255 784 354344
[ ] private organization	
[ ] NGO &/or CBO	
[ ] international agency	
[ ] other:	

Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon future similar interventions)

Planning: The planning was well accomplished as the scheme is operational since its establishment.

Design: The design was not properly done as the scheme suffers from drainage problems and some of the canals were lined by clay.
Construction: The construction phase was not properly completed as some of secondary canals are not lined.
Implementation: The implementation phase suffered from management problems. Managements have been changing since its establishment. This has resulted into poor production and yield when it was under certain management especially when it was under government management.
O&M : The operation and maintenance activities are carried out by professionals hence O & M is not limiting any production.
Beneficiary involvement: Beneficiaries involved from idea initiation, construction of initial irrigation infrastructure, O&M, crop husbandry, water management, environmental conservation, and soil management and farmer-to-farmer extension). The involvement of scheme owners, employees and nearby farmers is good as the industry give them better profit.
Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc). The scheme owners have realized a number of benefits that includes permanent employment and increase of food security and house hold income.
Other Remarks or observations:
Contact person completing form:
Contact details

Kibena Tea Ltd

Date of Visit: 07/12/2007	Category:
Name of Site: Kibena Tea Ltd	Either water Harvesting; Community Irrigation or Private Public Irrigation
Geographic location of practice: Njombe District, Iringa Region	Sketch Map of Site 
(GPS) Coordinates: 9°12'S, 34°45'E	

Description of the Community: (Including no of beneficiaries; gender groups; number of households; names of villages; overall population; etc It is a private company. The surrounding villages benefit as well through employment in farms and tea factory. In addition, the company provides funds, through Kibena Tea Fair Trade Fund, for schools and other public services.

Characteristics of the area:

Climate (AEZ) + Description: (Sets the climatic context - Arid; semi-arid; humid tropics; Mediterranean - Influences the types of crops that can be grown).

Average annual rainfall (mm): 800±1000	
Months of Short Rains:	None
Months of Main Rains:	November-May
Mean annual ref. crop Evapotranspiration (mm):	
Predominant soil type:	Clay Loam
Topography:	
Slope:	Medium to gently slope
Erosion:	Very minimum
Period of year during which used:	throughout

Period of year during which benefits utilized: throughout	
Water Source: (Storage on river; groundwater; run-of-the river; conjunctive use of surface and groundwater - Describes the availability and reliability of irrigation water supply). Natural dam (Lihogosa swamp) modified with a dam wall to retain more water; currently very unreliable as a result of low rains and over use	
Irrigated area: (Total annual and then by season (ha)) 730 ha	
Method of water abstraction: (Pumped; gravity; artesian - Influences the pattern of supply and cost of irrigation water). Pumped	
Water delivery infrastructure: (Open channel; pipelines; lined; unlined - Influences the potential level of performance.) Pipelines	
Type of water distribution: (Demand; arranged on-demand; arranged; supply orientated - Influences the potential level of performance.) Supply oriented. Depending on how much is available in the swamp	
Predominant on-farm irrigation practice: (Surface: furrow, level basin, border, flood, ridge-in-basin; Overhead: rain-gun, lateral move, centre pivot; drip/trickle - Influences the potential level of performance). Overhead movable sprinkler laterals (547 ha) and dripper lines (183 ha). Plan is to phase out sprinkler system slowly.	
Major crops (with percentages of total irrigated area): (Sets the agricultural context. Separates out rice and non-rice schemes, monoculture from mixed cropping schemes). Tea	
Average farm size: (Important for comparison between schemes, whether they are large estates or smallholder schemes). Two Estates; Itambo (381 ha) and Lihogosa (349 ha)	
Type of management: (Government agency; private company; joint government agency/farmer; farmer-managed - Influences the potential level of performance). Private company	
Technical Description: (Please describe in about 250 words the background of the irrigation development, how it is used, how it achieves its objectives and its main purpose - For local markets; home consumption; regional or national markets; export: Was a department of TANWAT (forestry company), became on its own under Tanzania Tea Packers Ltd in 2001 and now with Rift Valley Holdings since August 2007. The company produces tea for both local and international markets.	
Technical Details: (Describe the studies that were carried out before implementation, any design manuals or guidelines that were used for implementation, Relevant Reports and Design Data used in Designs, and any major calculations made including runoff, available water supplies irrigation area or number of people supplied with water etc.). Several studies were made namely climate, soils, hydro geological etc. All the reports can be obtained from the company	
Useful in: Describe the types of area where it can be used, the conditions where it produces good results, Sites of applications, etc. The practice is possible in a range of terrain with reliable water source (rainfall/irrigation)	Limitations: Describe the conditions or situations where it does not perform well and conditions that will restrict its wider application: The practice cannot perform well under limited water supply, poor soils like sandy soils
Geographical extent of use: The areas of the study country where it is found and the sort of areas where it could be used within the Nile Basin: The practice is widely used in Tanzania. Examples include Mbeya, Iringa and Tanga Regions. The practice is also used in several location in the Nile Basin Countries	Effectiveness: (Describe whether it has achieved its objectives, how well it has done and the general strengths of the practice and whether it has in fact achieved what it set out to do. So far, the company has achieved its objectives because of good management of resources available
Other Sites where used: Mufindi Tea Estates and Lushoto	
Cost: (If possible, and applicable, please indicate the total budget for the best practice, the sources of funding, the implementation period, the total cost and cost per cubic metre of water stored or per ha irrigated, beneficiary contributions, etc.) As per 1995 data, the cost of the scheme is 1500 USD/ha for drip and about 75% of that for sprinkler system. Unit cost is about 0.5 USD/mcu pumped (2006)	Operation and Maintenance arrangements: (Who manages, operates and maintains the works, how this is funded, contributions levied per user, percentage of payment received against amounts requested, any assistance and support received from Government or other organizations, etc): O&M is financed and managed by the company itself through its operation and service department

Benefits: (Estimate the returns achieved from the site if involves irrigation or costs saved in getting water if water for humans or livestock: The information not available	Water User Association or User Group: (Provide details of the type of organisation, how it works and elects members, number of members and all other pertinent details). None
Stakeholders and beneficiaries: (Who are the main initiators, actors, stakeholders, beneficiaries and users. How and why are they involved in the practice? Actual level of beneficiary involvement under operation: The main beneficiary and user is the Kibena Tea Ltd. Villages around the farm do also benefit by getting employment in the farm and factory. **Who are the main beneficiaries**	Enabling Environment: (Policies, design standards and manuals that made the concept possible, where the community obtained the idea, was it demand based or introduced by Government or private sector initiatives, etc.) Private sector initiatives **beneficiary involvement** **demand based interventions**
Training support: (Details of any training carried out before, during and after construction and how the community has benefitted from this). Various in house training are in place. Out of station training is also done through long & short courses, seminars and workshops	Extension support: (Details of any extension services provided and whether any help is given in assessing annual O&M needs and preparing costs and how the community has benefitted from this). Minimal as they do not deal with out-grower farmers
Environment benefits: (Whether it has been completed as part of part of watershed development or integrated management approach, how it fits in, visible benefits achieved in terms or water availability, reduction in erosion, vegetative growth etc). Sustainability economic aspects cultural environmental aspects technical	Social/Cultural acceptability: Very acceptable because of the support the company provides to the communities (employment, building of schools, etc).
Advantages: (Strengths of the approach adopted, how well it fits into the community and meets its needs, is it affordable and reliable, will the community continue to operate, maintain and use it after outside assistance has gone and reasons for this etc.). Movable sprinkler and drip system could be affordable to private companies with capital, but Not the majority of communities in Tanzania and even other Nile Basin countries	Disadvantages: (Constraints that restrict its effectiveness, the risks involved in its developments, the conditions under which it will not work or have reduced impact etc.). The system is capital intensive
Scaling Up: (Are there specific conditions or obstacles which make it impossible to replicate or transfer the practice elsewhere - e.g., a specific climate or specific cultural beliefs or social relations which are important for the success of this practice;) Availability of permanent water source, accessibility and labour are essential requirements	What is potential for applying all/parts of initiative elsewhere?
	(Score from 1 to 10 on list below with 10 being highly applicable)
	I [5] Transfer of practice to another group/culture/land-use system, etc.
	II [5] Easy to transfer the practice, but with minor adaptations for local conditions

	III [5] Transfer possible, but significant modifications/prerequisites to consider.
	IV [5] Difficult to transfer the practice. Need experienced support.
	V [1] It would be impossible to transfer the practice. Too site specific.
	Other specific remarks: (e.g., agreements, regulations, provisions regarding Intellectual Property Rights, etc.)

Best Practices: (Why this site/ case is considered to be a successful best practice; express this success in qualitative or quantitative terms; whether all or only part of the practices of the site can be considered best Practice - name them and give reasons why and provide any Conclusion and Recommendations). The scheme is a good example to use a high level of management over the sprinkler and drip irrigation systems it operates compared to management level offered to the gravity irrigation systems. Irrigation managers in the estate collect and use the whole range of weather data required for determination of crop water requirement and irrigation scheduling together with other data for assessing farm productivity (Kibena Tea Estate, 2001, 2002, and 2003). The Kibena piped irrigation system is equipped with gauges and gadgets for measuring amount of water, constantly monitoring irrigation application uniformity, yield and above all the cost of pumping water. The management gives high weight to management of water to justify water pumping bill and profit optimization. As such they have incorporated in their management system a way to assess productivity of water because it is a very important input to the estate.

Contact Organisation: (For further information; site visits' etc)	
Type of organisation:	Contact person: Gembe M.M. (Operation Manager)
[ ] government organization	Contact details: 0787555082, mgembe@iwayafrica.com
[x] private organization	
[ ] NGO &/or CBO	
[ ] international agency	
[ ] other:	

Lessons learnt: (at various stages of the realisation of the works, describe any lessons learnt that would improve upon fture similar interventions)
Planning:
Design
Construction
Implementation
O&M
Beneficiary involvement
Realisation of benefits: Such as markets; achieving better returns - crop selection &/or market linkages etc).
Other Remarks or observations:

Contact person completing form:
Contact details

Appendix 8: Ranking of irrigation best practices

SN.	Irrigation practices	CRITERIA						Total	Rank
		Water use efficiency (very high=20, high=15, med=10, low=5)	O&M (high =2, medium=5, low =10)	Technical requirement complex=1, some how complex=5, simple=10	Labour requirement high =2, medium=5, low =10	Environmental impact high =2, medium=5, low =10	Possibility of out scaling high =20, medium=15, low =10		
1	Gravity, open channel (semi-lined), level basin	10	10	10	2	2	20	54	1
2	Pumped, piped, lateral drip	20	2	1	10	10	10	53	2
3	Gravity, open channel (lined), level basin	10	10	10	5	2	15	52	3
4	Gravity, open channel (unlined), level basin	5	10	10	2	2	20	49	4
5	Pumped, piped, movable sprinkler	20	2	1	5	10	10	48	5
6	Pumped, open channel/ piped, pivot	15	2	1	10	5	10	43	6
7	Pumped, open channel/ piped, movable sprinkler	15	2	1	5	5	10	38	7
8	Pumped, open channel (unlined), level basin	5	5	5	2	2	15	34	8

End