

THE STUDY
ON
THE NATIONAL IRRIGATION MASTER PLAN
IN
THE UNITED REPUBLIC OF TANZANIA

Guidelines

for
Irrigation Scheme Formulation
for
District Agricultural Development Plan



December 2004

NIPPON KOEI CO., LTD.
NIPPON GIKEN INC.

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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF AGRICULTURE AND FOOD SECURITY (MAFS)

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Application of the Guidelines

1. What are described in the guidelines?

These Guidelines show a *quick and practical way of formulating irrigation schemes in District Agricultural Development Plan (DADP)*. However, district officers do not always have to apply the method or standard value presented in these guidelines if they plan to use a more detail method. The guidelines focus on *district-manageable small-scaled irrigation schemes* (small-scaled gravity irrigation schemes, pump irrigation schemes for which the water source is a river, pond/lake, or water harvesting scheme) considering currently available budget for DADP as well as current experience levels of district staff.

2. Why the guidelines were prepared?

Preparation of DADP was launched in 2003 as one of the key activities presented in the Agricultural Sector Development Programme (ASDP) completed in November 2002. As a result, many districts proposed irrigation development in their DADP. However, it was found that these DADP did not sufficiently present the appropriateness of their development plans. Considering this situation, "Preparation of Guidelines for Irrigation Scheme Formulation for DADP" was selected as one of the priority supporting programmes in the National Irrigation Master Plan Study (NIMP) conducted by Japan International Cooperation Agency (JICA), and the guidelines were prepared by the JICA Study Team for NIMP.

3. To whom the guidelines were prepared?

The guidelines were prepared mainly for *District officers dealing with the agriculture sector* who play a key role in DADP preparation. The guidelines are also useful for the *staffs of the Zonal Irrigation Units*, since they also have an important role in DADP, such as endorsement of district plans and providing technical support to districts.

4. How the guidelines were prepared?

A participatory approach was adopted for the preparation of the guidelines. Through trial usage activity in two model districts, the guidelines were improved by District staff, zonal irrigation unit staff and Division of Irrigation Technical Service staff.

5. What is the special feature of the guidelines?

The most outstanding feature of the guidelines is: *Quick and Practical Irrigation Development Planning in DADP*.

Terminology for the Guidelines

In these guidelines, the following terms are defined as shown below. However, this does not mean that the terms are always used with the meanings defined in these guidelines when they are used outside the guidelines.

1. Team and Committee	
<i>District Project Development Team (DPDT)</i>	One team will be formed in each district to prepare irrigation scheme formulation plans in DADP. The team will be composed of District Agriculture and Livestock Development Officer (DALDO) as chairperson, Subject Matter Specialist (SMS) for irrigation, SMS for agriculture, extension officer, and other relevant staff of the District Office. Participation of Ward leaders, Village leaders, representative farmers, and other stakeholders as determined by district council and NGO will be desirable.
<i>Zonal Review Committee (ZRC)</i>	A ZRC will be formed in each Zonal Irrigation Unit (ZIU) to assess and endorse the proposed irrigation scheme formulation in the DADP prepared by DPDT. The team will consist of the Zonal Irrigation Engineer as chairperson and experts in various fields such as irrigation, agriculture, soil science, and environment.


2. Survey and Planning	
<i>Quick Site Inspection</i>	The site survey to be conducted for all the irrigation schemes in the district to choose high potential scheme(s) for preliminary planning.
<i>Field Survey</i>	The site survey to be conducted for irrigation schemes selected through screening.
<i>Preliminary Planning</i>	The planning for irrigation schemes selected through screening.

3. Report and Document	
<i>Quick Site Inspection and Screening Report</i>	The report to be prepared by DPDT describing the result of screening. The report should be submitted to ZRC for assessment and endorsement.
<i>Screening Endorsement Letter</i>	The letter to be prepared by ZRC to endorse the result of screening conducted by district.
<i>Confirmation Letter on the Proposed Area</i>	The letter to be prepared by the village government to confirm that villagers agreed on the selection of the proposed area (area to be considered in the preliminary planning).
<i>Irrigation Scheme Formulation Plan Report</i>	The report to be prepared by DPDT containing all the results of the field survey, preliminary planning, and prioritization of the selected schemes along with the district supporting programme. All completed data forms and maps of the selected schemes should be attached to the report.
<i>Validation and Agreement Letter</i>	The letter prepared by ZRC to validate and agree on the result of the irrigation development planning conducted by the district.

4. Map	
<i>Village Resource Map</i>	The map prepared by villagers showing resources of the village, such as river, agricultural land etc.
<i>Present Situation Map</i>	The map prepared by DPDT based on the village resource map. It shows also village resources, but their exact locations (coordinates) are measured by handheld GPS and then plotted on graph paper.
<i>Scheme Development Plan Map</i>	The map prepared by DPDT based on the present situation map. It shows not only village resources but also the locations of any proposed intakes, canals, roads, etc.

5. Area	
<i>Potential Area</i>	The area proposed to be developed by villagers in O&OD (or village plan).
<i>Cultivated Area</i>	The area currently cultivated in the potential area.
<i>Present Irrigated Area</i>	The area currently irrigated in the cultivated area.
<i>Present Rainfed Area</i>	The area currently not irrigated in the cultivated area.
<i>Proposed Area</i>	The area to be considered in preliminary planning. The area should be selected by villagers as the first priority area in the field survey meeting, and a confirmation letter on the proposed area shall be sent to the district office by the village government.
<i>Irrigable Area in Rainy Season</i>	The area that can be irrigated in the wet season.
<i>Irrigable Area in Dry Season</i>	The area that can be irrigated in the dry season.
<i>Development Area</i>	The area to be developed (area to be provided irrigation and drainage facilities).
<i>Command Area of the Main Canal</i>	The area irrigated from the main canal. Normally, it is the same as the development area, except when the proposed development is an extension of an existing canal. For an extension scheme, the command area of the main canal consists of the existing area plus the development area (extension area).

6. Irrigation System	
<i>Irrigation Scheme</i>	Any irrigation system that meets one of following criteria should be recognized as a single irrigation scheme: 1) Several canals are conveying water from one intake 2) Several intakes but the canals are connected 3) Several intakes with scattered canals but the intakes and canals are situated within one village
<i>Traditional Irrigation Scheme</i>	Irrigation schemes that have been initiated and operated by farmers themselves, with no intervention from external agencies. Those would include schemes based on traditional furrows for the production of fruit and vegetables in the highland areas and simple water diversion schemes in the lowlands for paddies

	 <p style="text-align: center;">Traditional Intake made by Stones and Mud</p>
<i>Improved Traditional Irrigation Schemes</i>	Irrigation schemes that have been initiated and operated by semi-subsistence farmers themselves and on which there has subsequently been some intervention by an external agency in the form of construction of a new diversion structure.
<i>Modern Irrigation Schemes</i>	Formally planned, designed and fully developed smallholder scheme for which full irrigation facilities have been provided by external agencies with or without some contribution from the beneficiaries, and for which there is usually a strong element of management provided by the government or other external agency.
<i>Water Harvesting Schemes</i>	Irrigation schemes that subsistence farmers have themselves introduced using simple techniques to artificially control the availability of water to crops. Includes flood recession irrigation schemes.

7. Type of Irrigation Scheme	
<i>Gravity</i>	An irrigation scheme in which water is supplied to agricultural land only with gravity force.
<i>Pump (river)</i>	The irrigation scheme for which the water source is a river and water is abstracted by pump.
<i>Pump (lake/pond)</i>	An irrigation scheme for which the water source is a lake/pond and water is abstracted by pump.
<i>Rain water harvesting</i>	An irrigation scheme that subsistence farmers have themselves introduced using simple techniques to artificially control the availability of water to crops. Includes flood recession irrigation schemes.
<i>Groundwater</i>	An irrigation scheme for which the water source is groundwater. Groundwater irrigation is not handled in the guidelines, since it needs special hydro-geological study. It is recommended that groundwater irrigation schemes be formulated in consultation with the Zonal Irrigation Unit.
<i>Dam</i>	An irrigation scheme for which a dam is the water source. Dam irrigation is not handled in the guidelines, since it requires special engineering studies. It is recommended that dam irrigation schemes be formulated in consultation with the Zonal Irrigation Unit.

<i>Treadle pump</i>	A treadle pump is a pump to lift water by pedal power. Treadle pump irrigation is not handled in the guidelines as it should be installed by farmers themselves, not the district government. However, promotion of installing treadle pumps can be proposed in the DADP.
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8. Required Works

<i>Rehabilitation</i>	Works to recover the function of existing irrigation and drainage facilities up to the original level without changing irrigation system (not changing traditional or improved traditional system to a modern system).
<i>Improvement</i>	Works to enhance the function of existing irrigation and drainage facilities by changing the irrigation system (changing traditional or improved traditional system to modern system).
<i>New Development</i>	Works to develop a new irrigation and drainage system by providing new facilities (new irrigation and drainage facilities provision for a scheme where there are no existing facilities).
<i>Extension</i>	Works to extend the irrigation area from an existing upstream area to a non-developed downstream area.
<i>Drainage</i>	Works to improve the drainage condition of the scheme by providing new drainage facilities or improve existing drainage facilities without providing irrigation facilities (no irrigation works, only drainage works).

9. Interview Survey

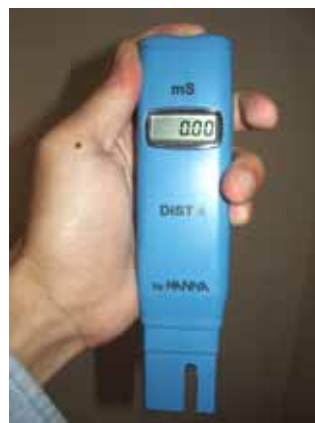
<i>Household</i>	A family unit managed under one financial control.
<i>Anticipated negative impact</i>	A bad influence that might occur because of a proposed irrigation development. Environmental problems not related to irrigation development (such as soil erosion under rainfed condition) are not "anticipated negative impact".
<i>Water conflict within the scheme/village</i>	Competition for limited water resources among villagers within the same scheme or village.
<i>Water conflict between other scheme/village</i>	Competition for limited water resources between different schemes or different villages.
<i>Land conflict</i>	Competition for limited land resources among villagers or between agronomists and pastoralists.

10. Equipment

<i>Handheld Global Positioning System (GPS)</i>	Equipment used to identify the geographical location of a point using satellite positioning. Horizontal measuring error of handheld type GPS is about 5-15 m, so while not suitable for measuring very small areas, handheld GPS is good enough for irrigation scheme formulation.
<i>Handheld Electric Conductivity (EC) Meter</i>	Equipment used to measure salinity, one of the major factors of water quality that must be checked. If salinity of the water is high, the EC meter shows a high value (high salt concentration).



A Type of Handheld GPS



A Type Handheld EC Meter

11. Database System	
<i>Irrigation Database</i>	A database system that has been established in the Division of Irrigation and Technical Services (DITS) of the Ministry of Agriculture and Food Security (MAFS) specifically for storing information about irrigation. It has three major functions: 1) Irrigation development monitoring, 2) Reference documents, and 3) Topographic maps. Data and information stored in the database can be provided to users of the guidelines upon request to the Data and Information Management Unit (DIMU) of DITS.
<i>Irrigation Geographic Information System (GIS)</i>	A GIS established specifically for irrigation in the DITS of MAFS. It was prepared mainly using materials employed for the analysis of the potential area for irrigation development. It consists of information on various types of general features (administration boundaries, rivers, and roads) along with more specific information such as agro-ecological zones, protected areas, land cover, land units and soil type. It can therefore be utilized for evaluating the irrigation potential of a proposed scheme. Data and information stored in the GIS can be provided to users of the guidelines upon request to the DIMU of DITS.

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Abbreviations

ASDP	Agricultural Sector Development Programme
ASDS	Agricultural Sector Development Strategy
DADP	District Agricultural Development Plan
DALDO	District Agriculture and Livestock Development Officer
DASAC	District Agricultural Sector Advisory Committee
DED	District Executive Director
DI MU	Data and Information Management Unit
DITS	Division of Irrigation and Technical Service
DPDT	District Project Development Team
EC	Electric Conductivity
EIA	Environmental Impact Assessment
ESA	Environmental Sensitive Areas
ETo	Evapo-Transpiration
GIS	Geographic Information System
GPS	Global Positioning System
IA	Irrigators' Association
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
LoU	Letter of Undertaking
MAFS	Ministry of Agriculture and Food Security
NEMC	National Environmental Management Council
NGO	Non-Government Organization
NIMP	National Irrigation Master Plan
O&OD	Opportunities and Obstacles to Development
O&M	Operation and Maintenance
SMS	Subject Matter Specialist
ZIU	Zonal Irrigation Unit
ZRC	Zonal Review Committee

Measurement Units

Extent

cm ²	= Square-centimeters (1.0 cm x 1.0 cm)
m ²	= Square-meters (1.0 m x 1.0 m)
km ²	= Square-kilometers (1.0 km x 1.0 km)
ha	= Hectares (10,000 m ²)
ac	= Acres (4,046.8 m ² or 0.40468 ha.)

Length

mm	= Millimeters
cm	= Centimeters (cm = 10 mm)
m	= Meters (m = 100 cm)
km	= Kilometers (km = 1,000 m)

Currency

Tsh	= Tanzanian Shillings
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Volume

cm ³	= Cubic-centimeters (1.0 cm x 1.0 cm x 1.0 cm or 1.0 m-lit.)
m ³	= Cubic-meters (1.0 m x 1.0 m x 1.0 m or 1.0 k-lit.)
lit (l)	= Liter (1,000 cm ³)
MCM	= Million Cubic Meter

Weight

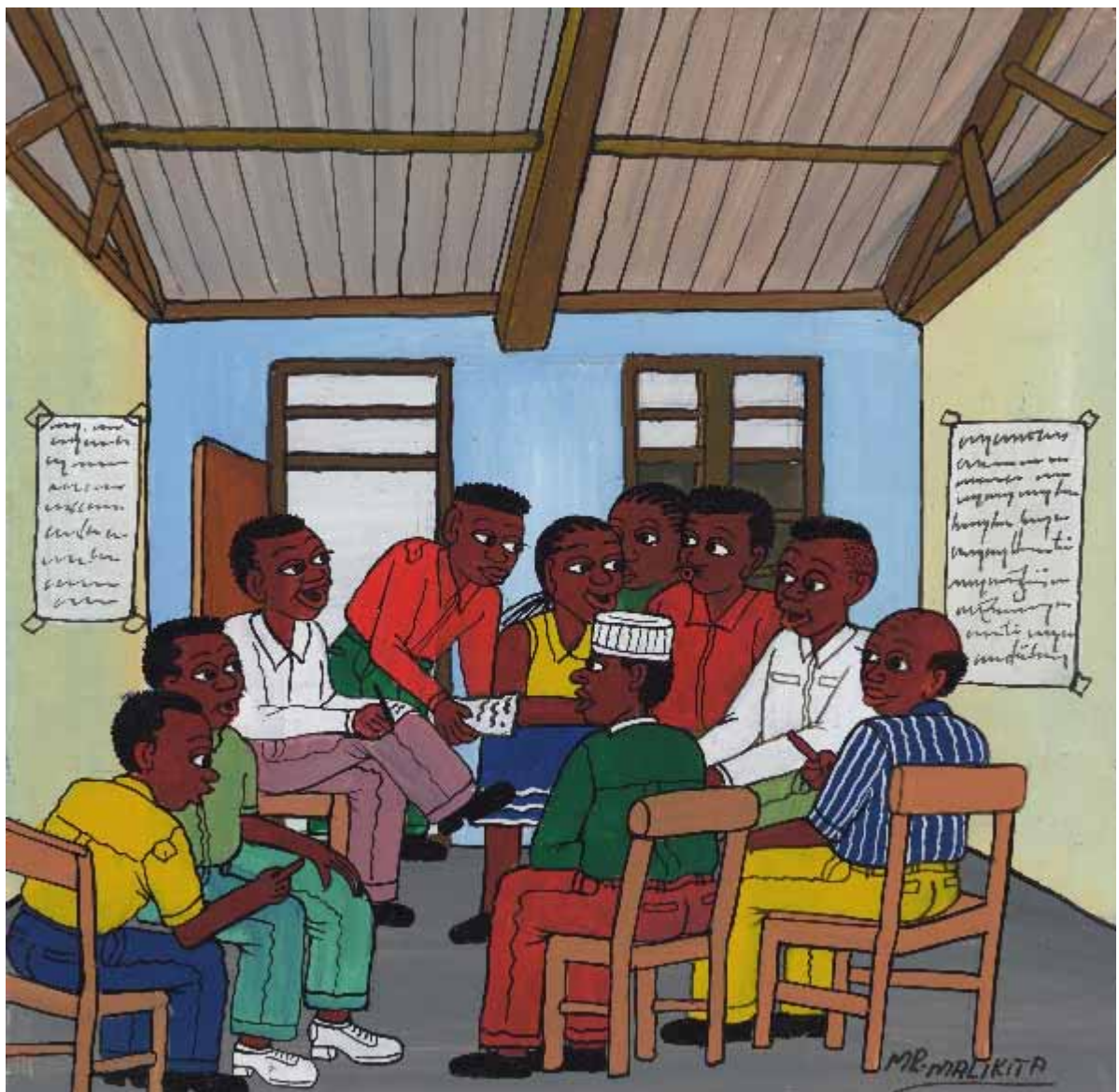
gr	= Grams
kg	= Kilograms (1,000 gr.)
ton	= Metric ton (1,000 kg)

Time

sec	= Seconds
min	= Minutes (60 sec.)
hr	= Hours (60 min.)

Section 1

Introduction



Section 1 Introduction

(1) Authority

These Guidelines were prepared as part of the Verification Study of the National Irrigation Master Plan Study in the Republic of Tanzania, as stipulated in the Scope of Work for the Study agreed on April 10, 2001 between the Ministry of Agriculture and Food Security, the United Republic of Tanzania (MAFS) and the Japan International Cooperation Agency (JICA).

(2) Background and Objective

(a) Background

The National Irrigation Master Plan Study emphasized that successful irrigation development depends upon the good performance of all aspects of irrigation development, such as good planning, good design, good construction, and good O & M. In this sequence of events, the planning of irrigation schemes including selection of appropriate irrigation schemes is the most fundamental activity as a starting point toward successful implementation.

During the Action Plan Study, site inspection of many irrigation schemes with existing development plans in hand and discussion with district staff of DADP indicated that the development plans of irrigation schemes were not clear, especially from technical and economical viewpoints, and also there were no definite criteria for the selection of appropriate irrigation schemes from those included in Village Plans. To improve this situation, it was essential to prepare and apply some practical guidelines showing the proper process of formulating schemes to be listed in DADP. The guidelines would, of course, need to be applied to have any effect, so there was also a need to provide training in their use to the relevant district staff.

The strategic approach to the Short-term Programme (2003 to 2007) in the Development Programme for the Year 2017 is to reform the environment for the promotion of decentralization of irrigation development. The preparation of the guidelines and the provision of related training to the district staff mentioned above duly coincide with this strategic approach.

(b) Objective

The objective of these Guidelines is to provide the district staff with a procedure for irrigation scheme formulation in the preparation of DADP; the procedure consists of quick site inspection, screening, preliminary study, prioritization, evaluation and selection activities.

(3) Proposed Entire Process of Irrigation Scheme Development under DADP

In this section, the entire process of irrigation scheme development is explained in order to clarify the position and roles of the "Guidelines for Irrigation Scheme Formulation for DADP". The entire process should be prepared in view of the existing authorized relevant guidelines, such as the Guidelines for District Agricultural Development Plans, November 2003 (see Attachment-1), and the Guidelines for Participatory Improvement to Farmers Initiated and Managed Smallholder Irrigation Schemes, July 2003 (see Attachment-1). In addition, the entire process should be demand driven through a participatory approach.

Taking into account the above, the process of irrigation scheme development under DADP is designed with the following basic concept:

- List-up of Irrigation Schemes on a "Demand Driven" basis

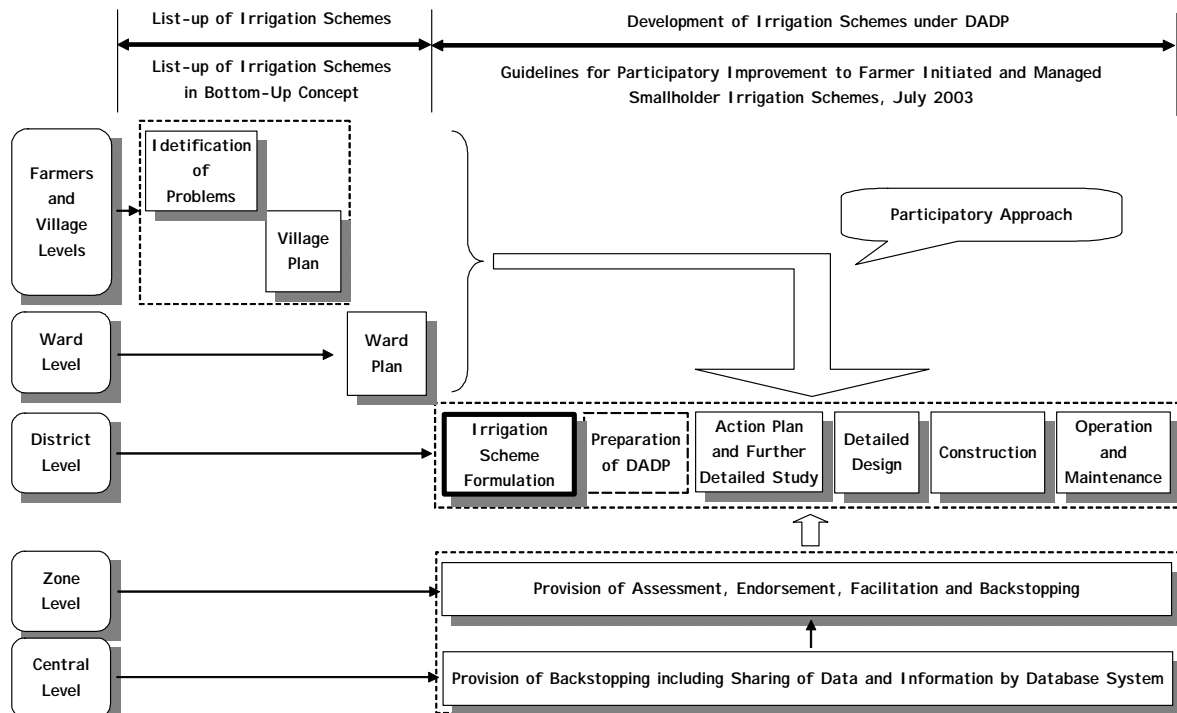
Application of all irrigation schemes should be made by the village government taking into account the real demand of farmers. The Guidelines for DADP indicate the use of O & OD methodology as an effective method of participatory planning, which was endorsed by the Central Government. The Guidelines for Irrigation Scheme Formulation for DADP should accordingly be prepared with this O & OD methodology in mind.

- Development of Irrigation Schemes by District Government in a Participatory Process of Farmers

The irrigation scheme development should be carried out in a participatory manner with the involvement of farmers to implant awareness and ownership of the irrigation scheme in their minds. In connection with the participatory approach, the MAFS has prepared the Guidelines for Participatory Improvement to Farmers Initiated and Managed Smallholder Irrigation Schemes in July 2003 under ASPs. Thus, the Guidelines for Irrigation Scheme Formulation for DADP will be elaborated within this larger framework.

The following figure shows an outline of the proposed process for irrigation scheme development under DADP:

Outline of Irrigation Development Process under DADPs



In this process, the target stage for these guidelines is the formulation of irrigation schemes.

(4) Relevant Guidelines and Manuals

There are many relevant guidelines and manuals in the DITS of MAFS that have mostly been prepared on an individual project basis. These are:

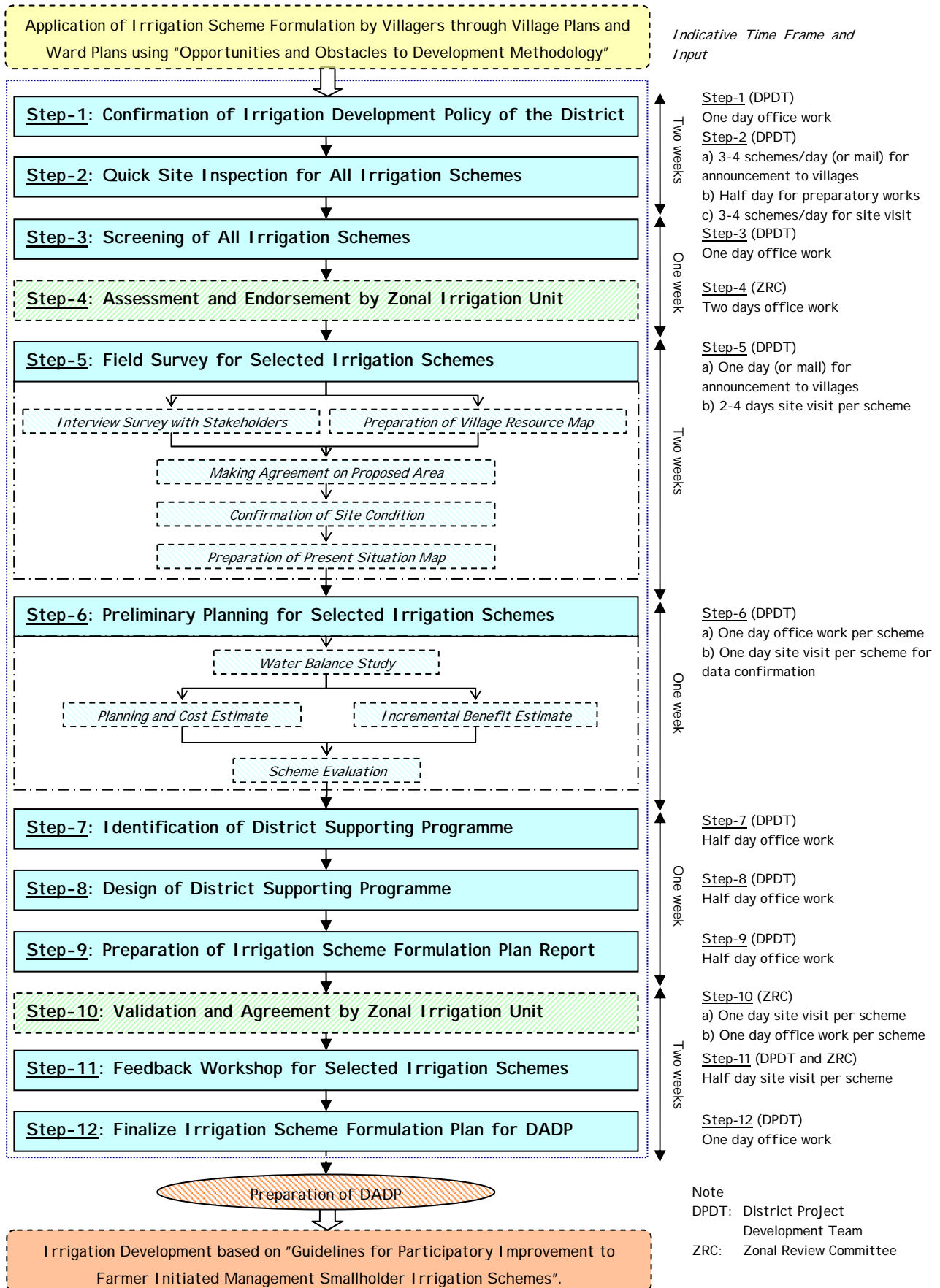
- Guidelines for Participatory Improvement to Farmers Initiated and Managed Smallholder Irrigation Schemes, July 2003
- Project Planning Manual
- Irrigation Design Manual
- Rainwater Harvesting Design Manual for Irrigated Agriculture in Marginal Areas
- Irrigation Water Management Field Handbook for Extension Staff

For the District staff's information and reference, key issues of these guidelines and manuals are briefly explained in Attachment-1.

(5) Flow of Irrigation Scheme Formulation

Flow of irrigation scheme formulation is shown on the next page.

Flow of Irrigation Scheme Formulation



Section 2

Procedure to be taken before DADP Stage



Section 2 Procedure to be taken before DADP Stage

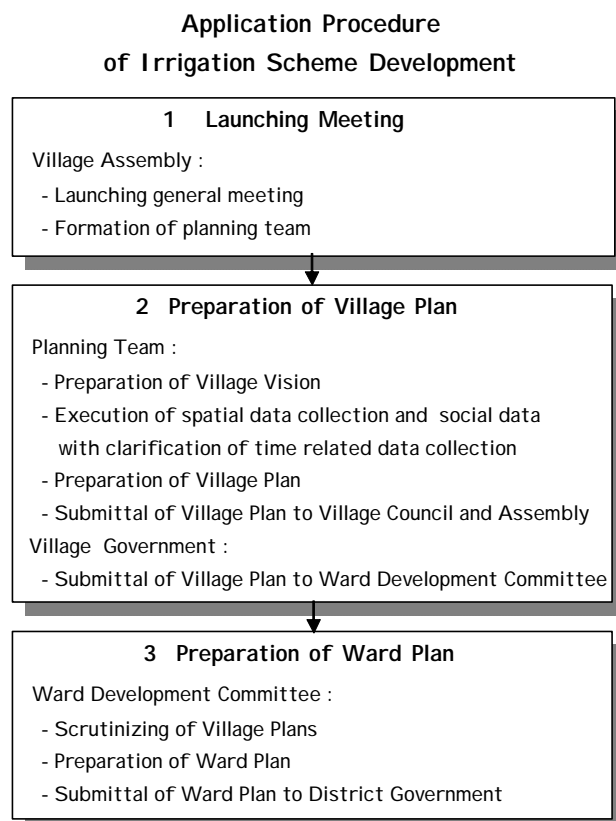
(1) General

As mentioned in Section 1 "Introduction", all irrigation schemes to be developed will be requested by villages by applying through the village government and ward development committee to the district government, i.e., using a bottom-up approach. In order to realize this application for irrigation scheme development with bottom-up approach, the Guidelines for DADP propose to use the Opportunities and Obstacles to Development (O&OD) which is accepted by the government as a participatory planning methodology. These Guidelines for Irrigation Scheme Formulation for DADP, therefore follow the same methodology to identify only irrigation schemes that are demanded by villagers.

(2) Procedure for Application to District Government

The application procedure for irrigation scheme development from farmers to their district government should be in accordance with the "TARATIBU ZA UANDAAJI MPANGO SHIRIKISHI JAMII KWA KUTUMIA FURSA NA VIKWAZO KWA MAENDELEO, April 2002" (the Guidelines for Preparing a Participatory Community Development Plans based on Opportunities and Obstacles to Development) and the Guidelines for District Agricultural Development Plans, November 2003. The application procedure derived from these two guidelines is largely divided into three parts, namely 1 Launching Meeting, 2 Preparation of Village Plan, and 3 Preparation of Ward Plan, of which the major activities are outlined in the figure at right.

The Village Plan and Ward Plan will include development plans for not only the irrigation sector, but also other sectors like education, health, roads, marketing, etc., and priority schemes will be selected from them in the light of District Vision and also ASDP and ASDS objectives.



Section 3
Irrigation Scheme Formulation
for DADP



Section 3 Irrigation Scheme Formulation for DADP

How to Proceed the Step Work

1. Main Format

This section, Section 3: Irrigation Scheme Formulation for DADP, is the main body of these guidelines. It presents a series of steps for undertaking the scheme formulation work. Each step is presented using the following format.

Main Format

Step-#: Title of Step

<u>Keywords</u> Keywords for the step.	
<u>Why is the work required?</u> Description of why the work in the step is necessary.	
<u>Key for the success of the work</u> Description on how to achieve the target of the step.	
<u>Required inputs</u> Description of required inputs for the work of the step, such as development team, material, equipment, and relevant document and information.	
<u>How is the work carried out?</u>	
Sub-step 1	Title of sub-step 1 Description of procedures for sub-step 1 work.
Sub-step 2	Title of sub-step 2 Description of procedures for sub-step 2 work.

1. First, carefully read the "Keywords", "Why is the work required?", and "Key for the success of the work" to fully understand the work.

2. Next, read "Required inputs" and confirm who is responsible for the work. If there is any material, equipment and so on required, obtain them before starting the work.

2. Indicator for Application of the Work

In some situations, not all the work needs to be conducted. For example, measurement of lake/pond capacity is not required if the water source of the scheme is not a lake/pond. If you encounter the following indicator, confirm whether the work is required or not before starting the work.

Indicator for Application of the Work

Sub-step 1	Title of sub-step 1
<u>Applicability</u> The sub-step should be applied to circled type of scheme	
1) Type of irrigation	
<input type="radio"/> Gravity	<input type="checkbox"/> Pump (Lake/pond) <input type="radio"/> Rain water harvesting
2) Type of irrigation development	
<input type="radio"/> Rehabilitation	<input type="radio"/> Improvement <input type="radio"/> New Development <input type="radio"/> Extension <input type="checkbox"/> Drainage

If there is no circle, the work is not necessary. In this example, work for a pump (lake/pond) or drainage development scheme is not required.

Step-1: Confirmation of Irrigation Development Priority of the District

Keywords

Confirmation of district irrigation development priority which is well harmonized with district local situation and National Irrigation Development Policy.

Why is the work required?

Irrigation schemes should be prioritized based on the irrigation development priority of the district (general direction for irrigation development in the district).

Key for the success of the work

The district local situation should be assessed carefully and the general direction of irrigation development in the district should be determined taking the national irrigation development policy into consideration.

Required inputs

1. District Project Development Team (DPDT)
2. Summary of National Irrigation Master Plan (NIMP) (see Attachment-2)
3. Agriculture Sector Development Programme (ASDP) report.
4. District Agricultural Development Plans (DADP) report.
5. Form for listing irrigation schemes in the district (Form-1)

How is the work carried out?

Sub-step 1	Organize the District Project Development Team.	The District Project Development Team (DPDT) will be composed of Subject Matter Specialist (SMS) for irrigation, SMS for agriculture, extension officer, and other relevant staff of the District Office.
Sub-step 2	Prepare a list of irrigation schemes in the District.	See Form-1. This will be the basic inventory of irrigation schemes in the district. The development stage and the present irrigated area for each scheme should clearly be indicated. Quick site inspection is not needed for schemes that are already completed with no further works required.
Sub-step 3	Review agriculture sector development programme (ASDP).	Review ASDP and confirm the role of the irrigation sub-sector development within the agriculture sector development programme.
Sub-step 4	Review National Irrigation Master Plan (NIMP).	Review NIMP and confirm the role of the District in the irrigation development of the country in order to achieve the target specified in the Master Plan (see Attachment-2).
Sub-step 5	Analyze the present status of irrigation activities in the District.	Analyze the present status of irrigation activities through careful examination of Form-1. Problems and constraints to irrigation development in the District will thus be revealed and the necessary countermeasures should be elaborated.
Sub-step 6	Prepare irrigation development priority of the District.	The general direction of future irrigation development should preferably be established as a District priority based on the constraints and countermeasures mentioned above. DPDT members should at least reach a consensus on the District irrigation development priority.

Step-1: Confirmation of Irrigation Development Priority of the District

Form-1 List of Irrigation Schemes in the District (page of)

Name of District _____

Prepared Date and Year _____

Prepared by _____

No.	Name of Scheme	Ward	Village(s)	Development Stage (circle one of the stage)	Present Irrigated Area	Quick Site Inspection
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed
				O&OD, DADP, F/S, D/D, Construction, Completion	ha	Needed Not needed

Note: O&OD: Opportunities and Obstacles to Development (or village plan), DADP: District Agricultural Development Plans, F/S: Feasibility Study, D/D: Detailed Design

- If the nominated scheme is in the O&OD (village plan) stage, Quick Site Inspection should be made.
- The prepared list should be submitted to zonal irrigation office together with the quick site inspection and screening report.

Step-2: Quick Site Inspection of All Irrigation Schemes

<u>Keywords</u> Confirm current conditions of irrigation scheme at site with relevant information and check list in hand.	
<u>Why is the work required?</u> To make a rough site check on the reliability of information on irrigation schemes listed in the Ward Plan is a prerequisite for successful irrigation planning within a limited time.	
<u>Key for the success of the work</u> In this stage, it is not necessary to make a detailed inspection. The site inspection should be conducted to confirm that the irrigation schemes with conditions as reported in Ward Plan exist. For that purpose, a survey sheet to be filled in during the inspection is a useful tool.	
<u>Required inputs</u> 1. District Project Development Team (DPDT) 2. Survey Sheet for Quick Site Inspection (Form-2) 3. Handheld GPS and Handheld EC meter 4. Camera (if available)	
<u>How is the work carried out?</u>	
Sub-step 1 Carry out preparatory works, before visiting the sites.	1) Obtain important pre-information (such as inventory survey result, soil type, land cover, agro-ecological zone, protection area, 1:50,000 topographical maps, etc.) from the data and information management unit of DITS, MAFS. 2) Acquire handheld GPS and EC meter. 3) The water rights related to the water resources, especially for the downstream site, should be checked at the water office concerned. 4) Prepare site inspection schedule. 5) Inform relevant village chairpersons about the quick site inspection schedule and ask them to invite stakeholders, such as irrigators' association (IA) chairpersons and some villagers.
Sub-step 2 Visit the scheme site.	Visit the scheme site according to the prepared site inspection schedule.
Sub-step 3 Conduct an interview with villagers.	Collect personnel concerned such as village chief, association chief and farmers. Conduct an interview survey using the survey sheet.
Sub-step 4 Inspect the potential area (or present irrigated) area	Visit potential (or present irrigated) area together with the villagers concerned. Collect further data in the field and confirm the information obtained during the interview. Measure coordinates of the location by handheld GPS (GPS is available in each zonal irrigation office).
Sub-step 5 Inspect the water source of the scheme	Visit the water source of the scheme together with the villagers concerned. Measure water quality by handheld EC meter. Collect further information about flood and drought conditions and try to understand whether the resource is enough for the proposed potential area.
Sub-step 6 Complete the survey sheet and examine the reliability of information at site.	Examination of reliability of information should be made at site, to avoid further inspection as much as possible.

Note: Indicative time required for the quick site inspection is 1-2 hours/scheme (excluding travel time).

Form-2 Survey Sheet for Quick Site Inspection (1/2)

1. General Information	Surveyed Date: _____
(1) Name of the scheme : _____	
(2) Location (any point in the scheme) : Latitude: _____ Longitude: _____	
(3) Administration : Ward _____	
: Village(s) _____	
(4) Number of households : _____ households/ _____	
2. Present Condition of the Potential Area (obtained from interview with villagers and confirmed by site visit)	
2.1 Present Agricultural Conditions in the Potential Area	
(1) Present condition : <input type="checkbox"/> Not Cultivated <input type="checkbox"/> Cultivated (_____ ha in average year)	
(2) Present crops : <input type="checkbox"/> Paddy <input type="checkbox"/> Maize <input type="checkbox"/> Vegetable <input type="checkbox"/> Others (_____)	
(3) Present markets : _____ (_____ km from the site)	
(4) Drainage problem : <input type="checkbox"/> No problem <input type="checkbox"/> Partially affected <input type="checkbox"/> Strongly affected	
(5) Flood : <input type="checkbox"/> Scarce <input type="checkbox"/> Once a year <input type="checkbox"/> More than twice a year	
2.2 Existing Irrigation System	
(1) Current irrigation system : <input type="checkbox"/> Traditional <input type="checkbox"/> Improved traditional	
<input type="checkbox"/> Modern <input type="checkbox"/> Rainwater harvesting <input type="checkbox"/> No irrigation	
(2) Present irrigated area : _____ ha (if the scheme area is already irrigated)	
(3) Main water source : <input type="checkbox"/> Perennial river <input type="checkbox"/> Seasonal river <input type="checkbox"/> Lake/Pond	
<input type="checkbox"/> Groundwater <input type="checkbox"/> Spring <input type="checkbox"/> Rain for water harvesting	
(4) Name of the water source : _____	
2.3 Existing Institution (Association or Group) Related with Agriculture/Irrigation	
(1) Establishment of Institution : <input type="checkbox"/> Established in year _____ <input type="checkbox"/> Not established yet	
(2) Name of the association : _____	
(3) Registered year : _____	
(4) Number of members : _____ members	
2.4 On-going support on irrigation development by government or some organization	
(1) Type of support : <input type="checkbox"/> Irrigation Facilities <input type="checkbox"/> Others (_____) <input type="checkbox"/> None	
3. Village Proposed Plan by O&OD etc. (proposed development plan by village)	
3.1 Irrigation System Development Plan	
(1) Potential area : _____ ha	
(2) Main water source : <input type="checkbox"/> Perennial river <input type="checkbox"/> Seasonal river <input type="checkbox"/> Lake/pond	
<input type="checkbox"/> Groundwater <input type="checkbox"/> Spring <input type="checkbox"/> Rain for water harvesting	
(3) Name of the water source : _____	
(4) Water rights : <input type="checkbox"/> Granted <input type="checkbox"/> Not granted yet <input type="checkbox"/> Intended <input type="checkbox"/> Not aware	
(5) Required works : <input type="checkbox"/> Rehabilitation <input type="checkbox"/> New development	
<input type="checkbox"/> Improvement (from traditional to modern) <input type="checkbox"/> Drainage improvement	
(6) Irrigation type : <input type="checkbox"/> Gravity <input type="checkbox"/> Pump <input type="checkbox"/> Treadle pump <input type="checkbox"/> Rain water harvesting	
(7) Water quality (EC) : <input type="checkbox"/> very high EC \geq 2.25 mS/cm <input type="checkbox"/> not very high EC < 2.25 mS/cm	
: _____ (unsuitable for irrigation)	

Form-2 Survey Sheet for Quick Site Inspection (2/2)

3.2 Agriculture Development Plan

(1) Proposed crops : Paddy Maize Vegetable Others ()

(2) Proposed markets : Name (km from the site)

3.3 Irrigators' Association Establishment Plan

(1) Establishment plan : Established Planned by year Not sure

(2) Mode of contribution to development : In cash In kind None

4. Anticipated Negative Impacts

Water conflict within the scheme/village Water conflict with other scheme/village

Land conflict Effect on protected area Soil erosion in the scheme

Cause of conflict (.....)

5. Observation by the Inspection Team

(1) Farmers motivation for irrigation : High Moderate Low

(2) Present support to the scheme : Enough Additional support is required None

6. Opinions of Village Officers and Beneficiaries

7. History of the Scheme

8. Findings of the District Project Development Team

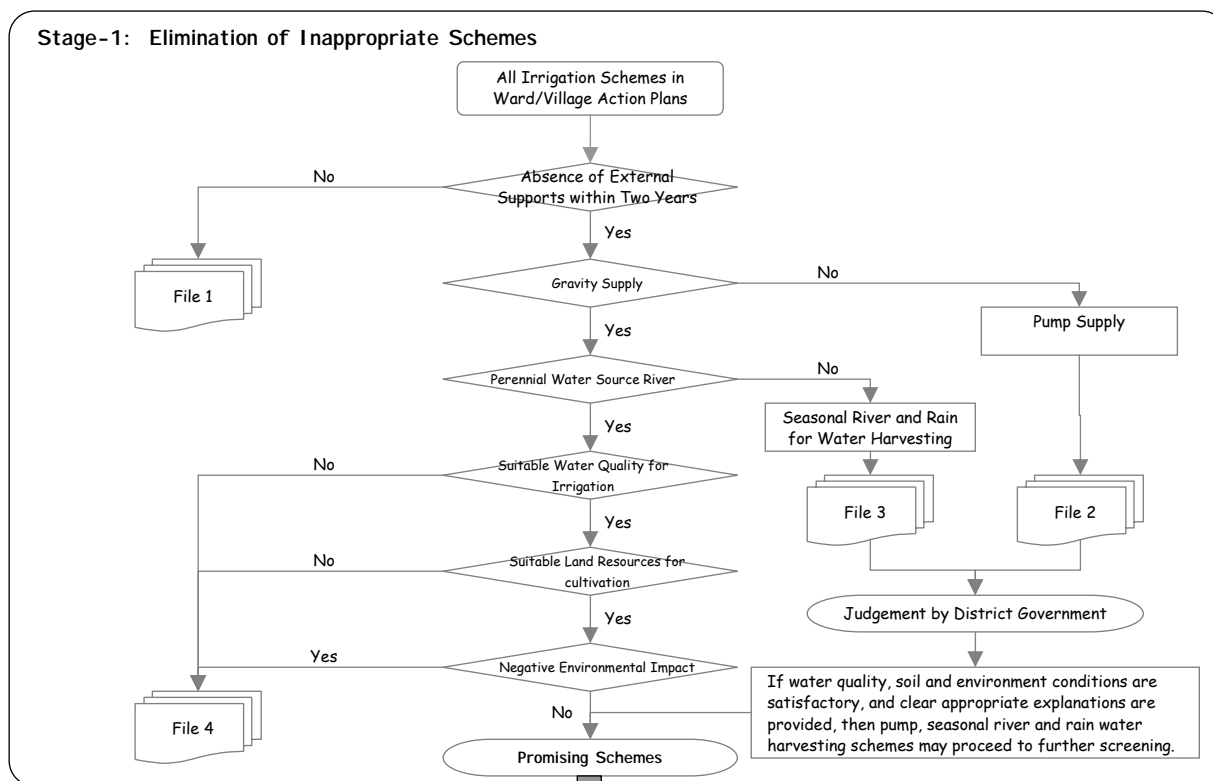
Step-3: Screening of All Irrigation Schemes

Keywords
Screening of irrigation schemes based on rational and transparent criteria under ownership of District government.

<i>Why is the work required?</i>	
All irrigation schemes listed in Village Plans could not proceed to further study in the limited time and budget, so that screening of them is required.	
<i>Key for the success of the work</i>	
Well-designed criteria that are appropriate to local conditions and district priorities as well as National policy are indispensable for successful screening work.	
<i>Required inputs</i>	
1. District Project Development Team (DPDT) 2. Result of the Quick Site Inspection (data filled Form-2)	
<i>How is the work carried out?</i>	
Sub-step 1 Arrange meeting for screening.	The participants at the meeting are the members of DPDT, and DALDO. The staff of Zonal Irrigation Unit and NGO will participate as observers if available.
Sub-step 2 Study sample screening flow, and revise it as required.	See Figure-1. This screening flow is an example, and may be changed based on local conditions and district priorities. DPDT will therefore study the sample screening flow.
Sub-step 3 Screen the irrigation schemes confirmed through site inspection based on the screening flow.	DPDT will carry out the screening in order to determine the schemes to be listed in DADP. This process will be carried out in 3 stages; the 1st stage to reject inappropriate schemes, the 2nd stage to prioritize according to the potential of the scheme, and the 3rd stage to reconsider the particular circumstance of each scheme. Careful attention should be paid to the treatment of irrigation schemes filed (see screening flow on next page) as using pump, seasonal river or rain as the water resource.
Sub-step 4 Prepare the quick site inspection and screening report on screening work including its results.	DPDT will prepare the quick site inspection and screening report by compiling the results of screening work, focusing on the explanation of weighted factors. If irrigation schemes using pump, seasonal river or rain water harvesting schemes are selected, the reasons should be clearly mentioned in the report. The report will also mention any problems in using the criteria including weighted factors if any, and this will be reflected in the next screening work. <u>Standard contents of the quick site inspection and screening report</u> 1. District priority for irrigation development 2. List of irrigation schemes in the District (data filled Form-1) 3. Result of the quick site inspection (data filled Form-2) 4. Established screening and scoring criteria 5. Result of screening with clear explanation
Sub-step 5 Submit the report to the Zonal Irrigation Unit.	DPDT will submit the abovementioned report to the Zonal Irrigation Unit (ZIU) along with the survey sheet of each scheme for assessment and endorsement.

Note: If there is continuous works for phase-wise development scheme, continuation of such works should be the first priority.

Figure-1 Flow of Screening



Stage-2: Prioritization according to the Potential of the Scheme

Sample Criteria for Prioritization	Original Score	Weighting Factor by District	Adjusted Score
(1) Technical Assessment			
(a) Water Resources			
Perennial River	3		
Seasonal River	2		
Rain Water Harvesting	1		
(b) Land Resources			
Suitable for Cultivation	2		
Sign of Salinity	0		
(2) Farmers' Motivation			
(a) Irrigators' Association			
Established and Registered	3		
Established by Not Registered Yet	2		
Not Established Yet	1		
(b) Function of Irrigators' Association			
Functioning (meeting, election, water charge collection, etc.)	2		
Not Functioning	1		
(3) Application of River Basin Approach			
(a) Water Rights			
Granted	2		
Not Granted Yet	1		
(4) Marketing			
Linked with Market/Traders	2		
Not Linked with Market/Traders	1		

- Note:
- a) These criteria are an example only. Each District Government may modify these criteria as required.
 - b) The criteria are used only for screening many irrigation schemes listed in Ward Action Plans or Village Action Plans, to select candidates to proceed to further scheme formulation for DADP.
 - c) The weighting factors (multiplication factors) should be determined by each District Government in line with its development priority.
 - d) The criteria can be prepared separately for rehabilitation/improvement schemes and new development schemes.

Priority Schemes

Stage-3: Consideration of Particular Circumstances of Priority Schemes

Sample of Particular Circumstances to be considered

- (1) **Budgetary Limitation** If the cost is expected to exceed the conceivable budget, some arrangement might be needed.
- (2) **Existing Support** If the scheme is already supported by certain fund, special consideration might be needed.
- (3) **Environmental Problem** If the scheme is anticipated to be affected by environmental problems, special attention should be paid.

- Note:
- a) Higher scoring schemes do not necessarily have to be selected as candidates for a DADP if there is a clear reason not to select them.
 - b) The particular circumstances of each scheme should be carefully compared and examined among priority schemes.

Schemes for Preliminary Planning

Step-4: Assessment and Endorsement by Zonal Irrigation Unit

Keywords

Execution of assessment and endorsement with objectivity and transparency.

Why is the work required?

Screening work calls for objectivity and transparency. In this sense, assessment and endorsement by a third party is absolutely necessary.

Key for the success of the work

The Zonal Irrigation Unit (ZIU) should assess and endorse the results of screening from an overall viewpoint. The ZIU should thus organize a specific review team to keep a consistent approach to assessment and endorsement works within any district.

Required inputs

1. Zonal Review Committee (ZRC)
2. Report on screening criteria and results

How is the work carried out?

Sub-step 1	Organize the review committee.	The review committee should consist of staff specializing in various fields such as irrigation, agriculture, soil, and environment and be chaired by the Zonal Irrigation Engineer.
Sub-step 2	Review the report on results of screening.	The review should focus on the following items: - Rationalization of the screening criteria if revised, especially the weighting of factors by district - Explanation of any irrigation schemes using pumps, seasonal river or rain water harvesting - Applied information for each irrigation scheme - Procedure of screening including score calculation
Sub-step 3	Clarify unclear parts in the submitted report.	The review committee should clarify all the unclear points by inquiring or sending letters to the DPDT and if necessary visit the site together with the members of DPDT for clarification.
Sub-step 4	Prepare the review papers on screening.	The review committee should prepare review papers containing the results of the assessment of screening and the outcomes from the process of clarification mentioned in Sub-step-3.
Sub-step 5	Issue an official letter on assessment and endorsement.	The Zonal Irrigation Engineer, on behalf of the review committee, will submit an official letter on assessment and endorsement to the DPDT and a copy to the District Executive Director (DED). The official letter should accompany the review papers.
Sub-step 6	Submit the compiled documents to DITS and ask for useful information for the field survey.	All the documents including the survey sheet of each scheme, screening report, review paper and official letter should finally be compiled and submitted to the "Data and Information Management Unit (DIMU)" of DITS for data input to the database system. At the same time, the DIMU should be asked to provide the following maps to the district office to be used in the field survey. 1) Agro-ecological zone and the distribution of surveyed schemes 2) Land cover and the distribution of surveyed schemes 3) Land unit and the distribution of surveyed schemes 4) Protected area and the distribution of surveyed schemes 5) Rainfall distribution and the distribution of surveyed schemes 6) Soil type and the distribution of surveyed schemes 7) 1:50,000 scale topographical maps around the selected schemes

Step-5: Field Survey for Selected Irrigation Schemes

(a) Preparatory Works in the Office prior to the Field Survey

<u>Keywords</u>	
Clarify the role of each member of DPDT for the execution of the field survey and familiarize with the natural condition of the site through available data before starting the field survey.	
<u>Why is the work required?</u>	
Good preparation enables the DPDT to undertake field survey smoothly.	
<u>Key for the success of the work</u>	
Understand the flow of the field survey and clarify the role of each member through the scrutiny of the guidelines. Analyze the materials supplied from the data and information management unit and familiarize with the natural condition of the site before visiting.	
<u>Required inputs</u>	
1. District Project Development Team (DPDT)	
<u>How is the work carried out?</u>	
Sub-step 1 Hold a meeting by the DPDT members.	The guidelines should be examined carefully by the DPDT members and then the role of each member should be clarified in order to execute the field survey efficiently. The team leader and personnel responsible for interview survey, mapping, and field study should at least be decided. Prepare the detailed field survey schedule.
Sub-step 2 Inform survey schedule to village(s).	Inform relevant village(s) about the field survey schedule and ask them to invite stakeholders, such as village leaders, ward counselor, irrigators' association (IA) chairpersons, village extension officer and some villagers. If a negative impact, such as water conflict, is anticipated, then representatives of the parties that may be affected should also be invited.
Sub-step 3 Become familiar with the natural conditions of the site through the materials supplied by the DIMU of DITS.	The team familiarizes itself with the natural conditions of the site in respect of: 1) Agro-ecological zone (recommended farming system) 2) Land cover (present land use) 3) Land units (topographical constraints) 4) Protected area (distribution of protected areas) 5) Rainfall distribution (annual rainfall range) 6) Soil types (general soil characteristics) 7) 1:50,000 scale topographical maps (topographic feature)
Sub-step 4 Prepare photocopies of the survey sheets and large sheets of paper and markers for mapping.	It is recommended to prepare photocopies of the survey sheets for efficient recording of the survey results (Form-3 and Form-4). For Form-4 (5/7) and Form-4 (6/7), one form should be used for one river or lake/pond, so several photocopies may be required. Large (A1 size) paper sheets and markers should also be prepared for the village resource mapping.

Filling Survey Sheets on Site

Prepare photocopies of the survey sheets and fill the information on site so that you do not miss any important data!



(b) Interview Survey with Stakeholders

<u>Keywords</u> Collection of data and information on the present condition of the scheme including agriculture, farmer associations, environment and existing irrigation system. .	
<u>Why is the work required?</u> To be appropriate, an irrigation scheme plan should be formulated based on the present local conditions. The present conditions relating to agriculture, institutions, environment and existing irrigation and drainage system should therefore be assessed properly.	
<u>Key for the success of the work</u> Interview survey will be carried out with stakeholders by using a suitable checklist for effective information collection. This process will be reinforced with readily available information such as irrigation GIS data obtained from the data and information management unit. Furthermore, the results of the interview survey will be crosschecked through subsequent site inspection.	
<u>Required inputs</u> 1. District Project Development Team (DPDT) 2. Various information on agriculture and environment obtained through the irrigation GIS 3. Previous related reports on irrigation and drainage 4. Survey sheets for interview survey (Form-3)	
<u>How is the work carried out?</u>	
Sub-step 1 Explain the purpose of the field survey to the participants	At the beginning of the session, the purpose of the field survey should be explained clearly to the participants along with the general flow of the activities. Background information such as the reason why this scheme was selected should be explained. Special attention should be paid to ensure that villagers do not develop excessive expectations for the future of the project.
Sub-step 2 Prepare the group for interview survey and mapping	The participants will be divided into two groups for interview survey and mapping. Ask the village chairperson to choose several suitable personnel who know the area very well as the mapping group members. (Excessive time will be consumed if the mapping is conducted with too many people.) The interview survey group will consist of farmers of different gender and generation and the group should include at least the village chairperson and the chairperson of the association. The village extension officer should attend and supervise both groups. For mapping group: Go to page 3-14
Sub-step 3 Conduct the interview survey using a suitable checklist	The interview survey will be conducted using Form-3 for the following aspects: (a) Present condition of Agriculture and Marketing, (b) Present condition of Irrigators' Association, and (c) Present condition of Environment.
Sub-step 4 Compile and analyze the survey results	DPDT will compile and analyze the results of the interview survey in the next step.

Note: Indicative time required for the interview survey is 1.5 hours/scheme.

Form-3 Survey Sheet for Interview Survey with Stakeholders (1/3)

Sub-step 3(a) Present Conditions of Agriculture and Marketing							
Applicability The sub-step should be applied to all schemes.							
1) Land Use in the Potential Area	Scheme Name		Surveyed Date				
<p>If the potential area is not clearly defined, agree with villagers on the potential area as village area, basin area or other area. If the cultivated area is not clear, estimate from the total household number and the average holding size. The village extension officer should confirm the villagers' answers in order to avoid odd data.</p> <p>(1) Potential Area (ha): _____</p> <p>(2) Cultivated Area within the Potential Area (ha): _____</p> <p>(3) Present Irrigated Area in the cultivated Area (ha): _____</p> <p>(4) Present Rainfed Area in the Cultivated Area (ha): _____</p> <p>(5) Average Holding Size/Family in the Potential Area (ha): _____</p> <p>(6) Total Household Number in the Potential Area: _____</p>							
2) Crop Production in the Potential Area							
<p>Let the farmers select two major rainy and dry season crops grown in the potential area. As for the yield and the price (farm gate price), ask farmers the maxima and minima in order to obtain average figures. Avoid any data for extraordinary years. The village extension officer should confirm the villagers' answers in order to avoid odd data.</p> <p>* Unit for Yield: bags/acre and weight/bag for cereals (paddy/maize), kg/acre for vegetables ** Unit for Price: Tsh/bag and weight/bag for cereals (paddy/maize), Tsh/kg for vegetables</p> <table style="width:100%; border:none;"> <tr> <td></td> <td style="text-align:center">Rainy Season</td> <td></td> <td style="text-align:center">Dry Season</td> </tr> </table> <p>(1) Name of Crops: _____</p> <p>(2) Cropped Area (ha): _____</p> <p>(3) Rainfed or Irrigated: _____</p> <p>(4) Month of Land Preparation: _____</p> <p>(5) Month of Harvest: _____</p> <p>(6) Maximum Yield*: _____</p> <p> Minimum Yield*: _____</p> <p> Weight/bag (kg): _____</p> <p>(7) Maximum Price**: _____</p> <p> Minimum Price**: _____</p> <p> Weight/bag (kg): _____</p>					Rainy Season		Dry Season
	Rainy Season		Dry Season				
3) Major Constraints to Crop Production							
<p>Let the farmers select three major constraints to crop production in the potential area. Do not spend a long time for discussion; just try to understand the level of irrigation needed for the scheme.</p> <p>(1) _____ (2) _____ (3) _____</p>							
4) Farmers Supporting System							
<p>Ask the following questions on technical assistance and extension services.</p> <p>(1) Technical Assistance <input type="checkbox"/> Available (extension) <input type="checkbox"/> Available (other party) <input type="checkbox"/> Not available on Irrigation</p> <p>(2) Extension Services: <input type="checkbox"/> Satisfied <input type="checkbox"/> Not satisfied (Reasons) _____</p>							
5) Input Supply for the Potential Area							
<p>(1) Improved Seeds: <input type="checkbox"/> In use: Amount _____ <input type="checkbox"/> Not in Use: Reason _____</p> <p>(2) Chemical Fertilizers: <input type="checkbox"/> In use: Amount _____ <input type="checkbox"/> Not in Use: Reason _____</p> <p>(3) Agro-chemicals: <input type="checkbox"/> In use: Amount _____ <input type="checkbox"/> Not in Use: Reason _____</p> <p>(4) Agricultural Machinery: <input type="checkbox"/> In use: Amount _____ <input type="checkbox"/> Not in Use: Reason _____</p>							
6) Marketing System in the Potential Area							
<p>(1) Market for Paddy: <input type="checkbox"/> Middleman <input type="checkbox"/> Local Market <input type="checkbox"/> Town Market</p> <p>(2) Market for Vegetables: <input type="checkbox"/> Middleman <input type="checkbox"/> Local Market <input type="checkbox"/> Town Market</p>							
7) Possibility of Group Purchasing and Selling							
<p>Since group purchasing and selling of inputs and products seems important for future development, ask the possibility in the future.</p> <p><input type="checkbox"/> High possibility through _____ <input type="checkbox"/> Low possibility <input type="checkbox"/> No possibility</p>							

Form-3 Survey Sheet for Interview Survey with Stakeholders (2/3)

Sub-step 3(b) Present Conditions of Institutions			
Applicability This sub-step should be applied to proposed schemes where circled groups already exist.			
1) Existence of organization <input type="checkbox"/> Irrigators' Association (IA) <input type="checkbox"/> Farmers' Group (FG) etc. <input type="checkbox"/> No organization			
1) General Information	Scheme Name	Surveyed Date	
(1) Name of IA/FG:	_____		
(2) Established Year of IA/FG:	_____		
(3) Registration of IA/FG:	<input type="checkbox"/> Cooperative Act <input type="checkbox"/> Association Act <input type="checkbox"/> None		
(4) Number of Present Members:	_____ People (Male _____ people, Female _____ people)		
(5) Area covered by IA/FG:	_____ ha		
2) Activities			
(1) Frequency of Meetings:	Weekly	Monthly	Half yearly
General Meeting:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Committees:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Each canal group:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(2) Documentation of Meeting Results:	<input type="checkbox"/> Done <input type="checkbox"/> Not done		
(3) Major Issues Discussed and Decisions Made:	_____		
(4) Have by-laws and regulations been adopted:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Intended		
(5) Does IA/FG have a bank account?	<input type="checkbox"/> Yes <input type="checkbox"/> Cash in hands <input type="checkbox"/> Others <input type="checkbox"/> NA		
(6) Is book-keeping prepared?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> No Answer		
3) Farmers' Contribution to the Construction/Repair Works			
(1) Construction Works:	<input type="checkbox"/> In Kind	<input type="checkbox"/> In cash	<input type="checkbox"/> None
(2) Repair Works:	<input type="checkbox"/> In kind	<input type="checkbox"/> In cash	<input type="checkbox"/> None

Form-3 Survey Sheet for Interview Survey with Stakeholders (3/3)

Sub-step 3(c) Present Conditions of Environment			
Applicability The sub-step should be applied to all schemes.			
1) Physical Conditions	Scheme Name	Surveyed Date	
(1) Siltation:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
(2) Soil erosion:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
(3) Salinity problem:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
2) Change in Ecosystems			
(1) Vegetation degradation:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
(2) Destructive animals:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
(3) Aquatic plants:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
3) Agricultural Activity			
(1) Water use conflict:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
(2) Land use conflict:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
(3) Loss of soil fertility:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
4) Sanitation and Public Health			
(1) Soil and water pollution:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
(2) Water borne diseases:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
5) Socio-economic Conditions			
(1) Population increase (immigrant)	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
(2) Increase in water demand:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known
(3) Vandalism of structures:	<input type="checkbox"/> Significant	<input type="checkbox"/> Not significant	<input type="checkbox"/> Not known

Note: Next step of page 3-15 (d) should be continued.

(c) Preparation of Village Resource Map

Keywords

Village resource map should be prepared with the area and items necessary for irrigation system planning.

Why is the work required?

A resource map drawn by villagers will provide important information for preparation of present situation map fundamental to irrigation system planning.

Key for the success of the work

The map should include areas and items necessary for irrigation system planning. It is important to assist villagers in drawing all the items and identifying all items necessary for their life.

Required inputs

1. District Project Development Team (DPDT)
2. A large paper sheet, marker pens (3-4 colors)

How is the work carried out?

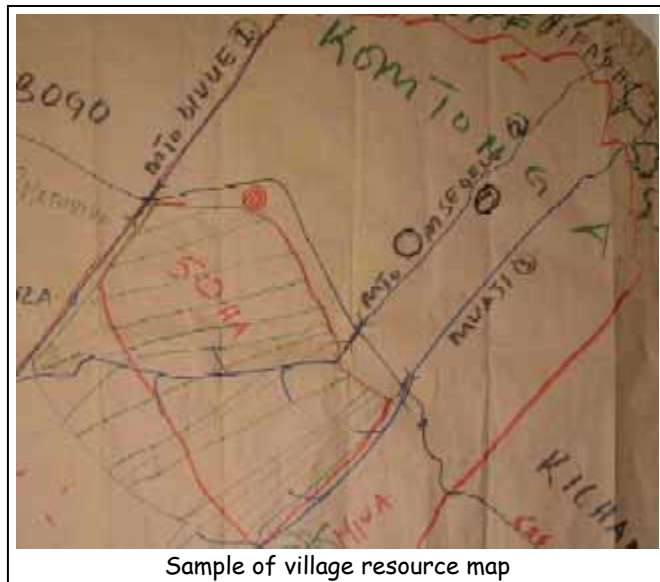
<p>Sub-step 1 Explain the work to draw a resource map to the villagers</p>	<p>After grouping the villagers, the DPDT will explain what village resource mapping is. It should be emphasized that the map doesn't need to be an accurate one but should show the general location of the major items.</p>
<p>Sub-step 2 Assist the villagers to draw a map with items necessary for scheme planning</p>	<p>Assist the villagers to draw the maps in the following manner.</p> <ol style="list-style-type: none"> 1) Draw river(s), lake/pond(s) and road(s). 2) Draw the potential area. The potential area should be divided into: a) present irrigated area, b) present rainfed area, and c) non-cultivated area 3) Indicate areas with flood or drainage problems and water shortage problems in the potential area. 4) Draw existing irrigation facilities, such as weirs, intakes and canals if any. 5) Show following information on the map. <ul style="list-style-type: none"> - Village and its rough boundary - Forest and bush - Wells - Market for agricultural products - School, cemetery(public/private), church, mosque etc. important places for villagers 6) Add legend (explanation of the symbol marks) and scheme name on the map.

Note:

Indicative time required for the village resource map preparation is 1.0-1.5 hours/scheme.



Sample of legend



Sample of village resource map

(d) Making Agreement on Proposed Area

Keywords
Proposed area for further planning should be determined and agreed by stakeholders.

Why is the work required?

To avoid conflict between villagers living inside and outside of the proposed area, it is essential that the proposed area be determined by villagers themselves.

Key for the success of the work

- 1) It should be emphasized that the proposed area is delineated not for development but for study.
- 2) Budget limitation of the district government should be clearly announced to the stakeholders.
- 3) Technical limitations in areas such as water resources, land, etc. should be clearly explained to the stakeholders.

Required inputs

1. District Project Development Team (DPDT)
2. Village resource map

How is the work carried out?

Sub-step 1 Reconfirm that relevant stakeholders attend the meeting.	Reconfirm that all relevant stakeholders (representatives of related villages, such as village leaders) attend the meeting. If not, the meeting should be postponed.								
Sub-step 2 Receive explanation of village resource map by the mapping group.	The mapping group leader should present the village resource map to the interview group members and finalize it according to the suggestions from the participants. Especially for the potential area, let the stakeholders confirm the boundary.								
Sub-step 3 Grasp possible size of the proposed area.	DPDT should grasp the possible size of the potential area considering allowable budget for irrigation development in the governing DADP. The following table shows the indicative cost of scheme development by size of area. If the size of the potential area seems more or less suitable for a DADP, proceed to Sub-step 6. If not (the potential area is too large), proceed to Sub-step 4. Indicative Cost of Scheme development <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Size of area (ha)</th> <th>Indicative Development Cost (Tsh.)</th> </tr> </thead> <tbody> <tr> <td>50</td> <td>150,000,000 - 300,000,000</td> </tr> <tr> <td>100</td> <td>250,000,000 - 500,000,000</td> </tr> <tr> <td>150</td> <td>350,000,000 - 700,000,000</td> </tr> </tbody> </table>	Size of area (ha)	Indicative Development Cost (Tsh.)	50	150,000,000 - 300,000,000	100	250,000,000 - 500,000,000	150	350,000,000 - 700,000,000
Size of area (ha)	Indicative Development Cost (Tsh.)								
50	150,000,000 - 300,000,000								
100	250,000,000 - 500,000,000								
150	350,000,000 - 700,000,000								
Sub-step 4 Explain budgetary limitation and technical limitation.	Explain to the stakeholders that the objective of this survey is to promote irrigation development under the DADP, and the available budget is limited. Make them understood that it is difficult to develop the whole potential area at once because of budgetary limitation. Technical limitation should also be explained to stakeholders. Make them understood that it is impossible to irrigate their field if there are not enough water resources.								
Sub-step 5 Let farmers choose the first priority proposed area in the village resource map.	After explanation, let the stakeholders choose the first priority proposed area, which is the area for the survey this time. If they cannot conclude their own idea, it means that the scheme might not be ready for development.								
Sub-step 6 Prepare confirmation letter on the proposed area	Ask stakeholders to prepare a "confirmation letter on the proposed area" showing that they have agreed on the boundary of the proposed area indicated in the village resource map. A list of attendants with necessary notes should be attached to prove the conclusion of the meeting.								

Note: Express gratitude to the participants and release them except the personnel to go together to the field.

(e) Confirmation of the Field Condition

Keywords

Water and land potential of the proposed area should be confirmed by simple method.

Why is the work required?

Water and land resources are one of the most important factors for successful irrigation scheme development, so their conditions need to be confirmed at the site. For rehabilitation or improvement schemes, the condition of the existing irrigation and drainage facilities are also very important factors, so they also should be checked at the site.

Key for the success of the work

Visit the site with the guidance of the village chairperson and several villagers to interview about the situation of the proposed area.

Required inputs

1. District Project Development Team (DPDT)
2. Survey sheets for field condition confirmation (Form-4)

How is the work carried out?

Sub-step 1	Confirm soil texture of the proposed area.	Visit the proposed area together with village chairperson and check and record the soil texture using Form-4 (1/7).
Sub-step 2	Confirm field drainage condition.	Ask farmers in the proposed area about drainage condition in a normal year using Form-4 (2/7).
Sub-step 3	Confirm bridge and river crossing condition.	Visit bridge and river crossing site and confirm the condition using Form-4 (3/7).
Sub-step 4	Confirm intake point condition.	Determine and visit intake point and confirm the condition using Form-4 (4/7).
Sub-step 5	Confirm water source river condition of the scheme.	(This sub-step is applicable if the water source of the scheme is a river or there is an inflow to a lake/pond water source.) Visit the water source river together with village chairperson and check the water using Form-4 (5/7).
Sub-step 6	Confirm water source lake/pond condition of the scheme.	(This sub-step is applicable if water source of the scheme is lake/pond and water abstraction method is pump. If water abstraction method is treadle pump, the sub-step should be skipped.) Visit the water source lake/pond together with village chairperson and check the water resource by using Form-4 (6/7).
Sub-step 7	Confirm condition of existing irrigation facilities.	(This sub-step is applicable if there are irrigation and drainage facilities.) Observe and evaluate the condition of facilities together with irrigators' association chairperson and members using Form-4 (7/7).

Note: Indicative time required for the field condition confirmation is 2-3 hours/scheme.



Form-4 Survey Sheet for Field Condition Confirmation (1/7)

Sub-step 1 Confirm Soil Texture of the Proposed area

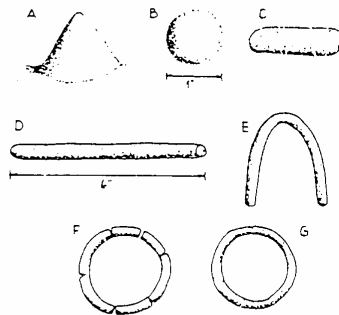
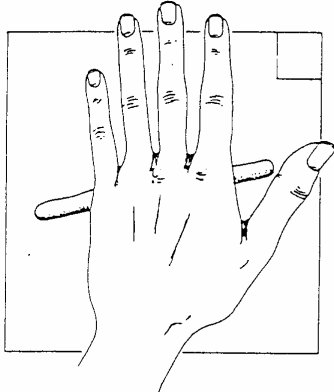
Applicability The sub-step can be skipped for non-circled type of scheme

1) Type of irrigation
 Gravity Pump (River) Pump (Lake/pond) Rain water harvesting

2) Type of irrigation development
 Rehabilitation Improvement New Development Extension Drainage

Instruction	Scheme Name	Surveyed Date
--------------------	--------------------	----------------------

- 1) Visit the survey together with village chief and villagers.
Visit the proposed area and choose typical soil in the area with the consultation of the village chairperson and villagers.
- 2) Sampling of the soil
Gather a soil sample from the soil surface (sample should be about 10 x 10 x 10 cm).
- 3) Knead the soil with water.
Add some water to the soil sample so it is moist but not wet. Knead it well. Pebbles should be removed.
- 4) Try to create ring shapes with the soil sample and choose the most advanced shape that can be made.



A: Soil can only be shaped into a cone. No other shapes hold together.
 B: Soil can be formed into a circle, but not a rod shape.
 C: Soil can be formed into a stout rod shape.
 D: A thin rod (about 6 mm diameter) can be formed but not bent.
 E: Thin rod can be bent without breaking
 F: Circle can be formed with some breaks.
 G: Complete circle with no breaks can be formed.

- 5) Evaluate the soil texture
According to the result of 4), circle one of the detailed soil texture types and choose a general soil texture type by conversion of the detailed soil texture type.

Detailed soil texture type	conversion		General soil texture type
Shape A Sand	} if you choose Shape A →	Sand	<input type="checkbox"/>
Shape B Loamy sand		Sandy Loam	<input type="checkbox"/>
Shape C Silty Loam	} if you choose Shape B or C →		
Shape D Loam		Clay Loam	<input type="checkbox"/>
Shape E Clay Loam	} if you choose Shape D or E →		
Shape F Light Clay		Clay	<input type="checkbox"/>
Shape G Heavy Clay			

6) Notable Soil Characteristics
If there are any notable soil characteristics such as high rock outcrop, shallow soil depth and symptom of salt accumulation, please note.
Note:

Form-4 Survey Sheet for Field Condition Confirmation (2/7)

Sub-step 2 Confirm Field Drainage Condition			
Applicability The sub-step can be skipped for non-circled type of scheme			
1) Type of irrigation			
<input type="checkbox"/> Gravity	<input type="checkbox"/> Pump (River)	<input type="checkbox"/> Pump (Lake/pond)	<input type="checkbox"/> Rain water harvesting
2) Type of irrigation development			
<input type="checkbox"/> Rehabilitation	<input type="checkbox"/> Improvement	<input type="checkbox"/> New Development	<input type="checkbox"/> Extension <input type="checkbox"/> Drainage
Instruction	Scheme Name	Surveyed Date	
1) Interview with farmers			
Inundation of proposed area in normal year <input type="text"/> cm depth for <input type="text"/> days			
Highest flood water depth in the past <input type="text"/> cm depth in (10-50 years)			

Form-4 Survey Sheet for Field Condition Confirmation (3/7)

Sub-step 3 Confirm Bridge and River Crossing Condition			
Applicability The sub-step can be skipped for non-circled type of scheme			
1) Type of irrigation			
<input type="checkbox"/> Gravity	<input type="checkbox"/> Pump (River)	<input type="checkbox"/> Pump (Lake/pond)	<input type="checkbox"/> Rain water harvesting
2) Type of irrigation development			
<input type="checkbox"/> Rehabilitation	<input type="checkbox"/> Improvement	<input type="checkbox"/> New Development	<input type="checkbox"/> Extension <input type="checkbox"/> Drainage
Instruction	Scheme Name	Surveyed Date	
1) Observe bridge or river crossing point			
River crossing point(s)	Number <input type="text"/> nos.	Total length <input type="text"/> m	Survey river crossing point(s) where provision of bridge is required.
Existing bridge(s)	Number <input type="text"/> nos.	Total length <input type="text"/> m	
	<input type="checkbox"/> 100 % replacement	<input type="checkbox"/> 50 % replacement	<input type="checkbox"/> 30 % replacement
	<input type="checkbox"/> minor rehabilitation	<input type="checkbox"/> functioning well	<input type="checkbox"/> Facility not exist

Form-4 Survey Sheet for Field Condition Confirmation (4/7)

Sub-step 4 Confirm Intake Point Condition			
Applicability The sub-step can be skipped for non-circled type of scheme			
1) Type of irrigation			
<input type="checkbox"/> Gravity	<input type="checkbox"/> Pump (River)	<input type="checkbox"/> Pump (Lake/pond)	<input type="checkbox"/> Rain water harvesting
2) Type of irrigation development			
<input type="checkbox"/> Rehabilitation	<input type="checkbox"/> Improvement	<input type="checkbox"/> New Development	<input type="checkbox"/> Extension <input type="checkbox"/> Drainage
Instruction	Scheme Name	Surveyed Date	
1) Determine intake point			
Determine intake point (location of the weir). The intake point should be narrow, strait, moderate (not too gentle) steep (to avoid siltation), stable flow, intake side water-route (see figure in the right), geologically strong and have easy access. Elevation of the intake point should not be very different from the elevation at			

the upstream-end of the command area of the main canal (see Figure-2). If you cannot find a suitable intake point, search upstream on the same river or change the water source to another river (if there is one). If you still cannot find a suitable place, because of flat river bed, go to 2) and choose "Seems No Good".

2) Evaluate reliability of the intake water level

Evaluate the reliability of the determined intake water level by referring to Figure-2. If you are not sure about the relationship between intake water level and the elevation of the proposed area, choose "Not sure".

Seems Good Not sure Seems No Good

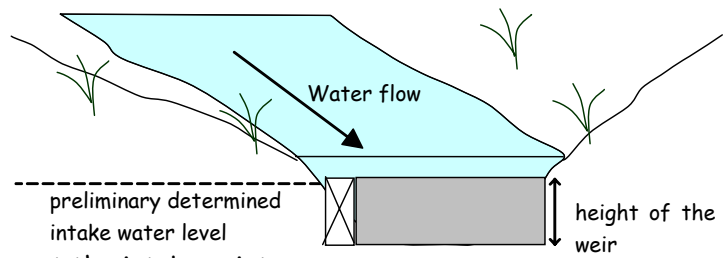
If it seems No Good, give up to irrigate the upstream part of the development area and find some lower land with elevation almost the same as the highest possible intake water level of the point.

3) Estimate intake water level

Estimate the intake water level (water level at the beginning point of the main canal). The intake water level should be almost the same or at a higher elevation than the upstream-end of the command area of the main canal and also be able to divert water to the main canal stably (it should not be very shallow). The water level should also be able to give some water depth for the main canal flow.

4) Estimate weir height

The elevation of the weir crest should be preliminarily determined as the same level as the intake water level. Estimate the weir height considering the intake water level and cross section of the river at the intake point.



Estimated weir height (h) m

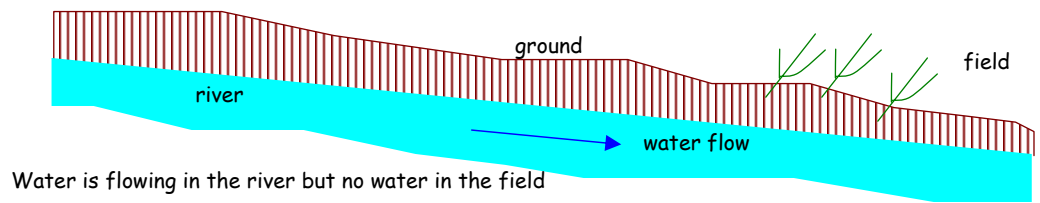
5) Measure river width and depth at the intake point

Width of river at the intake point m

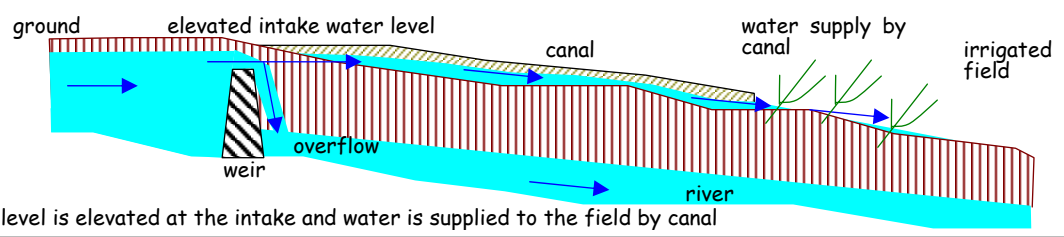
Depth of river at the intake point m (depth of the river but not water)

Figure-2 Required Intake Water Level

Before irrigation (profile along the water source river)

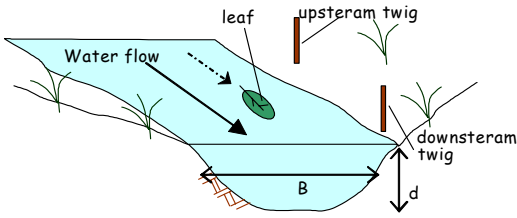


After irrigation (profile of the water source river and canal)



Form-4 Survey Sheet for Field Condition Confirmation (5/7)

Sub-step 5 Confirm Water Source River Condition			
Applicability The sub-step can be skipped for non-circled type of scheme			
1) Type of irrigation <input type="radio"/> Gravity <input type="radio"/> Pump (River) <input type="checkbox"/> Pump (Lake/pond) <input type="radio"/> Rain water harvesting			
2) Type of irrigation development <input type="radio"/> Rehabilitation <input type="radio"/> Improvement <input type="radio"/> New Development <input type="radio"/> Extension <input type="checkbox"/> Drainage			
Instruction	Scheme Name	Surveyed Date	
<p>1) Determine measurement point together with village chief and villagers Find a suitable point for measurement together with the villagers. The measurement point should be a) narrow, b) strait, c) steep, and d) upstream of any existing intake, or e) near the proposed intake site. In case of pump (lake/pond), major inflow to the lake/pond should be the measured, if there is any. If there is no major inflow, proceed to sub-step 3.</p> <p>2) Estimate flow area on the day of survey Measure average river width and water depth on the day of survey. B = <input style="width: 50px;" type="text"/> m (average river width) Dt = <input style="width: 50px;" type="text"/> m (water depth today) At = <input style="width: 50px;" type="text"/> m² (flow area of today) (At = B x Dt)</p> <p>3) Measure water flow velocity of the day a) Drive two twigs into the ground beside the river at a measured distance between the two twigs. b) Float a leaf on the water from the upstream twig to the downstream twig and measure the travel time. c) Calculate the flow velocity. Ls = <input style="width: 50px;" type="text"/> m (length between twigs) Tt = <input style="width: 50px;" type="text"/> sec (consumed time) Vt = <input style="width: 50px;" type="text"/> m/sec (V t = Ls/ Tt)</p> <p>4) Calculate river discharge on the day of survey Qt = <input style="width: 50px;" type="text"/> m³/sec (discharge on the day of survey) (Qt = At x Vt)</p> <p>5) Estimate water depth at critical/average month in dry and rainy season <u>For gravity, pump (river) and rain water harvesting scheme</u>, ask villagers when are the <u>critical months</u> (month in which most drought occurs) for rainy and dry season. Obtain water depth in those months by interviewing the villagers. <u>For pump irrigation</u>, obtain water depth in <u>average discharge months</u> in each season.</p> Dry season Critical/average month <input style="width: 50px;" type="text"/> <input style="width: 50px;" type="text"/> m (Dd; water depth) Rainy season Critical/average month <input style="width: 50px;" type="text"/> <input style="width: 50px;" type="text"/> m (Dr; water depth)			
<p>6) Water flow month Dry season from <input style="width: 50px;" type="text"/> to <input style="width: 50px;" type="text"/> Rainy season from <input style="width: 50px;" type="text"/> to <input style="width: 50px;" type="text"/></p>			
<p>7) Estimate discharge at critical/average month in dry and rainy season Qd = <input style="width: 50px;" type="text"/> m³/sec (Qd = Qt / Dt x Dd) Qr = <input style="width: 50px;" type="text"/> m³/sec (Qr = Qt / Dt x Dr)</p>			
<p>8) Nominate river discharge record keeper One villager who lives near the water source river should be nominated as the river discharge record keeper by the village chairperson. The keeper should measure the water level and velocity of the measurement point once every month. Nominated name of the record keeper <input style="width: 100px;" type="text"/></p>			



Form-4 Survey Sheet for Field Condition Confirmation (6/7)

Sub-step 6 Confirm Water Source Lake/Pond Condition			
Applicability The sub-step can be skipped for non-circled type of scheme			
1) Type of irrigation			
<input type="checkbox"/> Gravity <input type="checkbox"/> Pump (River) <input type="radio"/> Pump (Lake/pond) <input type="radio"/> Rain water harvesting			
2) Type of irrigation development			
<input type="radio"/> Rehabilitation <input type="radio"/> Improvement <input type="radio"/> New Development <input type="radio"/> Extension <input type="checkbox"/> Drainage			
Instruction	Scheme Name	Surveyed Date	
1) Preparatory arrangement Visit the site and drive twigs at regular intervals along the longer side of the shore.			
2) Measure surface width and depth Stretch a tape across the shore at the place pointed by the twigs. Then, a) measure the surface width (width of l_1 to l_5 in figure in the right), while b) measure the water depth along the tape at regular intervals (depth of d_1 to d_{13} in figure in the right).			
3) Calculate capacity of the pond/lake A= <input type="text"/> m ² (average surface area) D= <input type="text"/> m (average depth) V= <input type="text"/> m ³ (capacity of the pond/lake) (V = A x D)			

Form-4 Survey Sheet for Field Condition Confirmation (7/7)

Sub-step 7 Confirm Existing Irrigation and Drainage Facilities Condition			
Applicability The sub-step can be skipped for non-circled type of scheme			
1) Type of irrigation			
<input type="radio"/> Gravity <input type="radio"/> Pump (River) <input type="radio"/> Pump (Lake/pond) <input type="radio"/> Rain water harvesting			
2) Type of irrigation development			
<input type="radio"/> Rehabilitation <input type="radio"/> Improvement <input type="checkbox"/> New Development <input type="checkbox"/> Extension <input type="checkbox"/> Drainage			
Instruction	Scheme Name	Surveyed Date	
1) Observe and evaluate the structures Observe major facilities together with village chairperson or IA chairperson. Evaluate condition of the facilities by extent of required replacement and circle one of them.			
Weir and Intake Width _____ m Height _____ m <input type="checkbox"/> 100 % replacement <input type="checkbox"/> 50 % replacement <input type="checkbox"/> 30 % replacement <input type="checkbox"/> No replacement			
Pump(s) Number _____ nos. <input type="checkbox"/> 100 % replacement <input type="checkbox"/> 50 % replacement <input type="checkbox"/> 30 % replacement <input type="checkbox"/> No replacement			
Main Canal System Length _____ m (evaluation include related structures) <input type="checkbox"/> 100 % replacement <input type="checkbox"/> 50 % replacement <input type="checkbox"/> 30 % replacement <input type="checkbox"/> No replacement			
Secondary Canal System (evaluation include related structures) <input type="checkbox"/> 100 % replacement <input type="checkbox"/> 50 % replacement <input type="checkbox"/> 30 % replacement <input type="checkbox"/> No replacement			
Drainage System (evaluation include related structures) <input type="checkbox"/> 100 % replacement <input type="checkbox"/> 50 % replacement <input type="checkbox"/> 30 % replacement <input type="checkbox"/> No replacement			
Flood Dike Length _____ m <input type="checkbox"/> 100 % replacement <input type="checkbox"/> 50 % replacement <input type="checkbox"/> 30 % replacement <input type="checkbox"/> No replacement			

(f) Preparation of Present Situation Map

Utilize handheld GPS and record coordinates of the features recorded in the village resource map to prepare the scaled map of the scheme.

Why is the work required?

Preparation of a scaled topographical map is essential for scheme development planning.

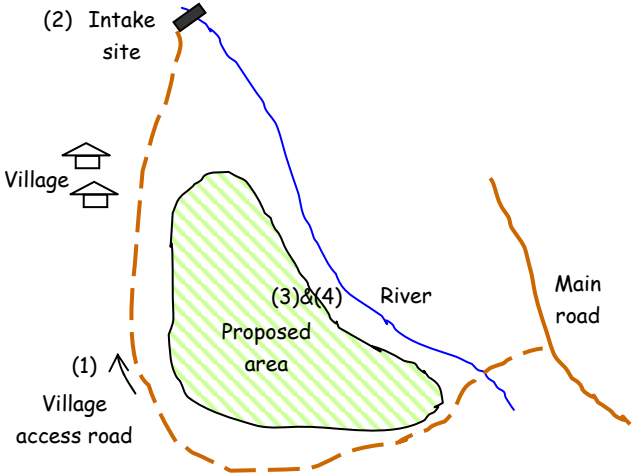
Key for the success of the work

Visit the site and measure coordinates of the major points by handheld GPS. UTM system should be used as the coordinate system.

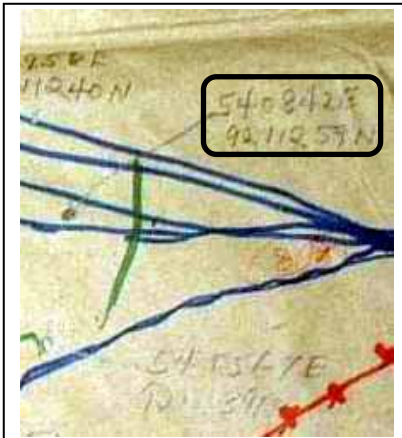
Required input

1. District Project Development Team (DPDT)
2. Village resource map
3. Villager (guide for the survey area)
4. Handheld GPS, sheets of section (graph) paper (A3 or A4 size), pencils

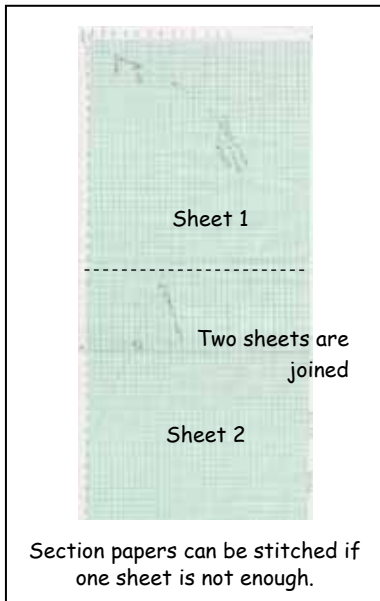
How is the work carried out?

<p>Sub-step 1 Decide the route to be taken on site</p>	<p>Review the village resource map and determine the route to be taken on site. The following is a general route.</p> <ol style="list-style-type: none"> 1) Take the access road from the downstream portion. 2) Go up to the intake site. 3)&4) Record the boundary of the proposed area and existing irrigation facilities (if any) and the river along the area. <p>*Order should be decided considering field conditions.</p> 								
<p>Sub-step 2 Set GPS in UTM system</p>	<p>Before going to the site, the coordinate system of GPS should be confirmed. UTM should be employed for map preparation. In general, the default system is Lat/Lon, so it should be switched to UTM before the survey</p> <table style="margin-left: 20px;"> <tr> <td>e.g. Lat/Lon:</td> <td>UTM:</td> </tr> <tr> <td>5°57.628'S</td> <td>345163E</td> </tr> <tr> <td>37°46.374'E</td> <td>9324327N</td> </tr> <tr> <td>(unit: degree/minutes)</td> <td>(unit: m)</td> </tr> </table>	e.g. Lat/Lon:	UTM:	5°57.628'S	345163E	37°46.374'E	9324327N	(unit: degree/minutes)	(unit: m)
e.g. Lat/Lon:	UTM:								
5°57.628'S	345163E								
37°46.374'E	9324327N								
(unit: degree/minutes)	(unit: m)								

Sub-step 3 Visit the site with a villager and record the coordinates and observations



Measured coordinates can be recorded on the village resource map.



Section papers can be stitched if one sheet is not enough.

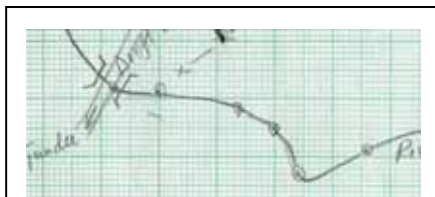
Visit the site and ask a villager to accompany the survey team. A villager who attended village resource mapping would be appropriate. Follow the route under the guidance of him/her and record the coordinates of the route. Items and approximate number of points are shown below.

Items	Measuring point
Road	<ul style="list-style-type: none"> -junction -major turning point -river crossing point (including bridge) *5-15 points in all.
River /Irrigation Facilities	<ul style="list-style-type: none"> River -major turning points along the proposed area Irrigation facilities -intake site (proposed/existing) -any canal diversion -any junction of drainage -any route of flood dike *5-10 points for each items (intake site:1)
Proposed area	<ul style="list-style-type: none"> -corner of the boundary *10-20 points

Sub-step 4 Estimate the area to be cropped within the proposed area

Roughly estimate the cropped area within the proposed area by percentage for the crops grown in rainy and dry season based on the opinion of villagers accompanied.

Sub-step 5 Plot the coordinates on section paper and write down surrounding items.



Sample of a present situation map

- (1) Pick out the coordinates including the maximum/minimum value in each axis.
- (2) Set the grid in order that it may cover the max/min value. 1:10,000 (1cm=100m) is easily applied for schemes of around 50 ha. If one sheet is not enough, add some more sheets and combine them.
- (3) Plot the coordinates and connect them. Write down related information such as village, forest reserve, percentage of cropped area in the proposed area etc.

Note: Indicative time required for preparation of present situation map is 2-3 days/scheme. (1-2 days for site visit and a half day for plotting.)

Step-6: Preliminary Planning for Selected Irrigation Schemes

(a) Irrigation Water Requirement Estimation

Keywords

Estimate irrigation water requirement reflecting site conditions analyzed through field survey.

Why is the work required?

Irrigation water requirement is the total water demand for crop cultivation in the irrigation scheme, and is a key factor for determination of the development area.

Key for the success of the work

Irrigation water requirement is estimated reflecting site conditions analyzed in the field survey. Meteorological conditions, soil conditions and situation of present crop production are the key factors.

Required inputs

1. District Project Development Team
2. Calculation sheet for irrigation water requirement (Form-5)
3. Calculator

How is the work carried out?

Sub-step 1 Obtain net water requirement

Estimate gross unit water requirement by using Form-5.

Note:

If you are not familiar with the procedure of economic analysis, refer to Attachment-3 (Additional Explanation on Economic Analysis of the Scheme) before starting the planning.



Form-5 Calculation Sheet for Irrigation Water Requirement

Sub-step 1 Estimate Gross Water Requirement																																																																																		
<i>Instruction</i>	Scheme Name			Planned Date																																																																														
<p>1) Determine crops to be irrigated</p> <p>Determine the crops to be irrigated considering present crop production surveyed in Form-3 (1/3), the agro-ecological zone obtained from the irrigation GIS, and the farmers' intentions for cropping after the scheme is implemented.</p> <p><u>Choose one crop for dry season and rainy season respectively.</u></p> <p>Dry season: <input type="checkbox"/> Paddy <input type="checkbox"/> Maize <input type="checkbox"/> Beans and Vegetables</p> <p>Rainy season: <input type="checkbox"/> Paddy <input type="checkbox"/> Maize <input type="checkbox"/> Beans and Vegetables</p>																																																																																		
<p>2) Setting-up a typical cropping calendar</p> <p>In order to simplify the water requirement calculation, the typical, ideal cropping calendar under irrigated conditions was established in the Action Plan study. This calendar, as shown below, was based on the following conditions.</p> <ul style="list-style-type: none"> - The major strategic crop for the irrigation development is paddy and the effective utilization of the long rains between March and May (Masika) is the key issue. - Since irrigated conditions are assumed, the land preparation can be performed within 1 month and the rainy season cropping can thus be started around January. - In this case, the harvesting can be carried out around June and that period is ideal for the harvest of paddy because of the dry conditions just after the long rains. - The double cropping of paddy will be possible if the irrigation water is available during the dry season starting from July. - Even if the irrigation water is not sufficient during the dry season, some crops can be grown under the effective utilization of the remaining soil moisture. <p style="text-align: center;">Typical Cropping Calendar</p> <table border="1" style="width:100%; border-collapse: collapse; text-align: center;"> <thead> <tr style="background-color: #cccccc;"> <th rowspan="2">Seasons</th> <th colspan="6">Dry season cropping</th> <th colspan="6">Rainy Season cropping</th> </tr> <tr style="background-color: #cccccc;"> <th>1st</th><th>2nd</th><th>3rd</th><th>4th</th><th>5th</th><th>6th</th> <th>1st</th><th>2nd</th><th>3rd</th><th>4th</th><th>5th</th><th>6th</th> </tr> </thead> <tbody> <tr> <td>Month</td> <td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td> <td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td> </tr> </tbody> </table>													Seasons	Dry season cropping						Rainy Season cropping						1st	2nd	3rd	4th	5th	6th	1st	2nd	3rd	4th	5th	6th	Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun																																
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Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun																																																																						
<p>3) Enter net unit water requirement (NWR)</p> <p>Obtain net unit water requirement (NWR) from Table-1. General soil texture type is confirmed from Form-4 (1/7).</p>																																																																																		
<p>4) Obtain irrigation efficiency (E)</p> <p>Obtain suitable irrigation efficiency from Table-2. Irrigation efficiency (E)</p> <div style="text-align: right; margin-right: 50px;"><input style="width: 50px; height: 20px;" type="text"/></div>																																																																																		
<p>5) Calculate gross unit water requirement (GWR)</p>																																																																																		
<p>Calculation Form of Gross Unit Water Requirement (Unit: mm/month)</p>																																																																																		
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<p>*D : number of days by the month,</p>																																																																																		

Section 3 Irrigation Scheme Formulation for DADP

Table-1 Net Unit Water Requirement (NWR) in each Region (1/2)

Unit: mm/month

Region	Crop	Soil Type	Dry Season						Rainy Season					
			Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Arusha	Paddy	Sandy Loam	637	460	502	501	-	-	686	465	484	358	390	-
		Clay Loam	432	310	352	346	-	-	481	325	329	208	235	-
		Clay	289	220	262	253	-	-	338	241	236	118	142	-
	Maize		90	112	194	191	144	-	45	124	165	58	75	-
	Bean & Veg		90	112	169	172	-	-	49	111	149	66	72	-
Kilimanjaro	Paddy	Sandy Loam	633	461	507	512	-	-	736	506	540	403	406	-
		Clay Loam	428	311	357	357	-	-	531	366	385	253	251	-
		Clay	285	221	267	264	-	-	388	282	292	163	158	-
	Maize		89	112	198	202	187	-	72	157	220	103	90	-
	Bean & Veg		89	112	172	182	-	-	72	138	193	102	85	-
Tanga	Paddy	Sandy Loam	658	456	474	470	-	-	732	500	522	374	340	-
		Clay Loam	453	306	324	315	-	-	527	360	367	224	185	-
		Clay	310	216	234	222	-	-	384	276	274	134	92	-
	Maize		85	102	166	160	139	-	70	153	203	74	23	-
	Bean & Veg		90	108	148	148	-	-	70	134	180	82	40	-
Iringa	Paddy	Sandy Loam	703	527	569	564	-	-	622	427	447	433	473	-
		Clay Loam	498	377	419	409	-	-	417	287	292	283	318	-
		Clay	355	287	329	316	-	-	274	203	199	193	225	-
	Maize		112	158	257	254	230	-	0	100	129	133	155	-
	Bean & Veg		112	158	224	228	-	-	13	89	120	123	139	-
Mbeya	Paddy	Sandy Loam	689	510	548	532	-	-	555	402	388	394	457	-
		Clay Loam	484	360	398	377	-	-	350	262	233	244	302	-
		Clay	341	270	308	284	-	-	207	178	140	154	209	-
	Maize		107	146	237	222	173	-	0	82	71	94	140	-
	Bean & Veg		107	146	206	200	-	-	0	73	74	92	125	-
Rukwa	Paddy	Sandy Loam	696	519	558	548	-	-	589	415	417	414	465	-
		Clay Loam	491	369	408	393	-	-	384	275	262	264	310	-
		Clay	348	279	318	300	-	-	241	191	169	174	217	-
	Maize		109	152	247	238	202	-	0	91	100	114	148	-
	Bean & Veg		109	152	215	214	-	-	0	81	97	107	132	-
Coast	Paddy	Sandy Loam	670	486	515	497	-	-	714	479	430	318	379	-
		Clay Loam	465	336	365	342	-	-	509	339	275	168	224	-
		Clay	322	246	275	249	-	-	366	255	182	78	131	-
	Maize		100	129	206	187	140	-	64	138	112	18	63	-
	Bean & Veg		100	129	179	170	-	-	65	121	109	37	67	-
D'Salaam	Paddy	Sandy Loam	665	484	511	491	-	-	703	478	440	347	381	-
		Clay Loam	460	334	361	336	-	-	498	338	285	197	226	-
		Clay	317	244	271	243	-	-	355	254	192	107	133	-
	Maize		96	127	202	181	151	-	53	137	122	47	64	-
	Bean & Veg		97	128	176	165	-	-	56	120	115	57	68	-
Morogoro	Paddy	Sandy Loam	627	450	485	485	-	-	673	445	426	325	381	-
		Clay Loam	422	300	335	330	-	-	468	305	271	175	226	-
		Clay	279	210	245	237	-	-	325	221	178	85	133	-
	Maize		86	104	177	175	161	-	34	111	109	25	66	-
	Bean & Veg		87	104	154	158	-	-	42	99	104	39	65	-
Lindi	Paddy	Sandy Loam	700	513	530	518	-	-	622	443	381	383	455	-
		Clay Loam	495	363	380	363	-	-	417	303	226	233	300	-
		Clay	352	273	290	270	-	-	274	219	133	143	207	-
	Maize		110	148	220	208	195	-	0	111	64	83	137	-
	Bean & Veg		111	148	192	187	-	-	6	99	71	86	125	-
Mtwara	Paddy	Sandy Loam	700	513	530	518	-	-	622	443	381	383	455	-
		Clay Loam	495	363	380	363	-	-	417	303	226	233	300	-
		Clay	352	273	290	270	-	-	274	219	133	143	207	-
	Maize		110	148	220	208	195	-	0	111	64	83	137	-
	Bean & Veg		111	148	192	187	-	-	6	99	71	86	125	-
Ruvema	Paddy	Sandy Loam	663	484	534	539	-	-	538	422	359	383	445	-
		Clay Loam	458	334	384	384	-	-	333	282	204	233	290	-
		Clay	315	244	294	291	-	-	190	198	111	143	197	-
	Maize		99	128	224	229	211	-	0	96	42	83	128	-
	Bean & Veg		99	128	195	206	-	-	0	85	54	83	115	-
Kagera	Paddy	Sandy Loam	664	451	424	357	-	-	579	361	337	242	294	-
		Clay Loam	459	301	274	202	-	-	374	221	182	92	139	-
		Clay	316	211	184	109	-	-	231	137	89	2	46	-
	Maize		97	100	117	47	8	-	0	40	20	0	0	-
	Bean & Veg		98	105	108	56	-	-	0	44	38	0	4	-

Table-1 Net Unit Water Requirement (NWR) in each Region (2/2)

Unit: mm/month

Region	Crop	Soil Type	Dry Season						Rainy Season					
			Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mara	Paddy	Sandy Loam	696	509	530	478	-	-	672	453	479	365	411	-
		Clay Loam	491	359	380	323	-	-	467	313	324	215	256	-
		Clay	348	269	290	230	-	-	324	229	231	125	163	-
	Maize	109	145	220	168	118	-	43	117	160	65	94	-	
	Bean & Veg	109	146	191	154	-	-	47	104	146	75	92	-	
Mwanza	Paddy	Sandy Loam	713	514	528	468	-	-	625	440	461	376	443	-
		Clay Loam	508	364	378	313	-	-	420	300	306	226	288	-
		Clay	365	274	288	220	-	-	277	216	213	136	195	-
	Maize	114	149	219	158	83	-	9	109	143	76	125	-	
	Bean & Veg	114	149	190	146	-	-	21	97	132	82	116	-	
Shinyanga	Paddy	Sandy Loam	727	545	577	523	-	-	619	441	449	424	475	-
		Clay Loam	522	395	427	368	-	-	414	301	294	274	320	-
		Clay	379	305	337	275	-	-	271	217	201	184	227	-
	Maize	119	170	265	213	140	-	0	110	130	124	156	-	
	Bean & Veg	119	170	231	192	-	-	12	97	124	120	141	-	
Dodoma	Paddy	Sandy Loam	719	537	568	555	-	-	667	447	505	475	496	-
		Clay Loam	514	387	418	400	-	-	462	307	350	325	341	-
		Clay	371	297	328	307	-	-	319	223	257	235	248	-
	Maize	116	165	257	245	230	-	22	114	185	175	177	-	
	Bean & Veg	116	165	223	220	-	-	34	101	166	159	158	-	
Kigoma	Paddy	Sandy Loam	702	517	528	435	-	-	584	408	418	373	452	-
		Clay Loam	497	367	378	280	-	-	379	268	263	223	297	-
		Clay	354	277	288	187	-	-	236	184	170	133	204	-
	Maize	111	151	219	125	55	-	0	86	102	73	135	-	
	Bean & Veg	111	151	190	118	-	-	0	77	96	77	121	-	
Singida	Paddy	Sandy Loam	745	563	637	545	-	-	589	413	440	413	478	-
		Clay Loam	540	413	487	390	-	-	384	273	285	263	323	-
		Clay	397	323	397	297	-	-	241	189	192	173	230	-
	Maize	125	183	323	235	152	-	0	90	122	113	160	-	
	Bean & Veg	125	183	281	212	-	-	0	80	116	110	143	-	
Tabora	Paddy	Sandy Loam	745	563	637	545	-	-	589	413	440	413	478	-
		Clay Loam	540	413	487	390	-	-	384	273	285	263	323	-
		Clay	397	323	397	297	-	-	241	189	192	173	230	-
	Maize	125	183	323	235	152	-	0	90	122	113	160	-	
	Bean & Veg	125	183	281	212	-	-	0	80	116	110	143	-	

Table-2 Irrigation Efficiency by Scheme Condition

Proposed canal condition	Lined	Unlined	
Farmers' experience	-	Sufficient	Poor
Irrigation efficiency	0.40	0.30	0.25



(b) Water Balance Study

Keywords
Appropriate water balance through analysis on available water resource and water demand by crop cultivation

Why is the work required?
To effectively utilize precious water for irrigation, in irrigation planning it is important to quantify and set the appropriate balance between available water and water required for irrigation.

Key for the success of the work
The water balance study is a time-consuming activity because many factors should be studied and analyzed. The water balance study should therefore be conducted taking into account the required precision and accuracy for planning. At this stage, only preliminary planning is required because the study purpose is scheme formulation for inclusion in DADP.

- Required inputs**
1. District Project Development Team (DPDT)
 2. Calculation sheet for water balance study (Form-6)
 3. Calculator

How is the work carried out?

Sub-step 1	Conduct water balance calculation for river	<u>This sub-step is applicable for the river water source scheme</u> Conduct water balance using Form-6(a).
Sub-step 2	Conduct water balance calculation for lake/pond.	<u>This sub-step is applicable for the lake/pond water source scheme</u> Conduct water balance using Form-6(b).

Box

Water and Land

Availability of water and land is the most crucial factor for irrigation development. Irrigation development should be concurrently approached for both water and land resources, not one side only. This approach seeks for a good balance between available water and water demand for crop cultivation on the available land, which in turn leads to an appropriate development scale.

Box

Irrigable Area in Dry Season

If the irrigable area in the dry season is smaller than the development area, it means that the irrigation system cannot supply enough water for the whole development area in the dry season. However, this does not mean that the system always supplies water only to the upstream farm plots in the dry season. Water distribution in the dry season should be discussed and agreed by the irrigators' association. Area-wise rotation of irrigable farm plots on an annual basis is recommended.

Form-6(a) Calculation Sheet for Water Balance Study (River)

Sub-step 1 Water balance calculation (river water source)														
Applicability The sub-step can be skipped for non-circled type of scheme														
1) Type of irrigation														
<input type="radio"/> Gravity <input type="radio"/> Pump (River) <input type="checkbox"/> Pump (Lake/pond) <input type="radio"/> Rain water harvesting														
Instruction														
Scheme Name							Planned Date							
1) Obtain river discharge of the critical months Obtain river discharge for the critical months of the rainy and dry seasons (Qd and Qr) from Form-4 (5/7) and enter the values into the calculation form below. For other months, enter "-". 2) Calculate 80% dependable river discharge Calculate 80% dependable river discharge by multiplying Qd and Qr by 0.6. 3) Obtain and enter <u>gross unit water requirement (GWR)</u> Obtain gross unit water requirement (GWR) for 12 months from Form-5 and enter the value in the calculation form below. 4) Calculate irrigable area in the dry and rainy season Calculate the irrigable area of each month and determine the irrigable area in the rainy season and dry season using the following calculation form.														
Calculation Form of Water Balance Study (River)											(Unit: m ³ /sec)			
		Dry season						Rainy season						
Month		1st Jul	2nd Aug	3rd Sep	4th Oct	5th Nov	6th Dec	1st Jan	2nd Feb	3rd Mar	4th Apr	5th May	6th Jun	
River discharge (1)														
80% dependable river discharge (2)		(1) x 0.6												
GWR (3)														
Irrigable Area (ha) in the month (4)		(2)/(3) x 1000												
Irrigable Area (ha) in the season		minimum of (4) in the season												
Note: (1) If river discharge data is available for only one month of each season, the water balance can only be made for that month. (2) If water requirement in the critical month is "-", shift the critical month to the nearest month for which water requirement is available.														
4) Determine development area (area to be provided with irrigation facilities) Obtain the size of the proposed area from the present situation map by counting the squares in the map. Compare the area of the proposed area with the irrigable area in the rainy season; the smaller value should be chosen as the development area.														
Proposed area (i)		<input style="width: 100px;" type="text"/> ha												
Irrigable area in rainy season (ii)		<input style="width: 100px;" type="text"/> ha												
Development area (smaller value of (i) and (ii))		<input style="width: 100px; border: 2px solid black;" type="text"/> ha												

Form-6(b) Calculation Sheet for Water Balance Study (Lake/Pond)

Sub-step 2 Water balance calculation (lake/pond water source)

Applicability The sub-step can be skipped for non-circled type of scheme

1) Type of irrigation

Gravity Pump (River) Pump (Lake/pond) Rain water harvesting

Instruction

Scheme Name _____ Planned Date _____

- 1) Calculate rainfall recharge (see Table-3 and Form-4 (6/7))
Calculate rainfall recharge for each of the 12 months and enter on the calculation form.
rainfall recharge (m³) = dependable rainfall (mm) x surface area of lake/pond (m²) /1000
- 2) Obtain inflow discharge to the lake/pond
Obtain the average river discharge (Qd and Qr) to the lake/pond from Form-4 (5/7), if any. Enter the average discharge in dry season (Qd; the same value) for each of the 6 months. Enter the average rainy season discharge for each month of the rainy season (Qr).
- 3) Calculate evaporation from the surface
Obtain ETo from Table-4 and surface area of the lake/pond from Form-4 (6/7).
Calculate evaporation for 12 months and enter the result on the calculation form.
evaporation (m³) = ETo (mm) x surface area of the lake/pond (m²) /1000
- 4) Calculate diversion water requirement (DWR)
Assume some development area (A). Calculate the diversion water requirement (DWR) by multiplying (A) and gross unit water requirement (GWR) calculated in Form-5.
Assumed development area (A) ha
- 5) Obtain capacity of the lake/pond and surface area
Obtain the capacity of the lake/pond from Form-4 (6/7).
- 6) Calculate the storage of the month
Calculate storage of each month, Qn, from storage of the previous month, Q(n-1), and inputs and outputs for the month. For the first month, Q(n-1) should be the capacity in 5). If calculated storage is larger than the capacity obtained in 5), enter the capacity in 5) instead of the calculated value.

Calculation Form of Water Balance Study (Lake/Pond)

(Unit: m³)

Month	Dry season						Rainy season					
	1st Jul	2nd Aug	3rd Sep	4th Oct	5th Nov	6th Dec	1st Jan	2nd Feb	3rd Mar	4th Apr	5th May	6th Jun
Rainfall recharge (1)												
Average inflow (2)												
80% dependable inflow (3) (2) x 0.6												
Evaporation (4)												
DWR (5) GWR x (A)/1000												
Storage of the month (Qn) Q(n-1)+ (1)+(3)-(4)-(5)												

Note: Q(n-1) is storage in the previous month

- 7) Determine development area (area to be provided with irrigation facilities)
If the calculated storage in a month is negative, or storage in the last month of the rainy season is less than obtained capacity in 5), decrease the assumed development area and re-calculate until these conditions are not met to obtain final development area.

Development area ha (the area also can be recognized as the irrigable area for both the dry and rainy season)

Calculation should start from the dry season and continue for one year.

Table-3 Monthly 80% Dependable Rainfall in each Region Unit: mm/month

Region	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Arusha	0.2	0.0	0.0	1.1	22.3	35.1	23.3	21.5	45.4	105.7	41.9	0.6
Kilimanjaro	0.1	0.0	0.0	0.1	1.4	7.5	0.6	1.2	15.3	76.6	39.2	0.2
Tanga	25.5	31.5	32.5	33.0	38.8	22.1	0.9	0.1	31.3	116.2	155.6	12.0
Iringa	0.0	0.0	0.0	0.0	0.4	44.8	83.1	12.0	69.5	24.1	0.1	0.0
Mbeya	0.0	0.0	0.0	0.7	16.2	110.2	143.3	12.0	112.7	54.2	0.1	0.0
Rukwa	0.0	0.0	0.0	0.3	8.3	77.5	113.2	12.0	91.1	39.1	0.1	0.0
Coast	2.2	1.2	0.0	8.5	46.2	34.5	1.3	0.0	98.9	154.8	86.6	2.2
D'Salaam	8.2	4.8	5.2	17.6	31.3	10.0	17.5	1.2	85.7	114.5	84.6	12.0
Morogoro	1.4	0.1	0.1	1.5	3.6	22.6	37.3	18.6	88.2	129.2	45.4	12.0
Lindi	0.2	0.2	0.6	0.7	4.0	67.8	107.2	12.0	142.1	91.0	16.3	0.1
Mtwara	0.2	0.2	0.6	0.7	4.0	67.8	107.2	12.0	142.1	91.0	16.3	0.1
Ruvema	0.0	0.0	0.0	0.0	4.0	79.9	192.0	12.0	159.3	62.7	0.4	0.0
Kagera	3.9	26.7	55.8	104.7	138.9	110.9	97.3	75.9	189.6	250.6	187.9	25.6
Mara	0.1	1.3	2.6	23.9	47.5	28.1	17.0	17.6	57.6	124.2	67.6	2.6
Mwanza	0.0	0.0	0.2	32.1	88.6	83.1	58.2	12.0	66.7	105.3	27.5	0.0
Shinyanga	0.0	0.0	0.0	0.9	45.7	56.5	81.1	12.0	99.8	62.0	9.1	0.0
Dodoma	0.0	0.0	0.0	0.0	0.0	11.0	59.2	12.0	49.9	7.2	0.0	0.0
Kigoma	0.0	0.0	0.1	39.6	92.2	96.1	89.0	12.0	74.3	89.5	4.0	0.0
Singida	0.0	0.0	0.0	0.5	38.0	105.9	89.9	12.0	87.8	68.1	0.9	0.0
Tabora	0.0	0.0	0.0	0.5	38.0	105.9	89.9	12.0	87.8	68.1	0.9	0.0

Table-4 Monthly Reference Evapo-transpiration (ET_o) in each Region Unit: mm/month

Region	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Arusha	115	139	169	192	168	164	174	174	171	132	109	105
Kilimanjaro	112	140	172	202	198	202	206	198	201	156	124	105
Tanga	151	155	164	183	175	188	202	192	195	155	139	149
Iringa	176	197	224	254	243	198	155	135	155	150	163	161
Mbeya	163	183	206	222	194	170	132	113	130	132	148	147
Rukwa	169	190	215	238	218	184	143	124	143	141	155	154
Coast	146	163	179	193	182	177	186	173	158	127	130	138
D'Salaam	146	163	179	193	182	177	186	173	158	127	130	138
Morogoro	107	130	154	176	172	176	172	155	148	116	103	97
Lindi	173	186	192	208	208	196	170	149	142	146	156	154
Mtwara	173	186	192	208	208	196	170	149	142	146	156	154
Ruvema	139	160	195	229	225	179	148	131	134	127	135	129
Kagera	142	148	136	120	111	114	125	117	133	117	115	126
Mara	170	183	193	184	160	163	158	161	174	152	149	150
Mwanza	184	186	190	180	153	155	142	147	165	150	152	158
Shinyanga	197	213	231	214	181	170	150	147	174	167	171	181
Dodoma	190	206	223	245	242	207	181	152	191	180	186	185
Kigoma	175	189	190	153	126	119	124	118	134	136	145	147
Singida	214	229	281	236	188	150	129	123	160	160	169	185
Tabora	214	229	281	236	188	150	129	123	160	160	169	185

(c) Scheme Development Planning and Development Cost Estimate

Keywords
 Planning of irrigation system well-fitted to site conditions, aiming at timely water supply of proper quantity.

Why is the work required?
 To present a development framework incorporating all the major features of the irrigation scheme with a cost estimate.

Key for the success of the work
 It is important to grasp the site conditions, such as topographic conditions, farmers' intentions, and any existing irrigation facilities, and reflect them in the system plan. In preparing DADP, the components of the scheme development plan shall be as shown in Figure-3.

Required inputs
 1. District Project Development Team (DPDT)

How is the work carried out?

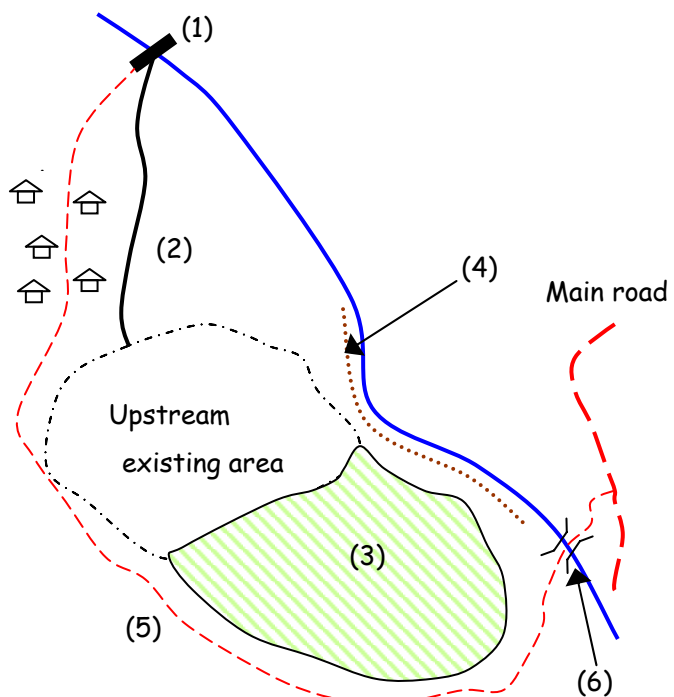
Sub-step 1	Prepare scheme development plan and estimate development cost	Conduct preliminary design and cost estimate by using Form-7.
Sub-step 2	Finalize scheme development plan map	Confirm that all the required information is plotted on the scheme development plan map as explained in Figure-3.

Figure-3 Sample of Scheme Development Plan Map

The scheme development plan map shall be prepared by plotting the following information on the present situation map.

- (1) weir & intake (or pump)
- (2) main canal
- (3) proposed area (not necessary to be development area)
- (4) flood dike
- (5) village access road
- (6) village bridge

The example at right shows a typical expansion scheme (upstream area has already been developed and downstream area is proposed to be developed).



Form-7 Planning Sheet for Scheme Development Plan (1/10)

Sub-step 1(a) Preliminary Design and Cost Estimate of Weir																										
Applicability The sub-step can be skipped for non-circled type of scheme																										
1) Type of irrigation <input type="checkbox"/> Gravity <input type="checkbox"/> Pump (River) <input type="checkbox"/> Pump (Lake/pond) <input type="checkbox"/> Rain water harvesting																										
2) Type of irrigation development <input type="checkbox"/> Rehabilitation <input type="checkbox"/> Improvement <input type="checkbox"/> New Development <input type="checkbox"/> Drainage																										
Instruction	Scheme Name	Planned Date																								
<p>1) Plot intake point on the present situation map Plot the intake point on the present situation map.</p> <p>2) Estimate width of the river at intake point Obtain width of the river at intake point and height of the weir from Form-4 (4/7).</p> <p style="margin-left: 40px;">Width of the river (W) <input style="width: 50px;" type="text"/> m</p> <p style="margin-left: 40px;">Height of the weir (h) <input style="width: 50px;" type="text"/> m</p> <p>3) Choose type (material) of the weir Choose concrete type weir if budget for that is available. If not, start the scheme with a gabion type weir. Circle one at right.</p> <div style="display: flex; justify-content: flex-end; align-items: center; gap: 20px;"> <input style="width: 20px; height: 20px;" type="checkbox"/> Concrete Type <input style="width: 20px; height: 20px;" type="checkbox"/> Gabion Type </div> <p>4) Estimate work quantity of construction Estimate work quantity of construction by using the chart at right.</p> <div style="text-align: center; border: 1px solid black; border-radius: 15px; padding: 10px; margin: 10px auto; width: 80%;"> <p style="text-align: center;">Simplified Profile of Concrete Weir</p> <p style="text-align: center;">Simplified Profile of Gabion Weir</p> <p style="font-size: small; text-align: right;">h : height of the weir W : width of the river at intake point</p> </div> <p>a) Work quantity of concrete weir (if you choose gabion type, proceed to b)) Concrete volume (i) $h \times h / 2 \times W + 6 \times h \times 0.6 \times W =$ <input style="width: 50px;" type="text"/> m³ Gabion volume (ii) $1 \times W \times 0.5 \times W + 1.5 \times W \times 0.5 \times W =$ <input style="width: 50px;" type="text"/> m³ </p> <p>b) Work quantity of gabion weir Gabion volume (ii) $h \times h \times W + 6 \times h \times 0.8 \times W + 1 \times W \times 0.5 \times W + 1.5 \times W \times 0.5 \times W =$ <input style="width: 50px;" type="text"/> m³ </p> <p>5) Estimate construction cost of the weir Obtain work quantity from 4) and estimate construction cost by multiplying unit cost.</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Concrete volume (i)</td> <td style="width: 10%;"><input style="width: 40px;" type="text"/> m³</td> <td style="width: 10%;">x Unit cost</td> <td style="width: 10%;">300,000 Tsh/m³</td> <td style="width: 10%;">=</td> <td style="width: 20%;"><input style="width: 100px;" type="text"/></td> <td style="width: 10%; text-align: right;">Tsh</td> </tr> <tr> <td>Gabion volume (ii)</td> <td><input style="width: 40px;" type="text"/> m³</td> <td>x Unit cost</td> <td>45,000 Tsh/m³</td> <td>=</td> <td><input style="width: 100px;" type="text"/></td> <td style="text-align: right;">Tsh</td> </tr> </table> <hr/> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%;">(1) Cost of weir body (Sub total (i + ii))</td> <td style="width: 10%;"><input style="width: 100px;" type="text"/></td> <td style="width: 20%; text-align: right;">Tsh</td> </tr> <tr> <td>(2) Miscellaneous works and contingency (50% of (1))</td> <td><input style="width: 100px;" type="text"/></td> <td style="text-align: right;">Tsh</td> </tr> <tr> <td>(3) Cost for new weir ((1) + (2))</td> <td><input style="width: 100px;" type="text"/></td> <td style="text-align: right;">Tsh</td> </tr> </table>				Concrete volume (i)	<input style="width: 40px;" type="text"/> m ³	x Unit cost	300,000 Tsh/m ³	=	<input style="width: 100px;" type="text"/>	Tsh	Gabion volume (ii)	<input style="width: 40px;" type="text"/> m ³	x Unit cost	45,000 Tsh/m ³	=	<input style="width: 100px;" type="text"/>	Tsh	(1) Cost of weir body (Sub total (i + ii))	<input style="width: 100px;" type="text"/>	Tsh	(2) Miscellaneous works and contingency (50% of (1))	<input style="width: 100px;" type="text"/>	Tsh	(3) Cost for new weir ((1) + (2))	<input style="width: 100px;" type="text"/>	Tsh
Concrete volume (i)	<input style="width: 40px;" type="text"/> m ³	x Unit cost	300,000 Tsh/m ³	=	<input style="width: 100px;" type="text"/>	Tsh																				
Gabion volume (ii)	<input style="width: 40px;" type="text"/> m ³	x Unit cost	45,000 Tsh/m ³	=	<input style="width: 100px;" type="text"/>	Tsh																				
(1) Cost of weir body (Sub total (i + ii))	<input style="width: 100px;" type="text"/>	Tsh																								
(2) Miscellaneous works and contingency (50% of (1))	<input style="width: 100px;" type="text"/>	Tsh																								
(3) Cost for new weir ((1) + (2))	<input style="width: 100px;" type="text"/>	Tsh																								

(4) Extent of required replacement
 For new development or improvement scheme, enter factor 1.0.
 For rehabilitation scheme, choose extent of required replacement (1.0(=100%), 0.5 or 0.3) from Form-4 (7/7). Minor rehabilitation can be omitted.

(5) Construction/Rehabilitation cost of the weir (3) x (4) Tsh

Form-7 Planning Sheet for Scheme Development Plan (2/10)

Sub-step 1(b) Preliminary Design and Cost Estimate of Pump															
<i>Applicability</i> The sub-step can be skipped for non-circled type of scheme															
1) Type of irrigation <input type="checkbox"/> Gravity <input type="checkbox"/> Pump (River) <input type="checkbox"/> Pump (Lake/pond) <input type="checkbox"/> Rain water harvesting															
2) Type of irrigation development <input type="checkbox"/> Rehabilitation <input type="checkbox"/> Improvement <input type="checkbox"/> New Development <input type="checkbox"/> Drainage															
Instruction	Scheme Name	Planned Date													
<p>1) Determine water abstraction point Determine water abstraction point and plot it on the present situation map.</p> <p>2) Measure head of the pump Measure required head of the pump (difference between ground elevation of the water abstraction point and lowest water level). (1) Required head of the pump <input type="text"/> m</p> <p>3) Obtain total capacity of the pumps Obtain total capacity of the pumps by multiplying peak (maximum) gross unit water requirement by development area. (1) Peak gross unit water requirement <input type="text"/> l/sec/ha (2) Development area <input type="text"/> ha (3) Total capacity of the pumps (1) x (2) x 3.6 (i) <input type="text"/> m³/hr</p> <p>4) Determine maximum possible capacity of single pump Obtain maximum possible capacity of single pump by required head using following table.</p> <p style="text-align: center;">Table-5 Maximum Possible Capacity of Single Pump by Require Head</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th>Required Head</th> <th>0-5 m</th> <th>5-10 m</th> <th>10-15 m</th> <th>15-20 m</th> <th>20-25 m</th> </tr> </thead> <tbody> <tr> <td>Possible Max Capacity of Single Pump (m³/hr)</td> <td style="text-align: center;">80</td> <td style="text-align: center;">75</td> <td style="text-align: center;">65</td> <td style="text-align: center;">50</td> <td style="text-align: center;">25</td> </tr> </tbody> </table> <p>(1) Possible Maximum Capacity of Single Pump (ii) <input type="text"/> m³/hr</p> <p>5) Determine required number of pumps Determine the required number of pumps by dividing the total capacity of pumps by the maximum possible capacity of single pump (if the required number of pumps turns out to be more than 10, reduce the development area or change the type of crops to be irrigated or find a larger pump by consultation with the Zonal Irrigation Unit). (1) Required number of pumps (i)/(ii) (rounduped integer) <input type="text"/> nos. (iii)</p> <p>6) Estimate cost of pumps Estimate the cost of pumps by multiplying the cost of a single pump (Tsh.1,600,000) by the number of required pumps (1) Cost of required number of pumps 1,600,000 x (iii) <input type="text"/> Tsh. (2) Miscellaneous works and contingency (50% of (1)) <input type="text"/> Tsh. (3) Total cost of pumps <input type="text"/> Tsh.</p>				Required Head	0-5 m	5-10 m	10-15 m	15-20 m	20-25 m	Possible Max Capacity of Single Pump (m ³ /hr)	80	75	65	50	25
Required Head	0-5 m	5-10 m	10-15 m	15-20 m	20-25 m										
Possible Max Capacity of Single Pump (m ³ /hr)	80	75	65	50	25										

Cost was estimated based on most easily available type of diesel pump in Tanzania.

Form-7 Planning Sheet for Scheme Development Plan (3/10)

Sub-step 1(c) Preliminary Design and Cost Estimate of Main Canal System																					
Applicability The sub-step can be skipped for non-circled type of scheme																					
1) Type of irrigation <input type="checkbox"/> Gravity <input type="checkbox"/> Pump (River) <input type="checkbox"/> Pump (Lake/pond) <input type="checkbox"/> Rain water harvesting																					
2) Type of irrigation development <input type="checkbox"/> Rehabilitation <input type="checkbox"/> Improvement <input type="checkbox"/> New Development <input type="checkbox"/> Drainage																					
Instruction	Scheme Name	Planned Date																			
<p>1) Obtain length of the main canal Seek preliminary route of the main canal, if there is no existing main canal. The route can be obtained to follow more or less the same elevation as the upstream-end of the command area of the main canal towards the intake site. Plot the route of the main canal on the present situation map and measure its length.</p> <p>2) Obtain command area of the main canal Obtain the command area of the main canal. Not only the development area for this DADP, which was determined in the Form-6 (a) or (b), but all the area that water is supplied by the main canal should be the command area of the main canal.</p> <p style="text-align: right;">Command area of the main canal <input type="text"/> ha</p> <p>3) Choose type of the main canal Choose the type of main canal. If the budget is limited or future expansion is planned, choose unlined canal, considering future enlargement of the canal capacity. If not, choose lined canal, since it needs less maintenance work. Circle one option at right.</p> <p style="text-align: right;"><input type="checkbox"/> Lined canal <input type="checkbox"/> Unlined canal</p> <p>4) Estimate construction cost of the main canal system Estimate the construction cost for the main canal and structures based on the length of the main canal and the unit cost classified by command area and type of canal.</p> <p>a) Basic cost of the main canal system Length of canal <input type="text"/> m × Unit cost <input type="text"/> Tsh/m = <input type="text"/> Tsh <div style="text-align: center;">↑ (i)</div> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="3" style="text-align: center;">Unit cost to be applied for new development and improvement</th> </tr> <tr> <th style="text-align: left;">Command area (A) (ha)</th> <th style="text-align: center;">Unlined canal</th> <th style="text-align: center;">Lined canal</th> </tr> </thead> <tbody> <tr> <td>A > 200ha</td> <td style="text-align: center;">18,500</td> <td style="text-align: center;">33,500 Tsh/m</td> </tr> <tr> <td>100 ≤ A < 200</td> <td style="text-align: center;">11,000</td> <td style="text-align: center;">21,000 Tsh/m</td> </tr> <tr> <td>50 ≤ A < 100</td> <td style="text-align: center;">6,000</td> <td style="text-align: center;">12,800 Tsh/m</td> </tr> <tr> <td>A < 50</td> <td style="text-align: center;">4,500</td> <td style="text-align: center;">10,000 Tsh/m</td> </tr> </tbody> </table> <p>For a rehabilitation scheme, obtain the extent of required replacement of the main canal and structures from Form-4 (7/7). The unit cost for a rehabilitation scheme can be estimated by multiplying the extent of required replacement (1.0(=100%), 0.5 or 0.3) by the unit cost for a new development and improvement. Minor rehabilitation can be omitted.</p> <p>b) Contingency (10% of (i)) (ii) <input type="text"/> Tsh</p> <p>c) Construction/rehabilitation cost of the main canal system (i + ii) <input type="text"/> Tsh</p> </p>				Unit cost to be applied for new development and improvement			Command area (A) (ha)	Unlined canal	Lined canal	A > 200ha	18,500	33,500 Tsh/m	100 ≤ A < 200	11,000	21,000 Tsh/m	50 ≤ A < 100	6,000	12,800 Tsh/m	A < 50	4,500	10,000 Tsh/m
Unit cost to be applied for new development and improvement																					
Command area (A) (ha)	Unlined canal	Lined canal																			
A > 200ha	18,500	33,500 Tsh/m																			
100 ≤ A < 200	11,000	21,000 Tsh/m																			
50 ≤ A < 100	6,000	12,800 Tsh/m																			
A < 50	4,500	10,000 Tsh/m																			

Form-7 Planning Sheet for Scheme Development Plan (4/10)

Sub-step 1(d) Cost Estimate of Irrigation Facilities in the Development Area			
<u>Applicability</u> The sub-step can be skipped for non-circled type of scheme			
1) <i>Type of irrigation</i>			
<input type="radio"/> Gravity <input type="radio"/> Pump (River) <input type="radio"/> Pump (Lake/pond) <input type="radio"/> Rain water harvesting			
2) <i>Type of irrigation development</i>			
<input type="radio"/> Rehabilitation <input type="radio"/> Improvement <input type="radio"/> New Development <input type="checkbox"/> Drainage			
<u>Instruction</u>	Scheme Name	Planned Date	
1) Obtain development area Obtain development area from Form-6 (a) or (b).			
2) Estimate construction cost of the irrigation facilities in the development area Estimate the construction cost from the size of development area and unit cost.			
a) Basic cost of the irrigation facilities in the development area			
Development Area <input type="text"/> ha x Unit cost <input type="text"/> Tsh/ha = <input type="text"/> Tsh <div style="text-align: center; margin-left: 150px;">↑</div> <div style="text-align: center; margin-left: 150px;">(i)</div>			
Unit cost to be applied New development and 750,000 Tsh/ha improvement			
For rehabilitation scheme, obtain extent of required replacement of the secondary canals and structures from Form-4 (7/7). The unit cost for a rehabilitation scheme can be estimated by multiplying the extent of required replacement (1.0(=100%), 0.5 or 0.3) by the unit cost for new development and improvement. Minor rehabilitation can be omitted.			
b) Contingency (10 % of (i)) (ii) <input type="text"/> Tsh			
c) Construction/rehabilitation cost of the irrigation facilities in the development area (i + ii) <input type="text"/> Tsh			

Form-7 Planning Sheet for Scheme Development Plan (5/10)

Sub-step 1(e) Cost Estimate of Drainage Facilities in the Development Area			
<u>Applicability</u> The sub-step can be skipped for non-circled type of scheme			
1) <i>Type of irrigation</i>			
<input type="radio"/> Gravity <input type="radio"/> Pump (River) <input type="radio"/> Pump (Lake/pond) <input type="radio"/> Rain water harvesting			
2) <i>Type of irrigation development</i>			
<input type="radio"/> Rehabilitation <input type="radio"/> Improvement <input type="radio"/> New Development <input type="radio"/> Drainage			
<u>Instruction</u>	Scheme Name	Planned Date	
1) Obtain development area Obtain development area from Form-6 (a) or (b).			
2) Estimate construction cost of the drainage facilities in the development area Estimate construction cost from the size of the development area and unit cost.			
a) Cost of the drainage facilities in the development area			
Development Area <input type="text"/> ha x Unit cost <input type="text"/> Tsh/ha = <input type="text"/> Tsh <div style="text-align: center; margin-left: 150px;">↑</div> <div style="text-align: center; margin-left: 150px;">(i)</div>			
Unit cost to be applied New development and 500,000 Tsh/ha improvement			

For a rehabilitation scheme, obtain the extent of required replacement of the drainage canals and structures from Form-4 (7/7). The unit cost for a rehabilitation scheme can be estimated by multiplying the extent of required replacement (1.0(=100%), 0.5 or 0.3) by the unit cost for new development and improvement. Minor rehabilitation can be omitted.

b) Contingency (10 % of (i)) (ii) Tsh

c) Construction/rehabilitation cost of the drainage facilities in the development area (i + ii) Tsh

Form-7 Planning Sheet for Scheme Development Plan (6/10)

Sub-step 1(f) Preliminary Design and Cost Estimate of Flood Dike

Applicability The sub-step can be skipped for non-circled type of scheme

1) Type of irrigation
 Gravity Pump (River) Pump (Lake/pond) Rain water harvesting

2) Type of irrigation development
 Rehabilitation Improvement New Development Drainage

Instruction Scheme Name Planned Date

1) Analyze necessity for providing flood dike

Obtain the inundation condition of the proposed area in the normal area from Form-4 (2/7). If the water depth of inundation in a normal year is shallower than 50 cm or inundation continues shorter than seven days, skip this sub-step and proceed to sub-step 6. If there is a risk of irrigation facilities being washed away by heavy flood, flood dike needs to be provided. The need for a flood dike can also be analyzed from Table-6.

Table-6 Loss of Paddy Production due to Poor Drainage

Stage	Condition	Duration (days)			
		1-2	3-4	5-7	more than 7
Tillering	Clean water	10%	20%	30%	35%
Booting	Muddy water	70%	80%	85%	90-100%
	Clean water	25%	45%	80%	90-100%
Heading	Muddy water	30%	80%	90%	90-100%
	Clean water	15%	25%	30%	70%
Ripening	Muddy water	5%	20%	30%	30%
	Clean water	0%	15%	20%	20%

2) Determine height of the flood dike if it is necessary

Obtain the highest flood level in the past from Form-4 (2/7). Determine the required height of the flood dike by adding 0.5 m allowance (freeboard) to the highest flood level.

The highest flood level m + 0.5 m = m (Height of the flood dike)

3) Estimate length of the flood dike by using the scheme development plan map

Estimate required extent of the flood dike plotting it on the scheme development map. Measure the plotted length of the flood dike.

Length of the flood dike m

4) Estimate construction cost of the flood dike

Estimate the construction cost from the length of the flood dike and unit cost, which is classified according height of the dike.

a) Cost of the flood dike

Length of the dike m × Unit cost Tsh/m = Tsh
↑ (i)

Unit cost to be applied Height up to 2.0 m 67,000 Tsh/m

Section 3 Irrigation Scheme Formulation for DADP

Height up to 1.5 m	41,000 Tsh/m
Height up to 1.2 m	26,000 Tsh/m
<p>For a rehabilitation scheme, obtain the extent of required replacement of the flood dike from Form-4 (7/7). The unit cost for a rehabilitation scheme can be estimated by multiplying the extent of required replacement (1.0(=100%), 0.5 or 0.3) by the unit cost for new development and improvement. Minor rehabilitation can be omitted.</p>	
b) Contingency (10 % of (i))	(ii) <input style="width: 100px;" type="text"/> Tsh
c) Construction/rehabilitation cost of the flood dike (i + ii)	<input style="width: 100px;" type="text"/> Tsh

Form-7 Planning Sheet for Scheme Development Plan (7/10)

Sub-step 1(g) Preliminary Design and Cost Estimate of Village Access Road			
<u>Applicability</u> The sub-step can be skipped for non-circled type of scheme			
1) Type of irrigation			
<input type="radio"/> Gravity	<input type="radio"/> Pump (River)	<input type="radio"/> Pump (Lake/pond)	<input type="radio"/> Rain water harvesting
2) Type of irrigation development			
<input type="radio"/> Rehabilitation	<input type="radio"/> Improvement	<input type="radio"/> New Development	<input type="radio"/> Drainage
<u>Instruction</u>	Scheme Name	Planned Date	
<p>1) Confirm route of the village access road on the present situation map Confirm the route of the village access road on the present situation map and analyze whether it connects the main road - development area - village - intake. If not, an additional road should be proposed. The additional road should be plotted on the present situation map using a different type of line.</p> <p>2) Measure length of the village access road Measure the length of existing and proposed village access roads on the present situation map.</p> <p>3) Estimate construction cost of the village access road Estimate construction cost from total length of the village access road and unit cost.</p> <p style="text-align: center;">Total length <input style="width: 50px;" type="text"/> m x Unit cost <input style="width: 50px;" type="text"/> Tsh/m = <input style="width: 100px;" type="text"/> Tsh</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px dashed black; padding: 5px; width: 60%;"> <p>Unit cost to be applied New development and improvement</p> <p>7,000 Tsh/m</p> <p>For a rehabilitation scheme, obtain the extent of required replacement of the village access road from Form-4 (7/7). The unit cost for a rehabilitation scheme can be estimated by multiplying the extent of required replacement (1.0(=100%), 0.5 or 0.3) by the unit cost for new development and improvement. Minor rehabilitation can be omitted.</p> </div> <div style="text-align: center;"> <p>↑</p> <p>Construction/rehabilitation cost of village access road</p> </div> </div>			

Village access road improvement is assumed to be surface treatment only.

Form-7 Planning Sheet for Scheme Development Plan (8/10)

Sub-step 1(h) Preliminary Design and Cost Estimate of Village Bridge			
Applicability The sub-step can be skipped for non-circled type of scheme			
1) Type of irrigation <input type="radio"/> Gravity <input type="radio"/> Pump (River) <input type="radio"/> Pump (Lake/pond) <input type="radio"/> Rain water harvesting			
2) Type of irrigation development <input type="radio"/> Rehabilitation <input type="radio"/> Improvement <input type="radio"/> New Development <input type="radio"/> Drainage			
Instruction	Scheme Name	Planned Date	
<p>1) Plot location of the village bridge on the present situation map Plot the route of the village access bridge on the present situation map.</p> <p>2) Obtain Total length of the village bridge Obtain the total length of bridge(s) proposed for construction and existing village bridge(s) from Form-4 (3/7).</p> <p>3) Estimate construction cost of the village bridge Estimate construction cost from the total length of the bridge and unit cost.</p> <p>a) New construction (river crossing point(s))</p> <p style="margin-left: 40px;">Total length <input style="width: 50px;" type="text"/> m x Unit cost <input style="width: 50px;" type="text"/> Tsh/m = <input style="width: 100px;" type="text"/> Tsh</p> <p style="margin-left: 150px;">↑</p> <div style="border: 1px dashed black; padding: 5px; margin-left: 40px;"> Unit cost to be applied New construction 700,000 Tsh/m </div> <p style="margin-left: 300px;">(i)</p> <p>b) Rehabilitation (existing bridge(s))</p> <p style="margin-left: 40px;">Total length <input style="width: 50px;" type="text"/> m x Unit cost <input style="width: 50px;" type="text"/> Tsh/m = <input style="width: 100px;" type="text"/> Tsh</p> <p style="margin-left: 150px;">↑</p> <div style="border: 1px dashed black; padding: 5px; margin-left: 40px;"> Unit cost to be applied 700,000 Tsh/m For rehabilitation bridge(s), obtain the extent of required replacement of the village access bridge from Form-4 (3/7). The unit cost for rehabilitation scheme can be estimated by multiplying the extent of required replacement (1.0(=100%), 0.5 or 0.3) by the unit cost for new development and improvement. Minor rehabilitation can be omitted. </div> <p style="margin-left: 300px;">(ii)</p> <p>c) Contingency (10 % of total of (i + ii)) (iii) <input style="width: 50px;" type="text"/> Tsh</p> <p>d) Construction/rehabilitation cost of village access bridge (i + ii + iii) <input style="width: 50px;" type="text"/> Tsh</p>			

Form-7 Planning Sheet for Scheme Development Plan (9/10)

Sub-step 1(i) Estimation of Total Construction Cost																														
Instruction	Scheme Name	Planned Date																												
<p>1) Estimate total construction/rehabilitation cost Obtain the total construction cost by summing up the costs on Form-7 (1/10) to (8/10)</p> <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:60%;">(1a) Weir</td> <td style="width:20%;"><input style="width: 100%;" type="text"/></td> <td style="width:20%; text-align: right;">Tsh</td> </tr> <tr> <td>(1b) Pump</td> <td><input style="width: 100%;" type="text"/></td> <td style="text-align: right;">Tsh</td> </tr> <tr> <td>(2) Main canal & structures</td> <td><input style="width: 100%;" type="text"/></td> <td style="text-align: right;">Tsh</td> </tr> <tr> <td>(3) Irrigation facilities in the development area</td> <td><input style="width: 100%;" type="text"/></td> <td style="text-align: right;">Tsh</td> </tr> <tr> <td>(4) Drainage facilities in the development area</td> <td><input style="width: 100%;" type="text"/></td> <td style="text-align: right;">Tsh</td> </tr> <tr> <td>(5) Flood Dike</td> <td><input style="width: 100%;" type="text"/></td> <td style="text-align: right;">Tsh</td> </tr> <tr> <td>(6) Village Access Road</td> <td><input style="width: 100%;" type="text"/></td> <td style="text-align: right;">Tsh</td> </tr> <tr> <td>(7) Village Bridge</td> <td><input style="width: 100%;" type="text"/></td> <td style="text-align: right;">Tsh</td> </tr> <tr> <td colspan="2">Total Construction Cost (sum of (1a) to (7))</td> <td style="text-align: right;"><input style="width: 100%;" type="text"/> Tsh</td> </tr> </table>				(1a) Weir	<input style="width: 100%;" type="text"/>	Tsh	(1b) Pump	<input style="width: 100%;" type="text"/>	Tsh	(2) Main canal & structures	<input style="width: 100%;" type="text"/>	Tsh	(3) Irrigation facilities in the development area	<input style="width: 100%;" type="text"/>	Tsh	(4) Drainage facilities in the development area	<input style="width: 100%;" type="text"/>	Tsh	(5) Flood Dike	<input style="width: 100%;" type="text"/>	Tsh	(6) Village Access Road	<input style="width: 100%;" type="text"/>	Tsh	(7) Village Bridge	<input style="width: 100%;" type="text"/>	Tsh	Total Construction Cost (sum of (1a) to (7))		<input style="width: 100%;" type="text"/> Tsh
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Form-7 Planning Sheet for Scheme Development Plan (10/10)

Sub-step 1(j) Scheme Development Cost Estimate			
<i>Instruction</i>	Scheme Name	Planned Date	
1) Estimate scheme development cost			
Obtain total construction cost from Form-7 (9/10) and estimate the relevant costs.			
(1) Total construction cost			Tsh
(2) Soft component cost	6.0% of (1)		Tsh
(3) Administration cost	4.0% of (1)		Tsh
(4) Engineering services cost	30.0% of (1)		Tsh
(5) Operation and maintenance (O&M) cost	1.5% of (1)		Tsh
(6) Replacement cost	2.0% of (1)		Tsh
Scheme development Cost			Tsh

Note: Soft component cost includes cost for institutional development (such as irrigators' association establishment) and strengthening of extension services.
 Administration cost includes incremental cost of governmental administration for the scheme.
 Engineering services cost includes survey, design and construction supervision.

(d) Estimation of Scheme Incremental Benefits

<u>Keywords</u>	
Estimate of costs covering construction, O & M, replacement of equipment, administration, engineering services and supporting work, and of benefits from increased crop production less production cost.	
<u>Why is the work required?</u>	
To estimate and clarify the required costs for scheme development and the expected benefits to accrue from scheme development. This is important for budgeting for DADP and future project evaluation.	
<u>Key for the success of the work</u>	
Costs and benefits for scheme formulation should be estimated considering the required accuracy for the particular planning stage to avoid spending unnecessary time and labor costs. In this case, the required level is preliminary, so a rough estimate is good enough, although the necessary costs and benefits need to be covered.	
<u>Required inputs</u>	
1. District Project Development Team (DPDT) 2. Scheme Incremental Benefit Estimation Sheet (Form-8)	
<u>How is the work carried out?</u>	
Sub-step 1 Estimate scheme incremental benefit	Estimate scheme incremental benefit by using Form-8.



Form-8 Scheme Incremental Benefit Estimation Sheet (1/2)

Sub-step 1 Scheme Benefit Estimate																																		
<u>Instruction</u>	Scheme Name	Planned Date																																
<p>The scheme incremental benefit should be estimated for the <u>development area</u> determined through the water balance study with and without project condition in the following manner.</p> <p>1) Without project condition (present condition)</p> <p>a) Estimate benefit during Rainy season</p> <table border="1" style="width:100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width:15%;">Rainy season crop</th> <th style="width:15%;">Average Yield (kg/ha)</th> <th style="width:15%;">Average Price (Tsh/kg)</th> <th style="width:25%;">Cropped Area in Development Area (ha)</th> <th style="width:30%;">Benefit (Bro) (Tsh)</th> </tr> </thead> <tbody> <tr> <td>1) <input style="width:80%;" type="text"/></td> <td>x <input style="width:80%;" type="text"/></td> <td>x <input style="width:80%;" type="text"/></td> <td>x <input style="width:80%;" type="text"/></td> <td>= <input style="width:80%;" type="text"/></td> </tr> <tr> <td>2) <input style="width:80%;" type="text"/></td> <td>x <input style="width:80%;" type="text"/></td> <td>x <input style="width:80%;" type="text"/></td> <td>x <input style="width:80%;" type="text"/></td> <td>= <input style="width:80%;" type="text"/></td> </tr> </tbody> </table> <p>b) Estimate benefit during dry season</p> <table border="1" style="width:100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width:15%;">Dry season crop</th> <th style="width:15%;">Average Yield (kg/ha)</th> <th style="width:15%;">Average Price (Tsh/kg)</th> <th style="width:25%;">Cropped Area in Development Area (ha)</th> <th style="width:30%;">Benefit (Bdo) (Tsh)</th> </tr> </thead> <tbody> <tr> <td>1) <input style="width:80%;" type="text"/></td> <td>x <input style="width:80%;" type="text"/></td> <td>x <input style="width:80%;" type="text"/></td> <td>x <input style="width:80%;" type="text"/></td> <td>= <input style="width:80%;" type="text"/></td> </tr> <tr> <td>2) <input style="width:80%;" type="text"/></td> <td>x <input style="width:80%;" type="text"/></td> <td>x <input style="width:80%;" type="text"/></td> <td>x <input style="width:80%;" type="text"/></td> <td>= <input style="width:80%;" type="text"/></td> </tr> </tbody> </table> <p>c) Estimate total benefit without project Bro1+Bro2+Bdo1+Bdo2 <input style="width:100px;" type="text"/> (I)</p> <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <p>Without project condition data should be derived from the survey sheet of Form-3 (1/3) and be calculated in the following manner.</p> <p><u>Average Yield and Average Price for Cereals:</u></p> <p>Average Yield (kg/ha) = $\left(\frac{\text{Max. Yield} + \text{Min. Yield}}{2} \right) \times \text{Weight/bag} \times 2.5$</p> <p>Average Price (Tsh/kg) = $\left(\frac{\text{Max. Price} + \text{Min. Price}}{2} \right) / \text{Weight/bag}$</p> <p><u>Average Yield and Average Price for Vegetables:</u></p> <p>Average Yield (kg/ha) = $\left(\frac{\text{Max. Yield} + \text{Min. Yield}}{2} \right) \times 2.5$</p> <p>Average Price (Tsh/kg) = $\left(\frac{\text{Max. Price} + \text{Min. Price}}{2} \right)$</p> <p><u>Cropped Area in the Development Area:</u></p> <p>This can be estimated from the cropped area in the proposed area shown in the present situation map by applying the percentage for each crop.</p> <p>Cropped Area in Development Area (ha)</p> <p>= <input style="width:150px;" type="text"/> x <input style="width:150px;" type="text"/></p> </div>					Rainy season crop	Average Yield (kg/ha)	Average Price (Tsh/kg)	Cropped Area in Development Area (ha)	Benefit (Bro) (Tsh)	1) <input style="width:80%;" type="text"/>	x <input style="width:80%;" type="text"/>	x <input style="width:80%;" type="text"/>	x <input style="width:80%;" type="text"/>	= <input style="width:80%;" type="text"/>	2) <input style="width:80%;" type="text"/>	x <input style="width:80%;" type="text"/>	x <input style="width:80%;" type="text"/>	x <input style="width:80%;" type="text"/>	= <input style="width:80%;" type="text"/>	Dry season crop	Average Yield (kg/ha)	Average Price (Tsh/kg)	Cropped Area in Development Area (ha)	Benefit (Bdo) (Tsh)	1) <input style="width:80%;" type="text"/>	x <input style="width:80%;" type="text"/>	x <input style="width:80%;" type="text"/>	x <input style="width:80%;" type="text"/>	= <input style="width:80%;" type="text"/>	2) <input style="width:80%;" type="text"/>	x <input style="width:80%;" type="text"/>	x <input style="width:80%;" type="text"/>	x <input style="width:80%;" type="text"/>	= <input style="width:80%;" type="text"/>
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Form-8 Scheme Incremental Benefit Estimation Sheet (2/2)

2) With project condition (after project implementation)

a) Estimate benefit during rainy season

Rainy season crop	Average Yield (kg/ha)	Average Price (Tsh/kg)	Development area (ha)	Benefit (Brw) (Tsh)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

b) Estimate benefit during dry season

Dry season crop under irrigation	Average Yield (kg/ha)	Average Price (Tsh/kg)	Irrigable Area in Dry Season (ha)	Benefit (Bdw1) (Tsh)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Dry season crop under rainfed	Average Yield (kg/ha)	Average Price (Tsh/kg)	Non-irrigable Area in Dry Season (ha)	Benefit (Bdw2) (Tsh)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

c) Estimate total benefit with project $(Brw)+(Bdw1)+(Bdw2)$ (II)

The with project condition data should be elaborated by the DPDT under the careful consideration of cropping intensity. The irrigable area in the rainy and dry seasons should be effectively utilized and the strategic crop should be determined. In addition, the non-irrigable area in the dry season (development area - irrigable area in dry season) should also be utilized for the effective utilization of remaining soil moisture. Although there might be several candidate crops for the dry season, the major crops under irrigation and rainfed conditions should be selected respectively. Average yield should also be estimated through various data. For example, the target yield of paddy was set as follows in the Action Plan study. Average price can basically be maintained as without project condition.

Type of Development	Present Yield (t/ha)	Target Yield (t/ha)
From rainfed condition to water harvesting or improved traditional	1.0-3.0	3.0-4.0
From traditional or poorly developed condition to improved traditional	3.0-4.5	4.5-5.5
From improved traditional or moderately developed condition to modern with full input	4.5-5.5	6.0-7.0

3) Obtain incremental agricultural benefit

Incremental agricultural benefit (II) - (I)

Note: In order to simplify the calculation process and also they are in the relation of offset, the production cost was neglected for the current estimation of agricultural benefit.

(e) Institutional Development Plan

Keywords

Activation of IA for existing schemes and promotion of establishment of IA for new projects aiming at operation and maintenance of irrigation schemes

Why is the work required?

IAs are principal actors in irrigation scheme formulation. Therefore it is indispensable to establish and activate an IA. At this stage, it is necessary to clarify the direction for activation, establishment and registration of the IA.

Key for the success of the work

The future direction should be determined according to the survey results on the present situation and farmers' intentions for establishment and registration of the IA obtained through the interview survey (refer to Form-3 (2/3)).

Required inputs

1. District Project Development Team (DPDT)
2. Data and information obtained through field survey
3. Planning sheet for institutional development plan (Form-9)

How is the work carried out?

Sub-step 1 Determine the future direction of IA

Determine the future direction of IA with respect to activation, establishment and registration by using Form-9.



For a new development scheme, irrigators' associations should be formed only after the facility development is budgeted by DADP. Establishing it before budgetary viability is confirmed may make farmers disappointed.

Since the cost of institutional development was already estimated in Step-6 (c) as "Soft Component Cost", it is not necessary to estimate the cost in Step-6(e).

Form-9 Planning Sheet for Institutional Development Plan

Sub-step 1 Irrigators' Association Activation/Establishment																			
Instruction	Scheme Name	Planned Date																	
<p>1) Present Situation: Classify the present situation of Irrigators' Association or other Farmers' Group from the results of the interview survey (refer to Form-3 (2/3)). Necessary actions for each category are shown below.</p> <table border="0"> <thead> <tr> <th></th> <th>Necessary Action</th> </tr> </thead> <tbody> <tr> <td>1) <input type="checkbox"/> Both Irrigators' Association and Farmers' Group do not exist</td> <td>a), b), c), d), e)</td> </tr> <tr> <td>2) <input type="checkbox"/> Farmers' Group without Registration</td> <td>b), c), d), e)</td> </tr> <tr> <td>3) <input type="checkbox"/> Farmers' Group registered under Cooperative Act</td> <td>b), d), e)</td> </tr> <tr> <td>4) <input type="checkbox"/> Farmers' Group registered under Association Act</td> <td>b), d), e)</td> </tr> <tr> <td>5) <input type="checkbox"/> Irrigators' Association without Registration</td> <td>b), c), d), e)</td> </tr> <tr> <td>6) <input type="checkbox"/> Irrigators' Association registered under Cooperative Act</td> <td>d), e)</td> </tr> <tr> <td>7) <input type="checkbox"/> Irrigators' Association registered under Association Act</td> <td>d), e)</td> </tr> </tbody> </table>					Necessary Action	1) <input type="checkbox"/> Both Irrigators' Association and Farmers' Group do not exist	a), b), c), d), e)	2) <input type="checkbox"/> Farmers' Group without Registration	b), c), d), e)	3) <input type="checkbox"/> Farmers' Group registered under Cooperative Act	b), d), e)	4) <input type="checkbox"/> Farmers' Group registered under Association Act	b), d), e)	5) <input type="checkbox"/> Irrigators' Association without Registration	b), c), d), e)	6) <input type="checkbox"/> Irrigators' Association registered under Cooperative Act	d), e)	7) <input type="checkbox"/> Irrigators' Association registered under Association Act	d), e)
	Necessary Action																		
1) <input type="checkbox"/> Both Irrigators' Association and Farmers' Group do not exist	a), b), c), d), e)																		
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7) <input type="checkbox"/> Irrigators' Association registered under Association Act	d), e)																		
<p>2) Necessary Action:</p> <p>a) Establishment: Any organization should be established in order to operate and maintain the irrigation facilities and this organization should be a principal actor for irrigation development.</p> <p>b) Choose type of organization (Irrigators' Association or Farmers' Group) An Irrigators' Association is not a marketing or business oriented organization and its main activities are operation and maintenance of the irrigation facilities. Compulsory participation of all irrigators is a prerequisite of irrigation development.</p> <p>c) Registration: The established organization should be registered as a legal entity to be able to access formal rights such as water rights, land tenure and public services from the government such as development assistance, technical advice, and training programmes.</p> <p>d) Register under Cooperative Act or under Association Act: Registration as a cooperative can be a lengthy procedure and, in any case, current legislation may not suit the commercial aspirations of all schemes. Registration as an association may result in there being certain limitations on profit-making activities and inadequate provision for audited accounts.</p> <p>e) Write a letter of undertaking to the District Council: The commitment of the irrigators should be confirmed in writing in a signed letter of undertaking to the District Council. This should define the obligations of the irrigators' association.</p>																			
<p>3) Institutional Development Plan:</p> <p>1) Establishment : by year <input type="text"/></p> <p>2) Type of organization : <input type="checkbox"/> Irrigators' Association <input type="checkbox"/> Farmers' Group</p> <p>3) Registration : by year <input type="text"/></p> <p>4) Law : <input type="checkbox"/> Cooperative Act <input type="checkbox"/> Association Act</p> <p>5) Letter of undertaking : by year <input type="text"/></p>																			

Indicative timeframe for institutional development

- 1) The organization should be established immediately after the budget is confirmed by DADP.
- 2) Registration and letter of undertaking need to be made before completion of the facilities construction (normally it takes about three years for further study, design and construction).

(f) Environmental Consideration

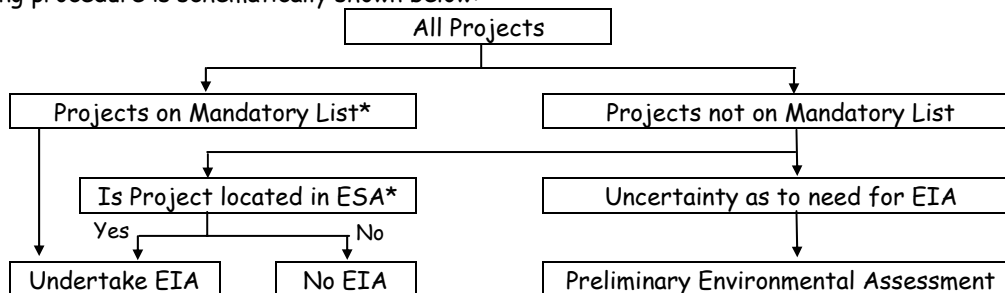
<u>Keywords</u>	
Identification of potential environmental problems and the consequent decision whether the scheme will be subjected to further investigation through full-fledged EIA.	
<u>Why is the work required?</u>	
Environmental consideration should be carried out to ensure that the development options under consideration are environmentally sound and sustainable. The objective at this stage is to get a preliminary understanding of the present environmental conditions according to the environmental assessment guidelines to finally decide the necessity for further investigation through EIA.	
<u>Key for the success of the work</u>	
Data and information obtained through the irrigation GIS and the results of interview survey should be assessed based on Tanzania Environmental Impact Assessment Procedures and Guidelines.	
<u>Required input</u>	
<ol style="list-style-type: none"> 1. District Project Development Team (DPDT) 2. Data and information obtained through the irrigation GIS and field survey 3. Tanzania Environmental Impact Assessment Procedures and Guidelines prepared by National Environmental Management Council (NEMC); NEMC Guidelines, if available. 4. Supplemental information on environmental consideration (Form-10) 	
<u>How is the work carried out?</u>	
Sub-step 1 Screening	Screening is the process of classifying a proposal to determine the level at which environmental assessment will be carried out. The details of screening procedure are stipulated in Vol.2 of NEMC Guidelines and outlined in Form-10.
Sub-step 2 Proposed scheme in protected areas	In case the proposed scheme is located in a protected area, a decision should be made according to the laws and regulations of Tanzania. The Ministry of Natural Resources and Tourism suggests the process in the case of forest reserves, as shown in Form-10.
Sub-step 3 Preliminary Environmental Assessment and Environmental Impact Assessment at a later stage	Preliminary Environmental Assessment is applied to projects (i) with limited impacts which are not included in the proposal, (ii) in which the need of EIA is unclear and (iii) with inadequate information in the proposal. If the screening exercise or preliminary environmental assessment shows that the project proposal will result in significant adverse environmental impacts, full-fledged EIA will be required. Those activities will be carried out at a later stage if deemed necessary.

Form-10 Supplemental Information on Environmental Consideration

Sub-step 1 Screening

<u>Instruction</u>	Scheme Name	Planned Date
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Screening procedure is schematically shown below:



Classify the proposed scheme in one of the following decisions through the screening procedure:

- (1) EIA is required where the project is known to have significant adverse environmental impacts.
- (2) Preliminary environmental assessment is required where the project may have environmental impacts.
- (3) EIA is not necessary where the project is unlikely to cause significant environmental impacts.

Note: Mandatory List (Agriculture)

- Cultivating natural and semi-natural not less than 50 ha,
- Water management projects for agriculture (drainage, irrigation),
- Large scale monoculture (cash and food crops),
- Pest control projects,
- Fertilizer and nutrient management,
- Agricultural programmes necessitating the resettlement of communities, and
- Introduction of new breeds of crops.

Note: ESA (Environmentally Sensitive Areas)

- Areas prone to natural disasters, - Wetlands, - Mangrove swamps,
- Areas susceptible to erosion, - Areas of importance to threatened cultural groups,
- Areas with rare/endangered/or threatened plants and animals,
- Areas of unique socio-cultural, archaeological or scientific significance and areas with potential tourist value,
- Polluted area, - Area subject to desertification and bush fires, - Coastal areas/Marine ecosystems,
- Areas declared as national park, watershed reserve, forest reserve, game reserve, wildlife corridors,
- Mountainous areas, water catchment areas and recharge areas of aquifers,
- Areas classified as prime agricultural lands or range lands,
- Green belts or public open spaces in urban area, - Burial sites and graves.

Sub-step 2 Proposed Scheme in Protected Areas

<u>Instruction</u>	Scheme Name	Planned Date
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Confirm whether the proposed scheme is located in a protected area or not:

As mentioned in Step-4 and Step-5(a), the information on protected areas and the distribution of surveyed schemes should be provided from the data and information management unit. Based on this information, check whether the proposed scheme is located in a protected area or not.

Proposed Scheme locates: Within the protected area Outside the protected area

Proposed schemes in productive forest reserves:

If the proposed scheme is located in a productive forest reserve, it may be possible to alter part of the land to another use (e.g. irrigation development). For such conversion, a request from the district authorities has to be submitted to the Permanent Secretary of the Ministry of Natural Resources and Tourism for careful examination and has to include the following:

- Information on intended land use for the piece of land requested within the productive forest reserve,
- Total area to be developed and the detailed development plan,
- The number of beneficiaries for the intended land use,
- Results of EIA in order to ascertain possible impacts of the intended project to the environment,
- A map, or at least a sketch, of the location of the intended scheme/project in relation to the forest reserve.

(g) Review of the Development Plan and Economic Evaluation

Keywords Analyze economic viability of the scheme.	
Why is the work required? It is essential to know whether the scheme is worth investing in for the district or not.	
Key for the success of the work Obtain and apply reasonable data and information estimating the scheme benefits.	
Required inputs 1. District Project Development Team (DPDT) 2. Check list of the development plan (Form-11)	
How is the work carried out?	
Sub-step 1	Obtain Internal Rate of Return (IRR) Obtain IRR of the scheme by using Table-7.
Sub-step 2	Review the Development Plan Review the irrigation technical plan and agricultural information by using the check list (Form-11). If the answer is NO, the information should be confirmed by visiting the site or by some other method. Especially if the obtained IRR in Sub-step 1 is out of the range, the agricultural data should be carefully checked again. If necessary, the development plan should be revised according to the confirmed data.
Sub-step 3	Analyze necessity for a study of alternatives After reviewing the development plan, obtain the IRR by using Table-7. If the obtained IRR is less than 10%, it is necessary to seek the possibility of increasing the IRR by changing some part of the plan (alternative study is needed).
Sub-step 4	Conduct alternative study Conduct alternative study if it is judged to be necessary in Sub-step 3.

Table-7 Simplified Chart for IRR Estimation (with 30 years project life)

IRR (%)	Annual Incremental Agricultural Benefit (million Tsh.)												
	2.5	5.0	7.5	10	15	20	30	40	50	75	100	125	150
50	2.5	8.9	14.0	18.7	27.2	35.2	L	L	L	L	L	L	L
75	S	4.9	8.9	12.4	18.7	24.5	35.2	L	L	L	L	L	L
100	S	2.5	5.9	8.9	14.0	18.7	27.2	35.2	L	L	L	L	L
125	S	0.8	4.0	6.6	11.0	15.0	22.2	28.9	35.2	L	L	L	L
150	S	S	2.5	4.9	8.9	12.4	18.7	24.5	29.9	L	L	L	L
175	S	S	1.3	3.5	7.3	10.4	16.1	21.2	26.1	37.3	L	L	L
200	S	S	0.3	2.5	5.9	8.9	14.0	18.7	23.1	33.2	L	L	L
225	S	S	S	1.6	4.9	7.6	12.4	16.7	20.7	29.9	38.5	L	L
250	S	S	S	0.8	4.0	6.6	11.0	15.0	18.7	27.2	35.2	L	L
275	S	S	S	0.1	3.2	5.7	9.9	13.6	17.0	25.0	32.3	39.3	L
300	S	S	S	S	2.5	4.9	8.9	12.4	15.6	23.1	29.9	36.4	L
350	S	S	S	S	1.3	3.5	7.3	10.4	13.4	20.0	26.1	31.8	37.3
400	S	S	S	S	0.3	2.5	5.9	8.9	11.6	17.6	23.1	28.3	33.2
450	S	S	S	S	S	1.6	4.9	7.6	10.1	15.6	20.7	25.4	29.9
500	S	S	S	S	S	0.8	4.0	6.6	8.9	14.0	18.7	23.1	27.2
600	S	S	S	S	S	S	2.5	4.9	7.0	11.6	15.6	19.4	23.1
700	S	S	S	S	S	S	1.3	3.5	5.5	9.7	13.4	16.7	20.0

Note S: smaller than 0%, L: larger than 40%

Indicated IRR values in the table are obtained through calculation under the condition having two years construction period with evenly distributed cost and expecting the specified benefit annually.

Form-11 Check List of the Scheme Development Plan

Sub-step 1 Confirm Irrigation Technical Plan	Scheme Name	
	Checked Date	
1) Water Balance (River Discharge)		
a) Does obtained river discharge seem reliable? (if the data is doubtful such as too much discharge in dry season, choose NO)	<input type="checkbox"/> YES	<input type="checkbox"/> NO
2) Weir and Intake (Reliability of intake water level)		
a) Does elevation of weir crest top seem to be higher than elevation of upstream end of the development area (can be obtained from Form-4 (4/7))?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
	<input type="checkbox"/> NOT SURE	
b) Does the intake site have a narrow, strait, moderate slope (not too gentle), stable flow and easy access point?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
3) Main Canal		
a) Does the planned main canal route connect the command area of the main canal and the intake site with a gentle slope (or almost same elevation), unless there is special suitable location for weir, such as small waterfall, etc.?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
b) Has the length of the main canal plotted on the scheme development plan map been measured by using ruler?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
4) Flood Dike		
a) Is the length of the planned flood dike enough to protect the development area from floods?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
b) Has the length of the flood dike plotted on the scheme development plan map been measured by using ruler?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
5) Village Access Road		
a) Does the planned village access road connect the main road - village - development area - intake site?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
b) Has the length of the village access road plotted on the scheme development plan map been measured by ruler?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
6) Village Bridge		
a) Is the total length of village bridges enough for crossing the river?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
Sub-step 2 Confirm Agricultural Information	Checked Date	
(Information on scheme benefit estimate)		
In case the result of benefit estimation is considered inappropriate, the following information should be reconfirmed.		
a) Cropped Area: With special attention to the difference in the cropped area between the rainy and dry seasons.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
b) Average Yield: With special attention to adjusting the unit (bag/acre to kg/ha) and proposed yield with project.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
c) Average Price: With special attention to obtaining the price for an ordinary year.	<input type="checkbox"/> YES	<input type="checkbox"/> NO

The item for reconfirmation is a sample only. All the data and information should be checked. If there is answer NO, the data should be reconfirmed on site.

In case the data is replaced with new data, revise the survey sheet and repeat Step-6.

(h) Prioritization of the Selected Schemes

<u>Keywords</u>		
Prioritize selected schemes from multi-viewpoints of adequacy, efficiency, dependability and equity		
<u>Why is the work required?</u>		
Prioritization of selected schemes is essential to implement irrigation development within limited budget.		
<u>Key for the success of the work</u>		
Successful prioritization employs logical evaluation of the schemes using transparent processes.		
<u>Required inputs</u>		
1. District Project Development Team (DPDT) 2. Scheme prioritization sheet (Form-12) 3. Scheme digest (Form-13)		
<u>How is the work carried out?</u>		
Sub-step 1	Evaluate adequacy	Evaluate the adequacy and rank the schemes. Adequacy of the schemes can be evaluated by the following factors as a minimum. a) Technical adequacy i) Reliability of intake water level (see Form-11), ii) availability of construction material, iii) availability of construction company b) Social adequacy i) villagers consensus, ii) farmers motivation c) Environmental adequacy (see Form-10) Ranking result shall be entered in Form-12. If adequacy of the scheme is not good enough for implementation, enter "NG" in the Form-12.
Sub-step 2	Evaluate efficiency	Evaluate efficiency and rank the schemes. Efficiency of the schemes can be evaluated by the following factors as a minimum. a) IRR (Internal Rate of Return) Ranking result shall be entered in Form-12. If IRR is less than 5%, enter "NG" in the Form-12.
Sub-step 3	Evaluate dependability	Evaluate dependability and rank the schemes. Dependability of the schemes can be evaluated by the following factors as a minimum. a) Performance of existing institutions (see Form-3) b) Performance of farmers in group activities (see Form-3) Ranking result shall be entered in Form-12. If the dependability of the scheme is not good enough for implementation, enter "NG" in the Form-12.
Sub-step 4	Evaluate equity	Evaluate equity and rank the schemes. Equity of the schemes can be evaluated by the following factors as a minimum. a) Even distribution of land in the development area b) No water conflicts between adjacent villages (over water rights) The ranking shall be entered in Form-12. If equity of the scheme is not good enough for implementation, enter "NG" in the Form-12.
Sub-step 5	Prioritize the schemes	Prioritize the schemes by using the analysis results of Form-12. However, Form-12 is only one of the tools for prioritization, so the final decision should be made considering District priority for irrigation development, scheme readiness for implementation, etc. If none of the schemes seem to be mature, proceed to Step-7.
Sub-step 6	Prepare scheme digest	Prepare a scheme digest of the first priority scheme for DADP by using Form-13.

Form-12 Schemes Prioritization Sheet

Only one Form-12 should be completed per district.

Name of the District: _____

Indicators	Criteria for Ranking
<i>Adequacy</i>	a) Technical adequacy i) Reliability of intake water level (see Form-11), ii) availability of construction material, iii) availability of construction company b) Social adequacy i) villagers consensus, ii) farmers motivation c) Environmental adequacy (see Form-10) d) e)
<i>Efficiency</i>	a) IRR (Internal Rate of Return), etc. b) c)
<i>Dependability</i>	a) Performance of irrigators' association, b) Performance of farmers on group activities, etc. c) d)
<i>Equity</i>	a) Even distribution of land in the development area, b) No water conflicts between adjacent villages (over water rights), etc. c) d)

Enter 1 for the first ranked scheme, enter 2 for the second, ...



Name of the Scheme Selected	Ranking				Final Ranking
	<i>Adequacy</i>	<i>Efficiency</i>	<i>Dependability</i>	<i>Equity</i>	
		(IRR ____%)			
		(IRR ____%)			
		(IRR ____%)			
		(IRR ____%)			
		(IRR ____%)			

Box

Meanings of Adequacy, Efficiency, Dependability and Equity

- (1) "Adequacy" means workability of the development plan or readiness for implementation. If the scheme is ready for implementation, "adequacy" is high.
- (2) "Efficiency" means rate of investment and return. High return with low investment represents high "efficiency".
- (3) "Dependability" means sustainability of the scheme. If farmers' performance in the scheme area is high, "dependability" is also high.
- (4) "Equity" means even distribution of public properties. An even distribution of land in the scheme area indicates high "equity".

Form-13 Scheme Digest (Summary of Preliminary Planning for DADP) (1/2)

1. General Information	Prepared Date: _____
(1) Name of the scheme : _____ (2) Name of the scheme in the Quick Site Inspection : _____ (3) Location (any point in the scheme) : Latitude: _____ Longitude: _____ (4) Administration : Ward _____ : Village(s) _____	
2. Present Condition of the Development Area	
2.1 Present Agricultural Conditions in the Development Area	
(1) Present condition : <input type="checkbox"/> Not Cultivated <input type="checkbox"/> Cultivated (_____ ha in average year)	
(2) Present crops : <input type="checkbox"/> Paddy <input type="checkbox"/> Maize <input type="checkbox"/> Vegetable <input type="checkbox"/> Others (_____)	
(3) Present markets : _____ (_____ km from the site)	
(4) Drainage problem : <input type="checkbox"/> No problem <input type="checkbox"/> Partially affected <input type="checkbox"/> Strongly affected	
(5) Flood : <input type="checkbox"/> Scarce <input type="checkbox"/> Once a year <input type="checkbox"/> More than twice a year	
2.2 Existing Irrigation System in the Development Area	
(1) Current irrigation system : <input type="checkbox"/> Traditional <input type="checkbox"/> Improved traditional <input type="checkbox"/> Modern <input type="checkbox"/> Rainwater harvesting <input type="checkbox"/> No irrigation	
(2) Present irrigated area : _____ ha (if the scheme area is already irrigated)	
(3) Main water source : <input type="checkbox"/> Perennial river <input type="checkbox"/> Seasonal river <input type="checkbox"/> Lake/Pond <input type="checkbox"/> Groundwater <input type="checkbox"/> Spring <input type="checkbox"/> Rain for water harvesting	
(4) Name of the water source : _____	
2.3 Existing Institution (Association or Group) Related with Agriculture/Irrigation	
(1) Establishment of Institution : <input type="checkbox"/> Established in year _____ <input type="checkbox"/> Not established yet	
(2) Name of the association : _____	
(3) Registered year : _____	
(4) Number of members : _____ members	
3. Development Plan	
3.1 Irrigation System Development Plan	
(1) Development area : _____ ha	
(2) Main water source : <input type="checkbox"/> Perennial river <input type="checkbox"/> Seasonal river <input type="checkbox"/> Lake/Pond <input type="checkbox"/> Groundwater <input type="checkbox"/> Spring <input type="checkbox"/> Rain water harvesting	
(3) Name of the water source : _____	
(4) Water right : <input type="checkbox"/> Granted <input type="checkbox"/> Not granted yet <input type="checkbox"/> Intended	
(5) Required works : <input type="checkbox"/> Rehabilitation <input type="checkbox"/> New development <input type="checkbox"/> Improvement (from traditional to modern) <input type="checkbox"/> Drainage improvement	
(6) Irrigation type : <input type="checkbox"/> Gravity <input type="checkbox"/> Pump <input type="checkbox"/> Rain water harvesting	
(7) Proposed facilities : Weir <input type="checkbox"/> Concrete <input type="checkbox"/> Gabion	
(including rehabilitation) : Pump _____ nos. Main canal _____ km <input type="checkbox"/> Lined <input type="checkbox"/> Unlined	
(except facilities in the development area) : Flood dike _____ km Village access road _____ km Village bridge _____ m in total	

Form-13 Scheme Digest (Summary of Preliminary Planning for DADP) (2/2)

3.2 Agriculture Development Plan

(1) Dry season : Cropped area _____ ha Paddy Maize Vegetable

(2) Rainy season : Cropped area _____ ha Paddy Maize Vegetable

(3) Annual incremental annual agricultural benefit : _____ Tsh.

3.3 Institutional Development Plan

(1) Establishment : by year _____

(2) Type of organization : Irrigators' Association Farmers' Group

(3) Registration : by year _____

(4) Law : Association Act Cooperative Act

(5) Letter of undertaking : by year _____

3.4 Environment

Water conflict within the scheme/village Water conflict with other scheme/village

Land conflict Effect on protected area Soil erosion in the scheme

Cause of conflict (_____)

EIA : Required Preliminary assessment is required Not required

Location : Within protected area Outside of protected area

3.5 Scheme development Cost

(1) Construction : _____ Tsh.

(2) Soft component : _____ Tsh.

(3) Administration : _____ Tsh.

(4) Engineering : _____ Tsh.

(5) O&M : _____ Tsh.

(6) Replacement : _____ Tsh.

TOTAL : _____ Tsh.

Scheme development plan map should be attached.

Step-7: Identification of District Supporting Programme

Keywords

Identification of the District supporting programme required for the smooth implementation of the irrigation scheme

Why is the work required?

In addition to the irrigation scheme formulation described in the previous steps, the district supporting programme might be needed in some cases for effective implementation of the irrigation scheme.

Key for the success of the work

The district supporting programmes should be identified through review and analysis of the quick site inspection, screening, field survey, and preliminary planning.

Required inputs

1. District Project Development Team (DPDT)
2. Report on screening work for irrigation schemes along with the result of the quick site inspection
3. Field survey results for irrigation schemes selected
4. Preliminary plan for irrigation schemes selected

How is the work carried out?

Sub-step 1	Arrange the meeting for identification.	The participants to the meeting are the members of DPDT, DALDO, Ward Extension Officer (concerned), Village Extension Officer (concerned). The following analysis should be carried out in the meeting according to the procedure shown in Figure-4.
Sub-step 2	Review and analysis of the report on screening work for irrigation schemes.	Prepare the matrix of all irrigation schemes and the constraints for the smooth implementation of each scheme based on the results of the quick site inspection. Identify the common constraints that are obstructing the smooth implementation of the scheme development. Build up the effective countermeasures as District supporting programmes by taking the District priority on irrigation development into account.
Sub-step 3	Review and analysis of the field survey results and preliminary plan for irrigation schemes selected.	A similar detailed analysis should be carried out for the irrigation schemes selected based on the field survey results and preliminary plans prepared. Identify common and particular constraints and build up the effective countermeasures. If such countermeasures are judged important according to the District priority on irrigation development, consider those as additional District supporting programmes.
Sub-step 4	Identification of the District supporting programme.	The District supporting programmes suitable for inclusion in DADP will be decided by analyzing all the above mentioned programmes. This process should be carried out by focusing on the activities required for the smooth implementation of the irrigation scheme.

Box

Meaning of District Supporting Programme

The district supporting programmes are considered to be programmes that contribute to solve the common problems in the irrigation sub-sector of a district or to assist non-mature irrigation schemes in reaching consensus etc. Other programmes may be adopted to strengthen the management of scheme implementation, to enhance the benefits of irrigation, and to sustain the implemented irrigation. Only improvement plans for problems of the irrigation sub-sector should be proposed.

Figure-4 Flow of District Supporting Programme Identification

Sub-step 2 Review and Analysis of Quick Site Inspection Results					
Findings through Quick Site Inspection					
Constraints	Scheme-1	Scheme-2	Scheme-3	-----	Scheme-n
Insufficient capacity of DPDT to execute irrigation projects	○	○	○		○
Insufficient Participation of Farmers in Irrigation Development Programme	○		○		
Insufficient Skill of Farmers on Scheme Management and O&M of Irrigation Facilities					○

↓

Extraction of Necessary Countermeasures

Sub-step 3 Review and Analysis of Field Survey Results					
Findings through Field Survey					
Constraints	Scheme-1	Scheme-2			
Insufficient experience of both DPDT and farmers in irrigation	○	○			
Insufficient Function of Irrigators' Association		○			
Insufficient Experience of Farmers in Rice Production		○			

↓

Extraction of Necessary Countermeasures

Sub-step 4 Identification of the District Supporting Programme	
<p>Identification of the District Supporting Programme</p> <p>Conceivable Countermeasures</p> <ul style="list-style-type: none"> - District Staff Capacity Building Programme - Farmers' Participation in Irrigation Development Programme - Farmers' Participation Training Programme - Village Irrigation Development Guideline Establishment Programme - Farmers' O&M Manual Establishment Programme - District Staff and Farmers' Study Tour Programme - Irrigators' Association Establishment Programme (for existing schemes) - Irrigated Agriculture Training Programme for Rice Production Increase <p style="text-align: center;">↓</p> <p>Identification of the Effective Countermeasures</p> <p style="text-align: center;">↓</p> <p>Identification of the Candidate District Supporting Programme</p>	

For new development schemes, an irrigators' association should be formed only after the scheme development is budgeted in a DADP. Establishment without available budget may lead to farmers being disappointed.

Step-8: Design of District Supporting Programme

<u>Keywords</u> Design the District supporting programme by using matrix format.	
<u>Why is the work required?</u>	
To shape the required actions for the identified District supporting programme.	
<u>Key for the success of the work</u>	
Logical thinking is the key to the success of the work. All the activities should be related to the goal of the plan, and the inputs should be required to conduct the activities.	
<u>Required inputs</u>	
1. District Project Development Team (DPDT) 2. District supporting programme digest (Form-14)	
<u>How is the work carried out?</u>	
Sub-step 1 Identification of target group	Identify target group (the group who will be improved by the District supporting programme) of the District supporting programme. Fill the column "Target Group" of Form-14 to answer the following question. 1) Who should be improved?
Sub-step 2 Setting the goal	Set the only one goal of the District supporting programme (goal of the activities). Fill the column "Goal" of Form-14 to answer the following question. 1) What should be achieved?; and 2) By when the target should be achieved?.
Sub-step 3 Required activities to achieve the goal	Determine the activities required to achieve the goal. The activities should be detailed actions to be taken. Fill the column "Activities" of Form-14 to answer the following questions. 1) Required activities to achieve goal. 2) Who will take action?; and 3) Tentative time schedule.
Sub-step 4 Required inputs to conduct activities	Identify the required inputs to conduct the activities. Fill the column "Input" of Form-14 to answer the following question. 1) What is required to conduct the activity? and 2) What is the quantity of the input required?
Sub-step 5 Give a suitable title of the programme	Give a suitable title to the District supporting programme and enter it in Form-14.



Form-14 District Supporting Programme Digest

1) Title of the District Supporting Programme		Planned Date	
2) Target Group (Who will benefit from the plan?)			
3) Goal of the Programme (should be only one)			
(What is the outcome of the plan?)		(By when should it be achieved?)	



4) Activities (Required activities to achieve the goal of the programme)		
(Activities)	(Who will take action?)	(Time Schedule)
a)		
b)		
c)		



5) Inputs (Required inputs to conduct the activities)			
(Activities)	(Required Manpower)	(Required Equipment)	(Cost)
a)			
b)			
c)			
			(Total)

Note: This sheet is applicable to present the plan for one programme.

Step-9: Preparation of Irrigation Scheme Formulation Plan Report

<p><u>Keywords</u> Compilation of all results of field survey, preliminary planning, prioritization and District supporting programme</p>

<u>Why is the work required?</u>	
The DPDT should submit a report to ZIU containing all the results of the field survey, preliminary planning, prioritization, and District supporting programme.	
<u>Key for the success of the work</u>	
To compile such a wide range of information, the various forms filled for each scheme in the course of the irrigation scheme formulation should be utilized efficiently.	
<u>Required inputs</u>	
<ol style="list-style-type: none"> 1. District Project Development Team (DPDT) 2. All the forms filled for each scheme in the course of irrigation scheme formulation 3. Maps created in the course of irrigation scheme formulation 4. Form to summarize irrigation scheme formulation plan (Form-15) 	
<u>How is the work carried out?</u>	
Sub-step 1 Decide contents of the irrigation scheme formulation plan for DADP this year	Decide what kinds of activities are most important for irrigation development in the district for DADP for the year being planned.. Basically, development of the first priority scheme or a combination of the first priority scheme and a District supporting programme are recommendable. However, if the first priority scheme is not well matured (insufficient consensus or motivation), the district supporting programme should be proposed for this year and scheme development can be postponed.
Sub-step 2 Summarize the irrigation scheme formulation plan	Finalize the plan by using Form-15. <ol style="list-style-type: none"> 1) Allocate the cost of operation and maintenance and replacement cost for the schemes in operation (farmers contribution can be considered) 2) Allocate the cost of irrigation scheme formulation for this DADP period. 3) Estimate the cost required for scheme development, if there is a recommendable scheme. 4) Estimate the cost of the district supporting programme, if any. 5) Calculate the total cost of irrigation development under this DADP.
Sub-step 3 Prepare the report on the irrigation scheme formulation plan	Prepare the irrigation scheme formulation plan report to explain how DPDT reached its conclusions. All the completed forms (Form-3 to Form-15) and the scheme development plan map should be attached to the report. In case all the selected schemes are judged unsuitable or not mature for implementation and there is no candidate scheme at this stage, the reason should be mentioned in the report.
Sub-step 4 Submit the report to ZIU	DPDT will submit the report to ZIU for validation and agreement.

Form-15 Summary of Irrigation Scheme Formulation Plan

Irrigation Scheme Formulation Plan for DADP		for Fiscal Year	
Name of District		Planned Date	
1) Operation & Maintenance Cost and Replacement Cost for Schemes in Operation			
List of schemes in operation (use additional sheet if there are more than three schemes)			
(a)	:	_____	Tsh.
(b)	:	_____	Tsh.
(c)	:	_____	Tsh.
TOTAL	:	_____	Tsh. (I)
2) Scheme Formulation Planning Cost for Next DADP			
Required cost for scheme formulation planning for next DADP :			_____ Tsh. (II)
3) Scheme Development Plan			
Name of the scheme _____			
<u>1. Overall Scheme Development Cost</u> (can be obtained from Form-13)			
(1) Construction	:	_____	Tsh.
(2) Soft component	:	_____	Tsh.
(3) Administration	:	_____	Tsh.
(4) Engineering	:	_____	Tsh.
(5) O&M	:	_____	Tsh.
(6) Replacement	:	_____	Tsh.
<u>2. Initial Investment Cost</u>			
(a) Initial investment cost	:	_____	Tsh. Total of (1) to (4) of 1.
(b) farmers' contribution	:	_____	Tsh. standard is 15% of 1-(1) (construction)
(c) by District government	:	_____	Tsh. (a) - (b)
<u>3. Phase-wise Development Plan</u> (should be finalized after Step-12)			
(if there is no phase-wise development, enter all the initial investment cost (c) into Phase-1)			
Phase-1	:	_____	Tsh. in fiscal year _____
Phase-2	:	_____	Tsh. in fiscal year _____
Phase-3	:	_____	Tsh. in fiscal year _____
Phase-4	:	_____	Tsh. in fiscal year _____
Phase-5	:	_____	Tsh. in fiscal year _____
TOTAL	:	_____	Tsh. (should be same as (c) in 2.)
Scheme development cost for this year			_____ Tsh. (III)
4) District Supporting Programme			
Title and cost of the plan (use additional sheet if there are more than three plans)			
(a)	:	_____	Tsh.
(b)	:	_____	Tsh.
(c)	:	_____	Tsh.
TOTAL	:	_____	Tsh. (IV)
5) Cost of Irrigation Scheme Formulation for DADP			Tsh. (total of (I)-(IV))

Step-10: Validation and Agreement by Zonal Irrigation Unit

<u>Keywords</u> Validation and agreement with objectivity and transparency	
<u>Why is the work required?</u> The irrigation scheme formulation plan was formulated by the DPDT. This formulation work calls for accountability to all stakeholders since the prepared plan is closely related to the implementation. In this sense, validation and agreement by a third party is essential.	
<u>Key for the success of the work</u> The specific review team formed at Step-4 should be engaged in the review on the report submitted by DPDT to maintain the consistency from screening through to District supporting programme.	
<u>Required inputs</u> 1. Zonal Review Committee (ZRC) 2. District Project Development Team (DPDT) 3. Irrigation scheme formulation Plan Report	
<u>How is the work carried out?</u>	
Sub-step 1 Review the report of irrigation scheme formulation plan	The review should focus on the following items: - Field survey results on each irrigation scheme - Preliminary development plan on each irrigation scheme - Procedure of prioritization - Scheme digest - District supporting programme digest
Sub-step 2 Prepare and send the questionnaire on the report if finding unclear parts in it	The review committee should send letters to the DPDT if unclear parts are found, or it should visit the site together with staff of DPDT.
Sub-step 3 Visit the scheme site	Visit the scheme site together with DPDT and confirm the site conditions.
Sub-step 4 Prepare the review papers on the irrigation scheme formulation plan	The review committee should prepare the review papers by compiling the review results.
Sub-step 5 Issue a validation and agreement letter to the DPDT	The Zonal Irrigation Engineer, on behalf of ZIU, will submit a "validation and agreement letter" to DPDT. The letter should be accompanied by the review papers.



Step-11: Feedback Workshop for Selected Irrigation Schemes

<u>Keywords</u> Inform results of irrigation scheme selection to villagers	
<u>Why is the work required?</u>	
Since the field survey process was carried out with the full cooperation of the villagers, the study results should be fed back to the villagers through a workshop.	
<u>Key for the success of the work</u>	
Suitable explanation is needed to convince the villagers of the appropriateness of the scheme selected as the first priority candidate for DADP and why other schemes were not selected.	
<u>Required inputs</u>	
1. District Project Development Team (DPDT) 2. DALDO 3. Zonal Review Committee (ZRC) 4. Irrigation Scheme Formulation Report	
<u>How is the work carried out?</u>	
(1) For the scheme selected as the candidate of DADP	
Sub-step 1(a) Inform villagers that the scheme was selected as the first candidate for the DADP	<p>DALDO and DPDT should explain the followings.</p> <p>1) <u>Possibility of implementation</u> Clearly explain to the villagers that the scheme was only selected as a candidate for the DADP, and the DPDT cannot promise to implement the scheme. Explain that a long process will be followed before implementation, and there is a chance that problems may arise during further study that could postpone implementation. However, the DPDT should explain that they will try their best to promote the scheme development.</p> <p>2) <u>Boundary of the development area</u> Inform the villagers that the boundary of the development area under this study could be adjusted for technical reasons depending on the results of further detailed study.</p> <p>3) <u>Making consensus within the village(s)</u> Explain to farmers that mutual understanding between farmers within and outside the development area is essential to promote the scheme development.</p> <p>4) <u>Irrigable area in the dry season</u> Explain to farmers that the irrigation system might not irrigate all the development area in the dry season due to insufficient water resources, so internal arrangements such as yearly rotation may be needed.</p> <p>5) <u>Necessity of establishing organization in future</u></p> <p>6) <u>Necessity of obtaining water right under guidance of DPDT and Ministry of Water and Livestock, if it is not obtained yet</u></p> <p>7) <u>Necessity of paying irrigation fee after implementation</u></p>
<div style="border: 1px solid black; background-color: yellow; padding: 5px; width: fit-content;"> <p>Explain to farmers that DPDT prepared the plan using a scientific approach</p> </div>	
(2) For the scheme not selected as a candidate of DADP on this occasion	
Sub-step 1(b) Explain the study results to villagers so that they understood that the scheme is still in the candidate list for future consideration	<p>DALDO and DPDT should explain the following.</p> <p>1) <u>Results of the study</u> The situation should be explained clearly that the scheme was not selected as a candidate for DADP in this year.</p> <p>2) <u>Future chance of implementation</u> Inform the villagers that there would be future chances for the scheme to be accepted as a candidate. Furthermore, the major reasons why the scheme was not selected as a candidate should also be explained clearly referring to the irrigation scheme formulation plan report. If there are any points that can be improved by the villagers, those points should be informed in order to encourage villagers for their future efforts.</p>

Step-12: Finalizing Irrigation Scheme Formulation Plan for DADP

Keywords

Revise and finalize irrigation scheme formulation plan according to the DASAC suggestions.

Why is the work required?

There are plural sub-sectors in the agriculture sector. Not all development schemes from the various sub-sectors are inserted in the DADP because of limited budget allocated. Therefore, the prepared irrigation scheme formulation plan should be submitted to the District Agricultural Sector Advisory Committee (DASAC) as a candidate development plan from the irrigation sub-sector. Phase-wise development should be considered if the budget is not enough for developing all the area at once.

Key for the success of the work

The prepared irrigation scheme formulation plan should be presented in precise form to enable the DASAC to easily understand the contents.

Required inputs

1. District Project Development Team (DPDT)
2. Scheme digest and District supporting programme digest
3. DASAC

How is the work carried out?

Sub-step 1	Submit prepared plan to DASAC	Submit Form-13 to 15 to DASAC for evaluation.
Sub-step 2	Consider phase-wise development if necessary	If DASAC requests the development cost for this year to be reduced, phase-wise development should be considered. Basically, meeting O&M costs for existing irrigation schemes should be the first priority, and irrigation scheme development or district supporting programmes follow. After receiving comments from DASAC, revise Form-15. <u>For phasing</u> If severe flood in the development area is anticipated, a flood dike should be constructed prior to the irrigation facilities to prevent the irrigation facilities being washed away by flood.
Sub-step 3	Submit final plan to DASAC and ZIU	Submit revised Form-13 to 15 to DASAC and also to the ZIU. Ask the ZRC to send them to the DITS data and information management unit.

Box

Phase-wise Development

In preparation of development plans for irrigation schemes, attention should be paid to the work volume and time required and the available budget. If the required work volume could not be fulfilled within the budget of a single year, then phase-wise development is an option.

Example:

- (1) Separate the study/design phase from the implementation phase
- (2) Separate the implementation into several packages considering progressive expansion of the irrigation and drainage canal network.

Section 4

Process of Irrigation Development

after DADP Stage



Section 4 Process of Irrigation Development after DADP Stage

(1) General

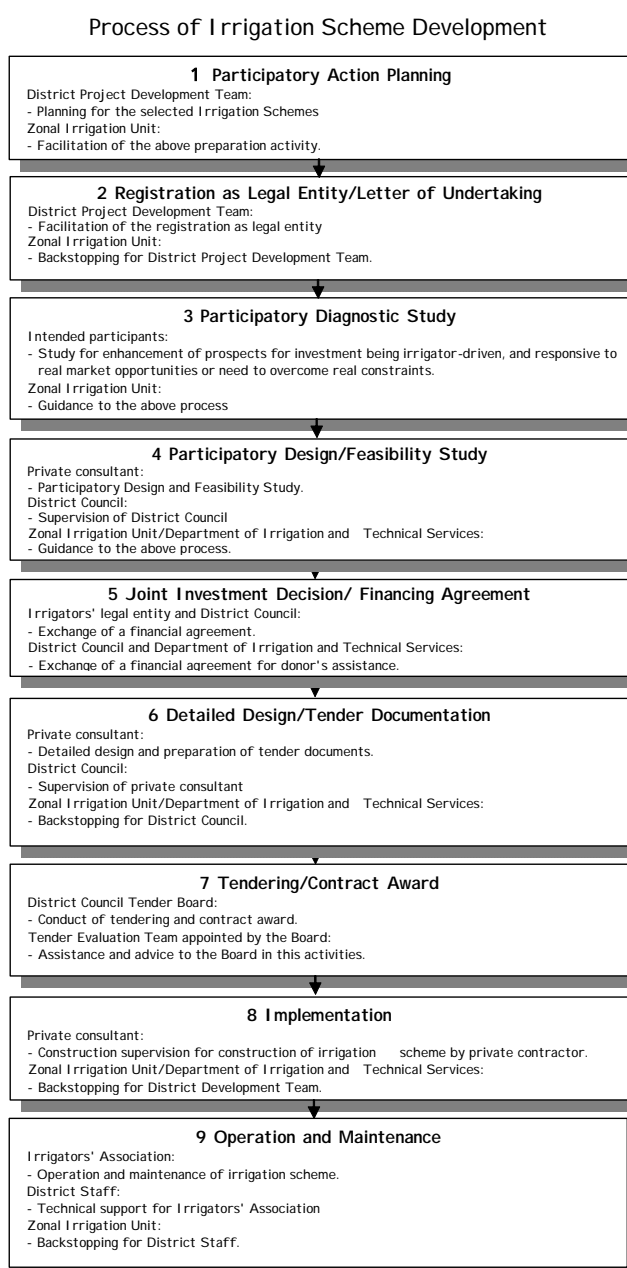
The irrigation schemes included in DADP will be developed based on the Guidelines for Participatory Improvement to Farmer Initiated and Managed Smallholder Irrigation Schemes, July 2003. The proposed process of irrigation scheme development after selecting an irrigation scheme, as presented in the guidelines, is outlined hereinafter (refer to the said guidelines for details).

(2) Process of Irrigation Scheme Development after Selection

After a scheme is selected for a DADP, the scheme will be developed with a participatory approach. The process is composed of the following nine stages:

- 1 Participatory Action Planning,
- 2 Registration as Legal Entity/Letter of Understanding,
- 3 Participatory Diagnostic Study,
- 4 Participatory Design/Feasibility Study,
- 5 Joint Investment Decision/ Financing Agreement,
- 6 Detailed Design/Tender Documentation,
- 7 Tendering/Contract Award,
- 8 Implementation
- 9 Operation and Maintenance.

The beneficial irrigators, as the main actors, will mostly take part in activities at these stages. The government agencies concerned at each stage are shown in the figure at right.



The activities mentioned in the guidelines are re-iterated as follows:

Major Activities at each Stage

Stages	Major Activities
1 Participatory Action Planning	Series of short planning workshops: - to identify the nature of intervention intended by irrigators - to define allocation of responsibilities for meeting costs of the preparatory activities
2 Registration as Legal Entity/Letter of Undertaking	- Registration of the scheme as an association/cooperative/company as preferred by the membership under existing legislation/regulations - Preparation and signature of LoU from scheme to District Council
3 Participatory Diagnostic Study	- Participatory analysis of opportunities and constraints, construction of problem and objective trees - Collection of supporting baseline data
4 Participatory Design/Feasibility Study	- Joint study among the scheme members, other stakeholders and specialists - Submission of results to irrigators' entity for approval/veto
5 Joint Investment Decision/ Financing Agreement	- Consideration and acceptance of positive Feasibility Report by all financiers - Preparation and signature of agreements
6 Detailed Design/Tender Documentation	- Detailed subproject design and study
7 Tendering & Contract Award	- Selection and employment of consultants following District Government - Procurement of goods and works following regulations or District Government
8 Implementation	- Joint effort between various actors involved, including especially the irrigators' entity
9 Operation and Maintenance	- To be defined through Participatory Diagnostic Study and Feasibility Study

Source: Guidelines for Participatory Improvement to Farmer Initiated and Managed Smallholder Irrigation Schemes, July 2003

In order to fulfill these activities successfully, the ZIU needs to provide the district staff with support in close communication.

(3) Flexible Management to Development Process

The Guidelines show the timeframe for development. According to the timeframe, two years would be required for study, design and tendering before implementation. On the other hand, the development scales of irrigation schemes cover a large range of sizes: 10 ha to 500 ha for small-scaled irrigation schemes. In addition, each irrigation scheme has a different level of maturity. Considering these points, some stages mentioned above might be skipped or the time shortened depending on the conditions of the irrigation schemes. Flexible management is needed.

Section 5

Use of the Database System in Irrigation Scheme Formulation



Section 5 Use of the Database System in Irrigation Scheme Formulation

(1) General

A simple database system was established to share the data and information with the District Government and to grasp the progress of irrigation development executed by the District Government. The database system was composed of two parts: Irrigation Database and Irrigation GIS. The database system will be housed in DITS of MAFS. The District Government is able to contact this database system at any time as or when required. In this section, an outline of the database system is presented.

(2) Useful Data should be obtained from the Database System

The following types of useful information are available in the database system. It is proposed that such data be obtained before you start the irrigation development planning.

Useful information stored in the irrigation database

- Result of the inventory survey of irrigation schemes conducted in year 2002
- 1:250,000 and 1:50,000 topographic maps (maps are scanned and stored in the computer, so users should carefully confirm the scale of maps to be printed and retrieved. The dataset is not completed, since some original maps are not available. See **Figure-5** for the index.)
- Useful design criteria and reference documents related to irrigation

Useful information stored in the irrigation GIS

- Rainfall maps
- Land cover maps
- Land unit maps
- Soil type maps
- Agro-ecological maps
- Protected areas maps

(3) Feedback Planning Results to the Database System

It is strongly recommended that the results of the irrigation scheme formulation be sent to the database system, since one of the most important roles of MAFS is responsibility for irrigation scheme planning for the whole country.

(4) Approach to the Database System

Presently, the data stored in the database system at KILIMO III is not ready for distribution via the Internet. Therefore, the District Government and other agencies concerned are kindly requested to contact the "Data and Information Management Unit" of DITS of MAFS by fax and/or telephone. The postal services can also be used to share data and information between the both.

Box

Data and Information Management Unit

Persons in charge: Eng. January Kayumbe and Mr. Amandus Lwena
 Telephone/Fax: 022-2865426
 Address: Department of Irrigation and Technical Services, Kilimo House III,
 Temeke, P.O.Box 9192, Dar es Salaam

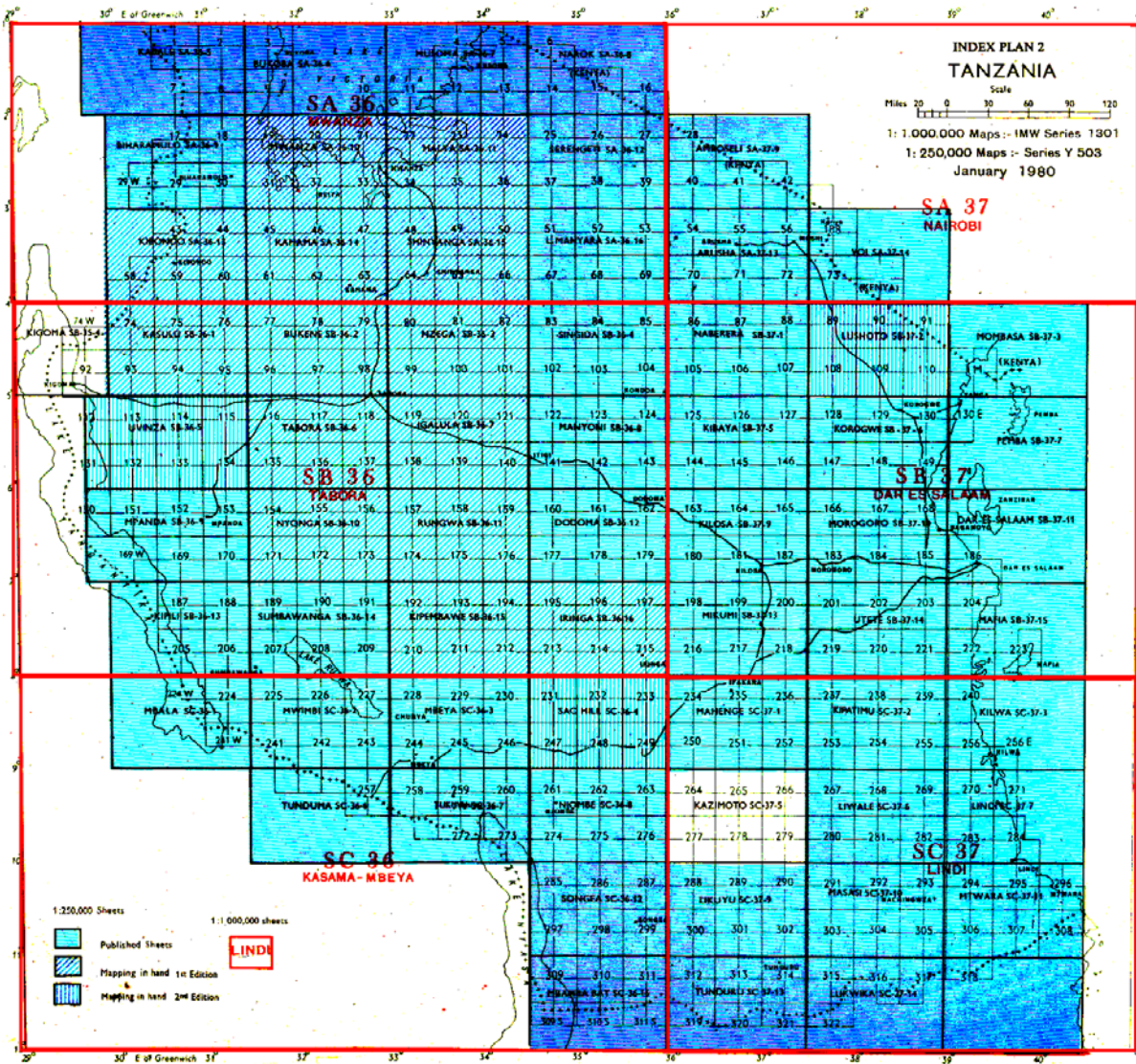
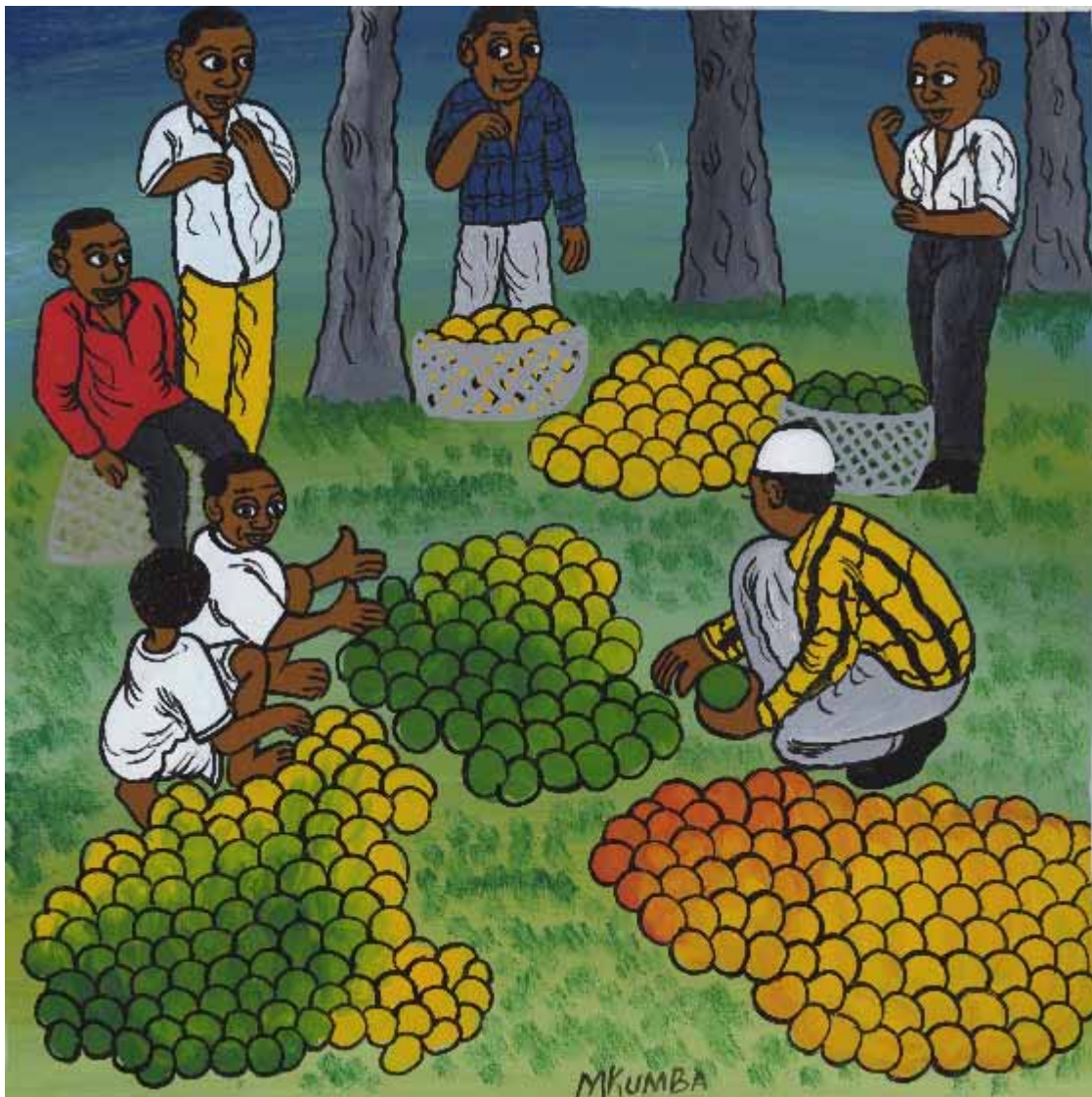


Figure-5 Index of Topographic Maps

Attachments



Attachment-1

Relevant Guidelines and Manuals

Relevant Guidelines and Manuals

1. Guidelines for District Agricultural Development Plans (DADPs)

A DADP is a three-year rolling plan of agricultural sector development at the district and field levels under Sub-Programme A specified in the Agricultural Sector Development Programme (ASDP). The guidelines for preparation of DADPs were issued in January 2003, and the 1st DADPs were prepared in March 2003. The guidelines were then revised in November 2003. In these revised guidelines, the District Government, as a mediator, is requested to play the following three roles: (i) Interpret the national policy and budget guidelines according to the district situation, (ii) Develop a district vision based on external and internal analyses, and (iii) Select project plans prepared by villagers. The guidelines present the following step wise explanation on the process of preparing DADPs.

Process for DADP Preparation

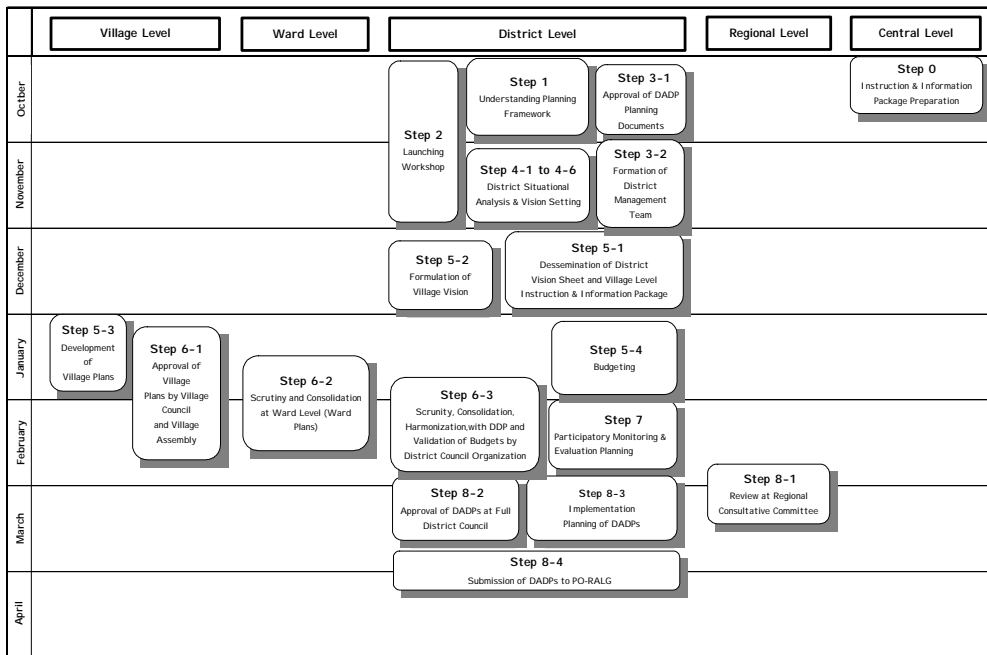
Step	Activities	Responsible Agency	Timing
0	Instructions & Information Package Preparation	ASLMs, PO-RALG and ASDP Secretariat	October
1	Understanding Planning Framework	DALDO	October
2	Launching Workshop	DALDO	October-November
3	Planning Team Formation	DALDO	October-November
4	District Situational Analysis & Vision Setting	DASAC	November
5	Development of Village Plans	DPDT and Villagers	December-January
6	Approval of Village Plans	Village Assembly, WDC and DASAC	January-February
7	Participatory Monitoring & Evaluation Planning	DASAC	February
8	Submission of DADPs	RCC, District Council and DASAC	Late February- Early April

Source: Guidelines for District Agricultural Development Plans, November 2003

Note: ASLMs (Agricultural Sector Lead Ministries: MAFS, MCM and MWLD), PO-RALG (President's Office-Regional Administration and Local Government), DALDO (District Agriculture and Livestock Development Officer), WDC (Ward Development Committee), DASAC (District Agricultural Sector Advisory Committee), RCC (Regional Consultative Committee)

The following figure shows a step wise explanation on the process of preparing DADPs.

DADPs Step Wise Planning Process



In addition, the guidelines introduce the official participatory planning methodology endorsed by the Central Government to obtain project plans from villages. This methodology, which is called Opportunities and Obstacles to Development (O & OD), is outlined below:

Participatory Planning Methodology (Opportunities and Obstacles to Development)

No.	Activities
1	Launching meeting in Village Assembly
2	Spatial data collection - Village sketch map: map community resources, features and boundaries. - Transect walk: verify information gathered on the village sketch map and identify opportunities and obstacles through a year.
3	Time related data collection - Historical time lines: list events and interventions useful for improving future actions for similar events. - Seasonal calendar: present large quantity of diverse information over a definite timeframe and determine whether there are periods of opportunities and obstacles through a year.
4	Social data collection - Focus groups discussion: improve different groups, i.e., women, men, young people and vulnerable groups, and develop village-based plan. - Gender daily calendar: generate information on gender distribution of labor based on age and sex. - Gender resource map: learn who owns, who controls, who provides labor and who is responsible over resources, based on sex.
5	Formulation of village plan Include other secondary data obtained from village and village institutions and primary schools and dispensaries.
6	Approval of village plan at Village Assembly

Source: Guidelines for District Agricultural Development Plans, November 2003

The Guidelines for Irrigation Scheme Formulation will be worked out in the framework of the guidelines for preparation of DADPs.

2. Other Relevant Guidelines and Manuals for Irrigation Development

There are many relevant guidelines and manuals that have been mostly prepared in the DITS of MAFS on an individual project basis. These are:

- Guidelines for Participatory Improvement to Farmers Initiated and Managed Smallholder Irrigation Schemes, July 2003
- Project Planning Manual (See Attachment-1)
- Irrigation Design Manual (See Attachment-1)
- Rainwater Harvesting Design Manual for Irrigated Agriculture in Marginal Areas (See Attachment-1)
- Irrigation Water Management Field Handbook for Extension Staff (See Attachment-1)

For the District staff's information and reference, the key issues covered by these guidelines and manuals are briefly explained as follows:

(1) Guidelines for Participatory Improvement to Farmers Initiated and Managed Smallholder Irrigation Schemes, July 2003

The guidelines were prepared for use in national, regional and district level programmes for all types of improvement of farmer-initiated and farmer-managed irrigation schemes, in a sector-wide framework proposed in ASDP. The guidelines were compiled for rehabilitation and/or improvement of existing irrigation schemes; however the principles embodied in them would be applicable for new development schemes. The guidelines adopt an eleven-step approach to participatory planning and implementation of cost-effective, profitable, farmer-initiated and farmer-managed smallholder irrigation investment projects. The eleven steps are as follows:

Step-by-Step Approach

No.	Activities
0	Selection of Districts
1	Selection of Schemes
2	Participatory Action Planning
3	Registration as Legal Entity/Letter of Undertaking
4	Participatory Diagnostic Study
5	Participatory Design/Feasibility Study
6	Joint Investment Decision/Financing Agreements
7	Detailed Designs/Tender Documents
8	Tendering/Contract Award
9	Implementation
10	Operation & Maintenance

Source: Guidelines for Participatory Improvement to Farmer Initiated and Managed Smallholder Irrigation Schemes

As can be seen in this table, the guidelines do not indicate how to pick up the irrigation schemes from the farmers through the Village Government. All irrigation schemes are assumed to be in the hands of the District Offices. Therefore, the process starts from the selection of schemes in the District Office, although selection of districts is preferentially mentioned assuming the programme support by donors.

In each step of irrigation scheme development process under DADP, the guidelines clearly state "Why", "How", "Who" and the results. Such an approach enables the District staff concerned to easily understand the development process, so the guidelines are extremely useful to them.

(2) Project Planning Manual

The manual consists of the following eleven sections:

Composition of Manual

Section	Title
1	Preliminary Appraisal of Proposed Irrigation Schemes
2	Topographic Surveys
3	Soil Survey and Land Classification
4	Climate and Hydrology
5	Socio-economic Surveys
6	Agronomy
7	Irrigation Water Requirements
8	Engineering
9	Organization, Operation and Maintenance
10	Financial and Economic Analysis
11	The Feasibility Report

The manual was prepared to provide guidelines on investigation and studies necessary for feasibility study. It covers almost all items necessary for irrigation scheme planning from survey to project evaluation, although planning for rain water harvesting is not included. It seems that the manual focuses on medium- to large-scaled schemes, the so-called modern irrigation schemes in Tanzania, and its contents are sufficient to target relatively sophisticated irrigation systems. The manual states that the main users of the manual are expected to be the staff of project planning of ZIU and DITS of MAFS. In this sense, the manual might be unwieldy for less experienced users, but is a good guideline for persons of middle standing who want to accumulate further knowledge.

(3) Irrigation Design Manual

The manual is composed of two volumes: guidelines and drawings. The guidelines consist of the following ten chapters:

Composition of Guidelines

Chapter	Title
1	Project Identification Process
2	Site Investigation and Survey
3	Water Resources Studies
4	Water Demand
5	Drainage of Agricultural Lands
6	Irrigation Scheme Design
7	Design of Structures and Infrastructure
8	Design of Diversion Weirs
9	Design of Silt Excluders
10	Drawing Office Standards

The guidelines present the activities necessary for design works along with detailed exercises. The guidelines might be useful for the government staff/experts with some experiences in irrigation design works, but troublesome for those with less experience, such as District staff, because most of the guidelines were prepared by reference to technical papers like FAO Irrigation and Drainage Papers. In addition, the guidelines do not deal with methodology for participatory design, which is now a fundamental requirement.

(4) Rainwater Harvesting Design Manual for Irrigated Agriculture in Marginal Areas

This manual was prepared in the Participatory Irrigation Development Programme (PIDP) for the design of rainwater harvesting, presently a high priority approach in marginal areas. Its contents are tabulated below:

Composition of Guidelines

Chapter	Title
1	Techniques and Identification Process
2	Site Investigation and Survey
3	Water Resources Studies
4	Scheme Water Demand
5	Earth Dams and Levees
6	Drainage of Agricultural Lands
7	Irrigation Scheme Design
8	Design of Irrigation Infrastructure
9	Design of Diversion Weirs
10	Design of Silt Excluders
11	Scheme Cost Estimation

Of the eleven chapters, only a few chapters are original; the remaining chapters are copies of the Irrigation Design Manual mentioned previously.

(5) Irrigation Water Management Field Handbook for Extension Staff

This handbook was prepared under the Agricultural Sector Programme Support (ASPS), aiming to provide extension field personnel with

information on irrigation water management and to build their skills and capacities. The handbook is composed of the following ten chapters:

Composition of Handbook

Chapter	Title
1	Introduction
2	Source of Water
3	Measurement of Irrigation Water
4	Irrigation Systems and Water Application Methods
5	Basic Soil-Water Plant Relationships
6	Crop Water Requirement
7	Operation of Irrigation Facilities and Structures
8	Drainage
9	Maintenance, Repair and Rehabilitation of Irrigation Facilities and Structures
10	Organization of Irrigators' Association
11	Environmental Issues in Irrigation Systems

The handbook is prepared to be easily understandable for extension officers for water management. The handbook treats not only technical issues, but also the formation, registration and operation of irrigators' associations. Furthermore, the handbook refers to the environmental issues brought by irrigation development, such as (i) soil degradation, (ii) deterioration of groundwater quality, (iii) deterioration of surface water quality, and (iv) water logging. Ways and means to remedy these problems are also clarified in the handbook. With these contents, the handbook provides important reference information for the District staff in other agricultural fields as well as the extension workers.

Attachment-2

*Summary of
the National Irrigation Master Plan*

Summary of the National Irrigation Master Plan

[Background]

The National Irrigation Development Plan (NIDP) prepared in 1994 requires revision due to its unsatisfactory implementation and the need for consistency with the new government policies, i.e., the "Agriculture and Livestock Policy, 1997", "Tanzania Development Vision 2025, 2000", and the "Agricultural Sector Development Strategy, 2001". The Government of Tanzania (GOT) therefore requested the Government of Japan (GOJ) to extend technical assistance and undertake the Study on the National Irrigation Master Plan (NIMP). The GOJ agreed to this request, and a Scope of Work was signed by both parties on April 10, 2001. "The Guidelines for Irrigation Scheme Formulation for DADP" were prepared as a part of the activity of NIMP study.

[Objectives]

- Formulate the Master Plan for irrigation development at a national level with a target year of 2017
- Carry out technology transfer to the counterpart personnel through on-the-job training in the course of the Study

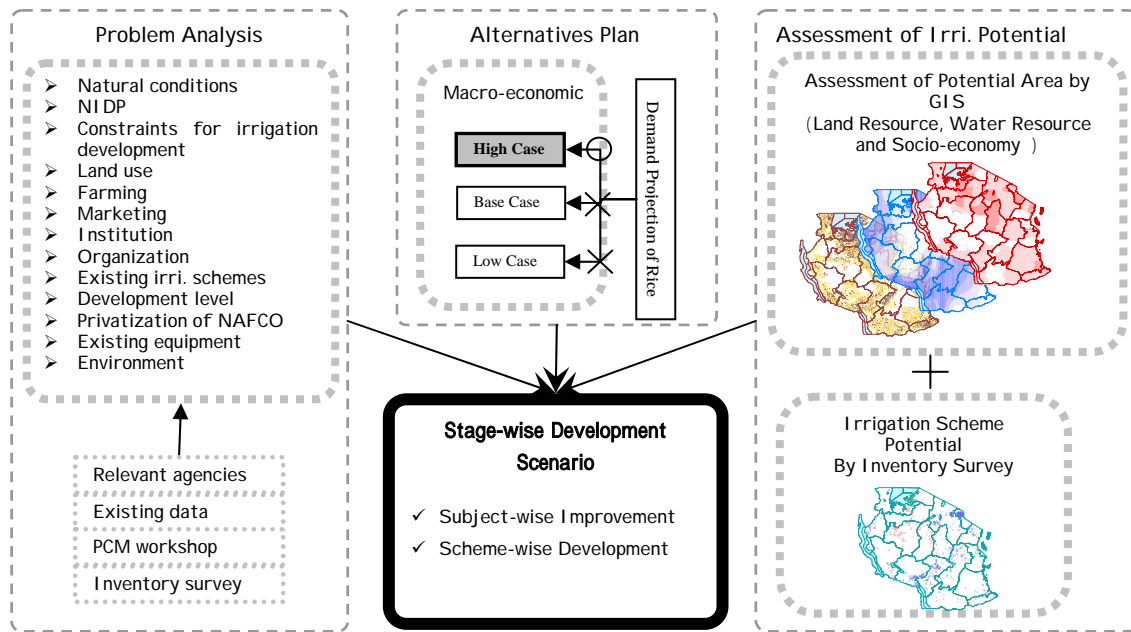
[Methodology of Study]

There is no doubt that irrigation contributes to the stabilization of agricultural production. However, irrigation by itself could not realize the remarkable increase of agricultural production without interventions from other sub-sectors such as agricultural inputs and extension services. The other sub-sectors therefore require to be developed in close co-ordination with the irrigation sub-sector to achieve a significant increase in agricultural production.

The ASDS defines that its primary objective is to create an enabling and conducive environment for improving the productivity and profitability of the agricultural sector as the basis for improved farm incomes and rural poverty reduction in the medium and long term. In consideration of the strategic activities/interventions stipulated in the ASDS and philosophy employed in the NIDP and also the study results, "*Sustainable Irrigation Development*" was selected as a purpose of the NIMP with emphasis on comprehensive measures through "*Effective Use of National Resources*", to largely contribute to attainment of the primary objective of ASDS. "*Sustainable Irrigation Development*" means the establishment of technically and financially self-reliant irrigation schemes through institutional and organizational strengthening/reform.

The study first conducted problem analysis on the existing irrigation schemes and assessed irrigation potential. Based on these results, a stage-wise development scenario was worked out for 15 years from 2003 to 2017 in a well considered framework of policy, macro-economy and demand projection of staple food. The NIMP was formulated with the two ideologies of Subject-wise Improvement and Scheme-wise Development, and close linkage between them, as a strategic approach to sustainable irrigation development. The following is a flow chart showing how NIMP was formulated.

Formulation Flow of National Irrigation Master Plan



The major points covered in the study are discussed below.

[Problem Analysis]

In the Study, problem analysis was carried out from the results of five PCM workshops and an inventory survey of 1,428 existing and proposed irrigation schemes as well as data collected from the relevant agencies.

《PCM Workshops》

Subjects and participants of the respective PCM Workshops are given in the table at right.

In the Study, the PCM Workshops were held five times, and then objective analysis was made for problem analysis for each subject.

《Inventory Survey》

An analysis was made for 1,428 irrigation schemes consisting of 739 irrigation schemes inventoried by the World Bank and

689 irrigation schemes recorded in the NIMP Study, which totally covered all of mainland Tanzania. The inventory survey indicated a total irrigation area of 854,000 ha.

[Assessment of Irrigation Potential Area]

In general, irrigation development potential is assessed from the water resources potential and land resources potential only. In the NIMP Study, socio-economic potential was also taken into consideration, because marketing conditions are very important for irrigation development and

PCM Workshops

Subjects	Participants
Awareness on irrigation management	Irrigation Section of MAFS Zonal Irrigation Units
Ineffective performance of irrigation section	Irrigation Section of MAFS Zonal Irrigation Units Project Manager of Irrigation Projects
Poor support to irrigation farming by Local Government	District Governments Extension Workers
Water scarcity on farm plots	Irrigators' Associations Extension Workers
Poor development of irrigation farming	Farmers' Representatives District Government

have a large influence on the selection of irrigation schemes. The possible extent of irrigation development was determined by preparing and overlaying the assessment maps for the respective potentials mentioned above. The, locations of existing irrigation schemes were then inventoried and plotted on the irrigation potential map to examine the consistency between the map and existing irrigation schemes. The results were used for preparing a regional development plan. Indicators employed for assessment were as follows:

«Land Resources Potential»

Land resources potential was assessed using land cover, topography and land unit maps, as shown in the figure at right.

«Water Resources Potential»

Areas of high water resources potential were defined as those with an average annual specific run-off of more than 1.0 m³/sec/500km².

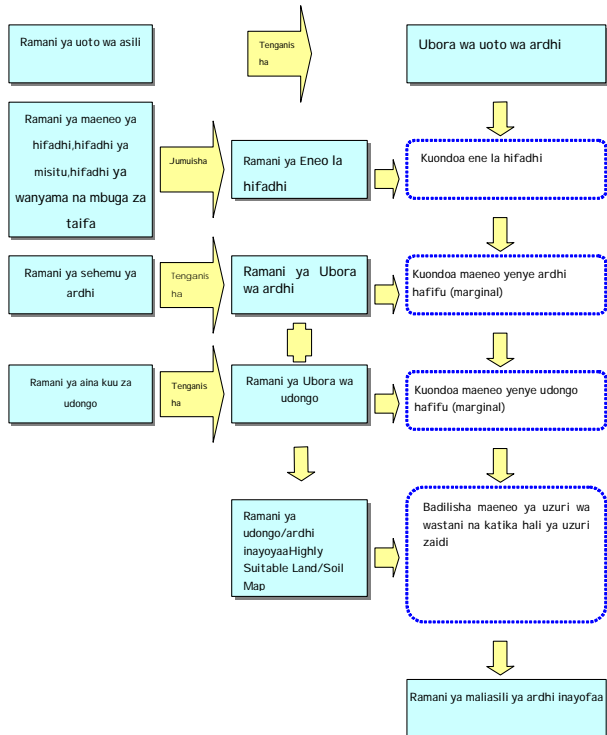
«Socio-economic Potential»

Socio-economic potential was assessed using three indicators: population density, road density, and food production, as shown in the figure at right.

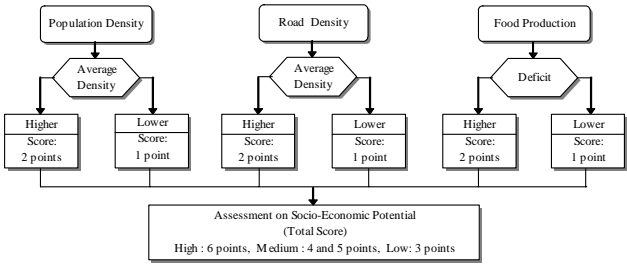
[Alternative Study on Development Plan]

Through the analysis on actual development and recurrent expenditures on irrigation development from 1998/99 to 2002/03, expected financial resources were projected for three cases: High Case, Base Case and Low Case. A comparison of demand projection of rice for three cases showed that the irrigation development areas under the High Case would satisfy the rice demand in 2017 subject to proper agricultural input supply. The development scenario selected in the NIMP was thus prepared for the High Case

Utayarishaji wa Ramani ya Mali Asili ya Ardhi



Assessment Flow of Socio-Economic Potential



Conditions of Sensitivity Analysis

	Base Case	High Case	Low Case
GDP Growth Rate	5.8% for 2003/04 - 2007/08 5.9% for 2008/09 - 2012/12 6.0% for 2013/14 - 2017/18	1.0% p.a. above Base Case	5.1% p/a/ for entire NIMP period
Budget allocation to Irrigation Development	1.5%	1.7%	1.5% (No change)
Out-of-budget (Donors Assistance)	100% (Same amount of foreign fund portion)	110%	100% (No change)
Amount in million Tsh.	350,042	451,251	327,967
Amount in million US\$	369	475	345

[Stage-wise Development Scenario]

The development programme for implementing the NIMP targets the establishment of a sustainable irrigation development system by 2017 in a stage-wise development: Short Term (2003 - 2007), Medium Term (2003 - 2012) and Long Term (2003 - 2017). As mentioned above, the NIMP adopted the two ideologies of Subject-wise Improvement and Scheme-wise Development. Subject-wise Improvement targets enhancing scheme quality and Scheme-wise Development targets expansion of irrigation areas and diversity; the overall objective is to attain sustainable irrigation development.

Stage-wise Irrigation Development Scenario			
	Short Term (2003 -2007)	Medium Term (by 2012)	Long Term (by 2017)
Development Target	To Establish Sustainable Irrigation Development System by 2017		
Key Issue for each Term	Reform	Decentralization	Self-reliance
Subject-wise Improvement			
Strategic Approach	<ul style="list-style-type: none"> - Reform of environment for promotion of decentralization and involvement of private sector - Establishment of appropriate technologies on irrigation development in cost-effective concept - Dissemination of concept of river basin approach - Establishment of irrigation development system by participatory approach 	<ul style="list-style-type: none"> - Actualization of irrigation development by LGA's initiatives under decentralization - Application of appropriate technologies on irrigation development in cost-effective concept - Establishment of environmental protection method on irrigation - Establishment of farmers-oriented irrigation development system 	<ul style="list-style-type: none"> - Establishment of easy access system from farmers on technical support - Spread of environmental protection method established - Establishment of self-reliant irrigation development by private sector-oriented with public sector partnership
Activities	Prepare and apply tailor-made improvement programme for project sustainability		
Scheme-wise Development			
Strategic Approach	Expand the irrigated area through development of irrigation schemes in effective use of national resources		
Activities	Give priority to rehabilitation of small-scale irrigation and water harvesting schemes		
Expected Annual Growth Rate of GDP	5.8 % to 6.0 %		

《Subject-wise Improvement Programme》

The Subject-wise Improvement Programme consists of several programmes: (i) institution, (ii) organization, (iii) technical issues, (iv) data and information control, and (v) environment. Thirty seven programmes were designed based on the results of PCM Workshops, problem analysis and inventory survey.

《Scheme-wise Development Programme》

The 1,428 irrigation schemes, with total estimated irrigation area of about 854,000 ha, were prioritized using the following six items, and then classified into five groups of ranked priority.

Criteria for Scheme Prioritization

Technical Factors	Economical Factors	Environmental Factors	Ease of Implementation	Social Factors	Regional Conditions	Total
15 points	30 points	10 points	5 points	20 points	20 points	100 points

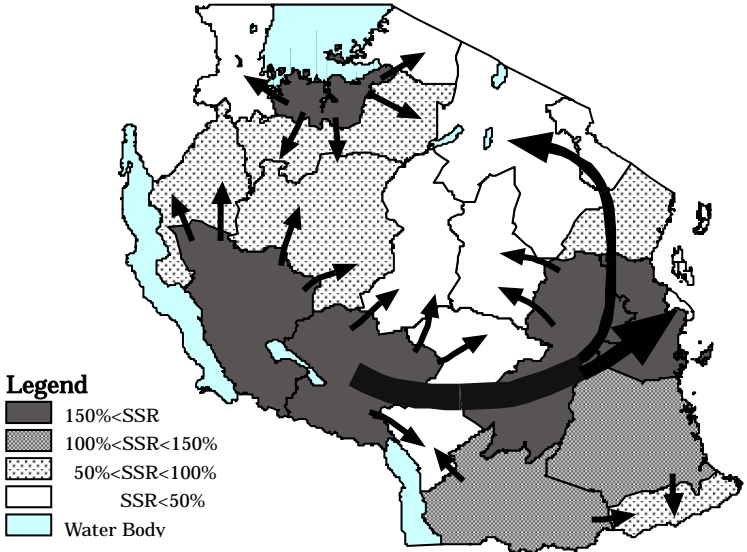
Based on the prioritization of irrigation schemes and projected development budget, the irrigation development areas were estimated as follows:

Accumulated Irrigation Development Area

Description	Short Term	Medium Term	Long Term
	2003 - 2007	by 2012	by 2017
(a) Nos. of Schemes	141	305	626
(b) Irrigation Development Areas (accumulated)	265,200 ha	324,900 ha	405,400 ha

[Regional Development Programme]

An irrigation development area of 405,000 ha would contribute to the achievement of national rice self-sufficiency by 2017. In addition, rice production levels at regional level were examined taking into consideration the policy of "suitable product on suitable land". Projected rice demand was compared against the development of selected priority schemes, and, as a result, rice surplus in 2017 would occur in seven regions (out of 20): Coast, Lindi, Mbeya, Morogoro, Mwanza, Rukwa, and Ruvuma. Judging from the variations in rice production and road conditions, the re-distribution plan shown in the figure at right was conceived.



Note: SSR(Self-sufficient Ratio) is the ratio of "Rice Production" to "Rice Demand"

[Conclusions]

The Study presents a framework and set of strategies for sustainable irrigation development for mainland Tanzania with the target year of 2017; the overriding aim is to contribute to the creation of an enabling and conducive environment for improving productivity and profitability of the agricultural sector. In order to achieve this aim, the Study prepared the development programme toward the year 2017. As a result, the Study selected 37 components of Subject-wise Improvement Programme and 626 irrigation schemes of Scheme-wise Development Programme.

In preparing the development programme, the Study established a system for the prioritizing of candidate irrigation schemes for implementation and conducted a priority ranking of potential schemes using the data and information obtained through the inventory survey. The availability of data and information on the scheme largely affected the priority ranking and, therefore, the ranking should be updated whenever new data and information becomes available.

The Study concludes that the implementation of these programmes would have a high probability of meeting the future demand of rice by 2017 with successful inter-sectoral coordination.

Attachment-3

*Additional Explanation on
Economic Analysis of the Scheme*

Additional Explanation on Economic Analysis of the Scheme

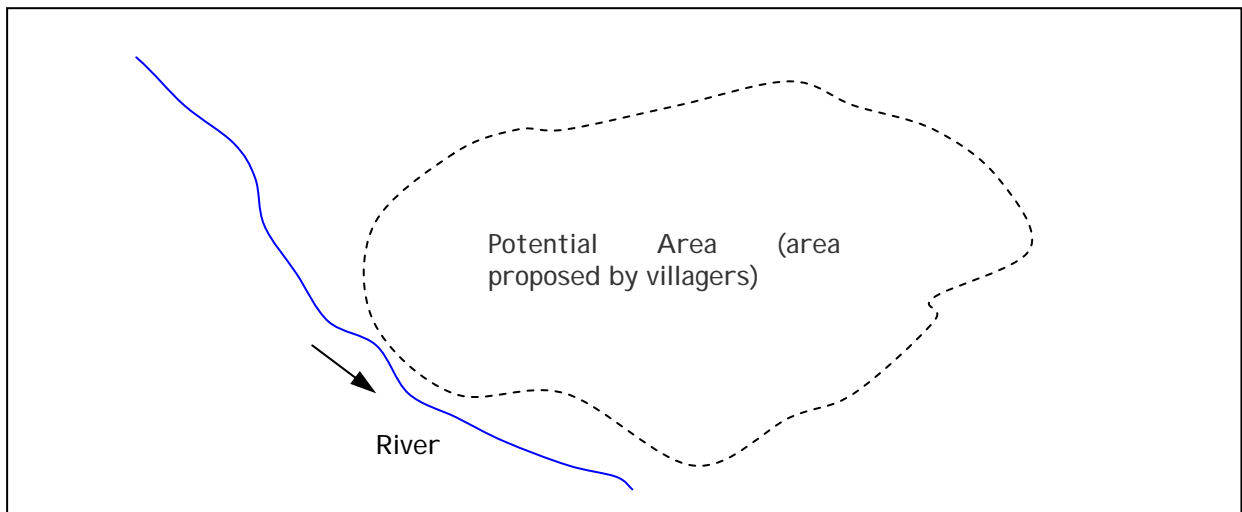
Before implementing scheme development, economic, social, technical, environmental and economic viability of the scheme should be confirmed.

Economic viability of the scheme should be checked by the following process.

(1) Determine the development area

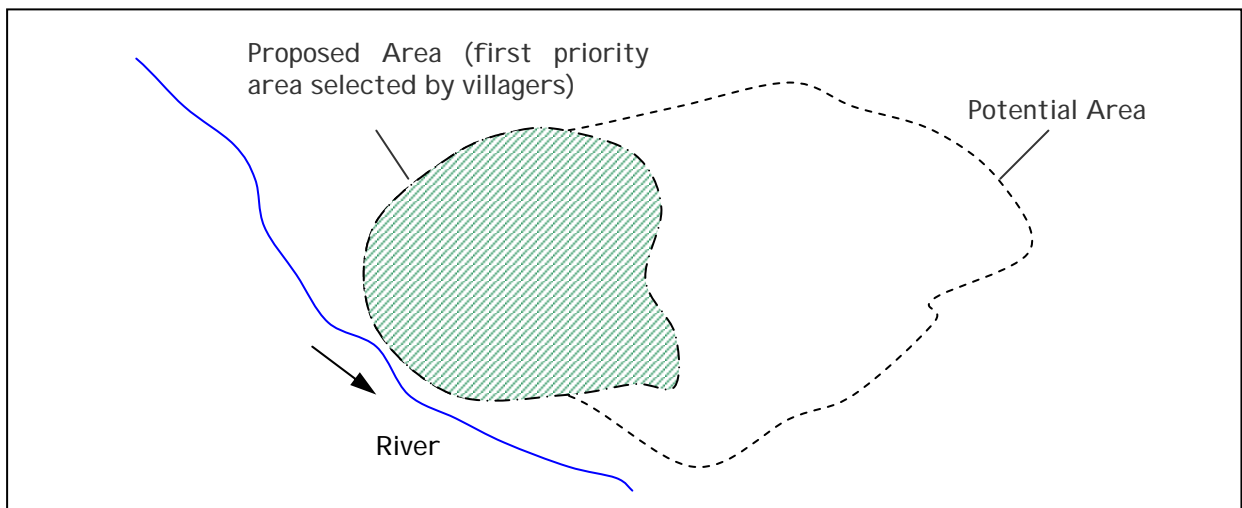
Situation 1 (situation of O&OD or village proposed plan)

Some area is proposed to be irrigated by villagers.



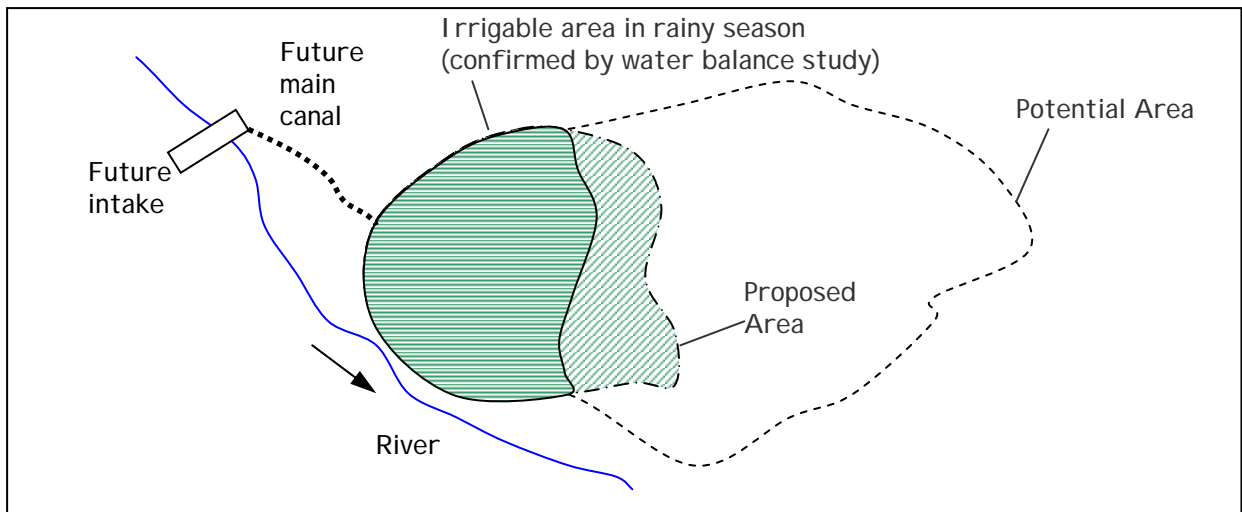
Situation 2 (after reaching agreement on the proposed area)

Potential area may be too large for development due to budget limitation.



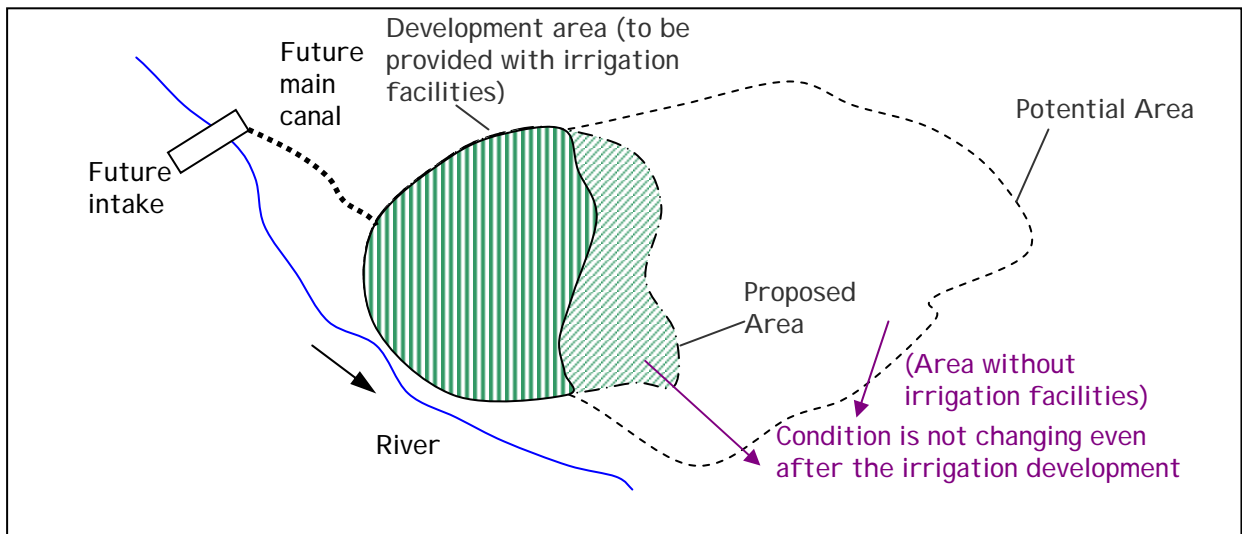
Situation 3 (after water balance study)

Not all of the proposed may be irrigable due to water resources limitation.



Situation 4 (development area decided)

In this example, the irrigable area in the rainy season is determined to be the development area since it is smaller than the proposed area..



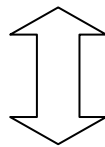
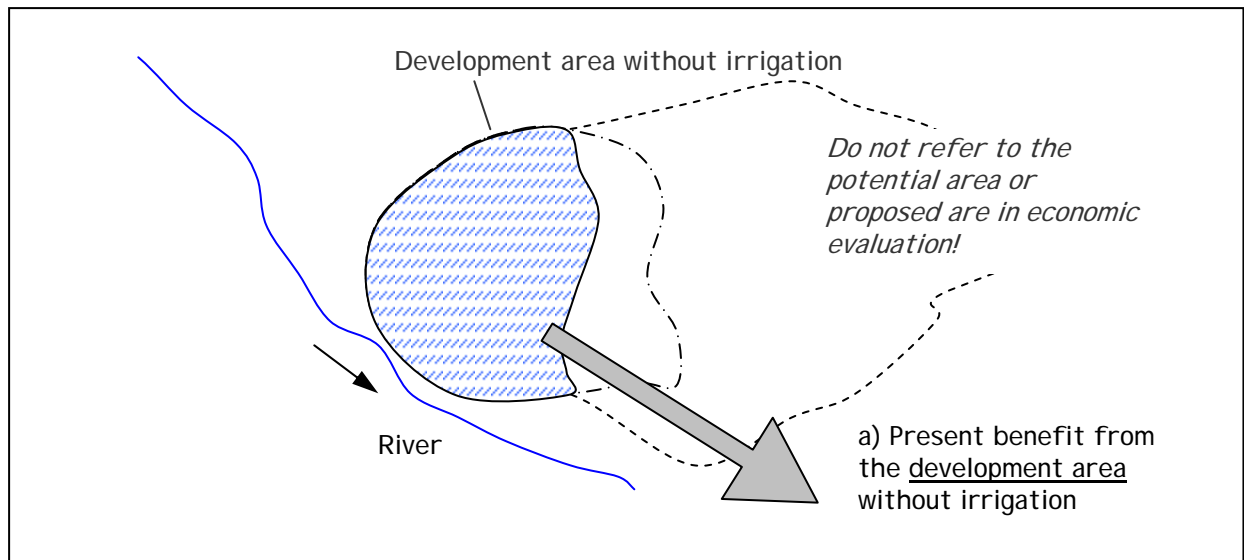
Caution

Once the development area is determined, only this area should be used for the economic analysis. Do not refer to the potential area or proposed area. Since the conditions in the rest of the development area will not change after irrigation development, it should be neglected in the economic analysis.

(2) Economic Evaluation

Without project condition

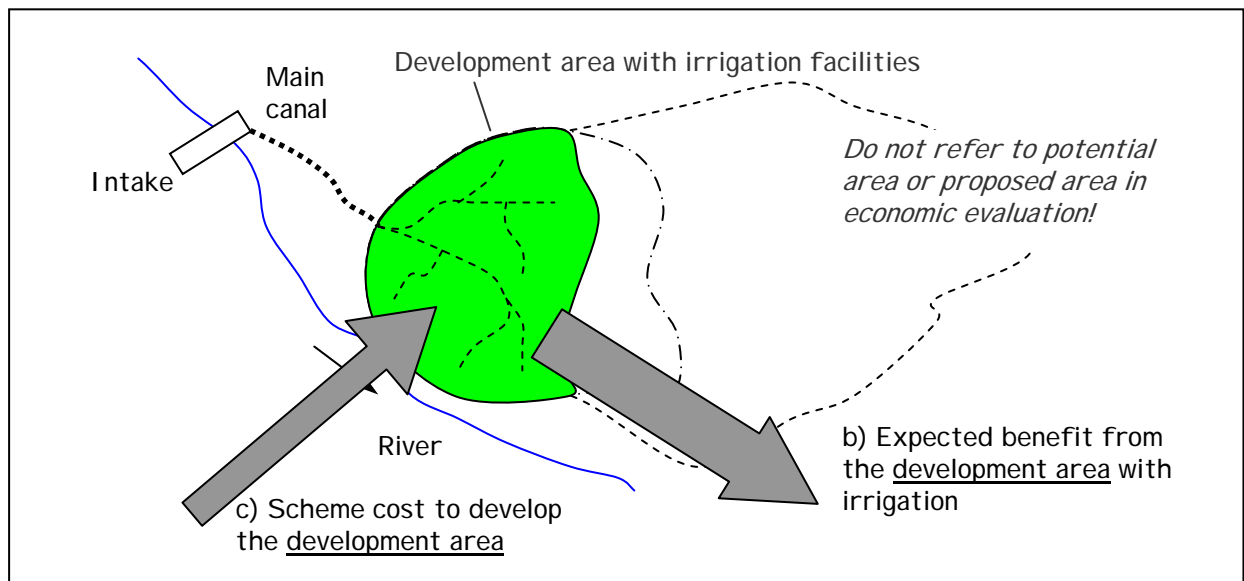
Without project condition means the condition in the development area at present.



Compare condition in the same area (development area) for without and with condition

With project condition

With project condition means condition in the development area after development..



Incremental agricultural benefit = b) - a)

Before starting the development, it should be confirmed that the scheme cost (investment) is larger than the incremental agricultural benefit (return on investment). However, simple comparison of the two is not enough since inflation within the life of the project (30 years) should be considered. IRR (Internal Rate of Return) analysis provides an investment vs. return comparison accounting for inflation.