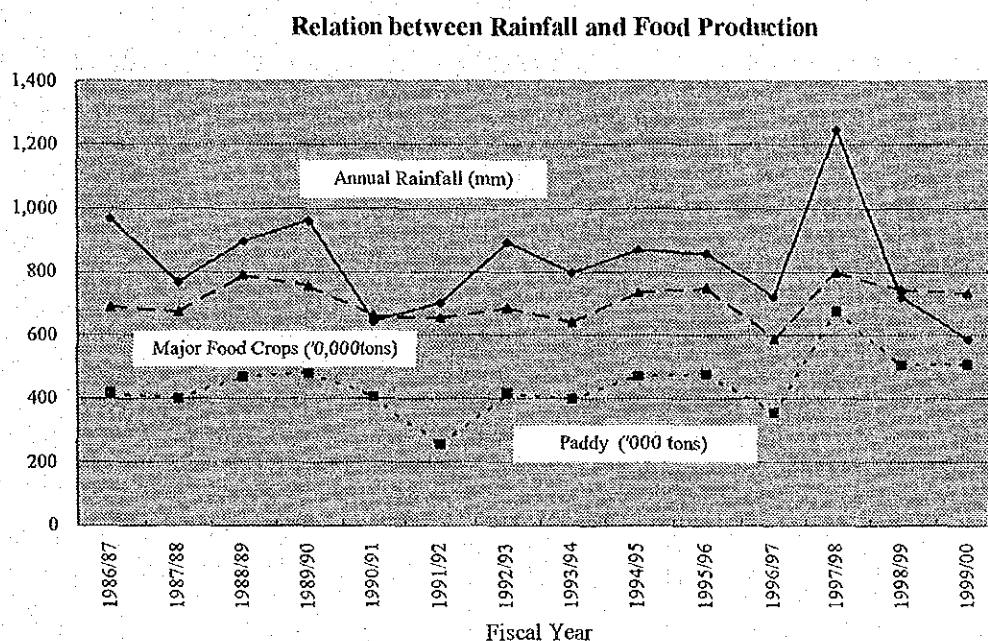


CHAPTER 6 FRAMEWORK FOR IRRIGATION DEVELOPMENT PLAN

6.1 Need for Irrigation Development

(1) Stabilization of Food Crop Production

Rainfed cultivation which is prevailing in Zanzibar, results in an unstable and low production due to erratic and unreliable rainfall. To improve this undesirable situation, irrigation is essential. The figure below, which was developed using available data from the Mainland, shows the relationship between annual rainfall and food production:



Source: Annual Rainfall (Tanzania Meteorological Agency, Ministry of Communication and Transport

Major Food Crops (Maize, Rice, Wheat, Sorghum, Pulses, Cassava, Potatoes, Bananas: A Statistical Analysis of the 2000/01, Food Security Department, MAFS)

This figure shows a direct relationship between rainfall and production. It would also indicate that provision of a timely water supply to crops, namely due to irrigation, would bring about not only stability in crop production, but also an increase in crop production. Irrigation development is therefore a key activity to improve the productivity and also an important factor to improve the profitability in agriculture.

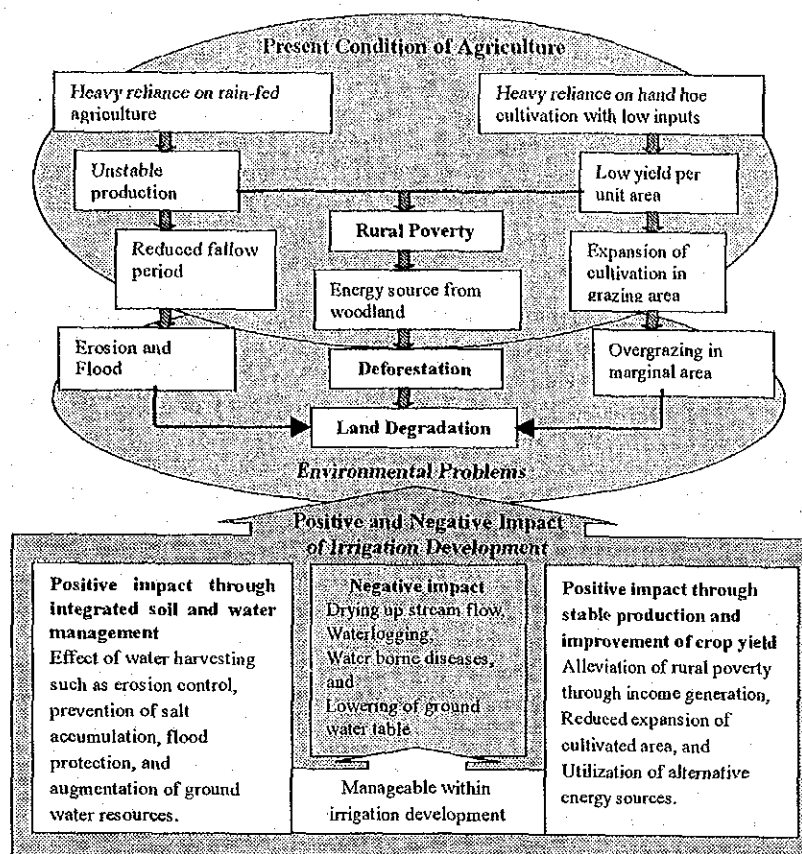
(2) Poverty Reduction of Smallholders due to Improvement of Farm Income

In addition to unstable food production, Zanzibar has another crucial issue, poverty. It is reported that 51 % of the population are in a state of poverty, and mostly are engaged in rainfed cultivation in rural area. Improvement of farm income for them is therefore urgently required so as to alleviate this poverty. Irrigation development would produce stable and higher production and therefore could be regarded as one of the most effective approaches to poverty alleviation in rural areas.

(3) Environmental Conservation Effects of Irrigation Development

Agriculture in Zanzibar is heavily depending on hand hoes as main cultivating tools with minimum inputs under rainfed conditions. These are the major causes of unstable production and low yield per unit area. Inappropriate land husbandry practices accelerate the soil erosion and the consequent flood hazard. It can be expected that irrigation development could greatly contribute to the environmental conservation. Stable production and improvement of yield per unit area through irrigation development, could contribute to (i) the reduced expansion of cultivated area, (ii) the access to alternative energy sources and (iii) creation of job opportunity. Increased byproducts such as straw and bran can effectively be incorporated into organic agriculture combined with livestock activities. Furthermore, integrated soil and water management could be performed under a properly designed irrigation scheme, to control erosion, prevent salt accumulation, increase flood protection and improve underground water resources. Although the negative impacts of irrigation development on the environment such as drying-up of stream flows, water-logging, water borne diseases and lowering of ground water level are often pointed out, such problems can be controlled through appropriate management of irrigation schemes. The interrelation between environmental problems and irrigation development is summarized in the figure shown below.

Interrelation between Environmental Problems and Irrigation Development



Source : JICA Study Team

(4) Effect of Irrigation Development

According to past trends of cropped area and production of paddy, the future production for 17,000 ha could be estimated to reach 13,000 tons in the year 2020. However, under full development of irrigation, that is 8,521 ha developed for irrigation and remaining for rainfed cultivation, production could rise to more than 40,000 tons. It is thus obvious that the rice production will improve significantly with the development of irrigation resulting also in a reduced reliance on imported rice. Irrigation development is effective not only for increasing the production but also stabilizing the production. In this sense, irrigation development could also be regarded as one of the effective approaches to poverty alleviation in the rural area. Additionally, since the available land resources are limited in Zanzibar, the higher cropping intensity under the irrigation development will result in more efficient land use.

6.2 Purpose and Strategies of Zanzibar Irrigation Master Plan

6.2.1 Overall Goal and Sub-sector Objective in ASP

The Zanzibar Vision 2020 mentions that by the year 2020 Zanzibar should have

the income per capita rising from US\$ 200 to that of middle income countries, namely US\$ 755 at 2002 current cost with GDP growth rate of 7 – 8 % by 2010 and 9 – 10 % by 2020. The Vision also stresses active involvement of the private sector, and the need for promotion of effective partnership between the public and private sectors, for its successful implementation.

To contribute to the realization of the above Vision, the ASP sets an overall goal to promote sustainable development of the agricultural sector for economic, social and environmental benefits for its people. The ASP states 9 specific objectives and 12 policies to meet them. These are narrowed down to attainment of household and national food security through improvement of quantity and quality of agricultural products and encouragement of private sector participation in agriculture. In policy instruments for reaching the objectives, promotion of small-scale irrigation is recommended.

In sub-sector strategies, the ASP indicates the need for framework and strategies to enhance the development of irrigation in a cost-effective, efficient and sustainable manner, and presents the following policy strategies for the irrigation development:

- Promote the rehabilitation of the existing irrigation schemes;
- Promote and strengthen Water Users Associations to ensure proper use of irrigation water;
- Develop and promote water-harvesting techniques;
- Encourage the private sector to invest in irrigation farming; and
- Create an efficient mechanism for the collection of water fees from water users in order to cover the running and maintenance costs of providing water.

The ZIMP shall include these policies and strategies.

6.2.2 Purpose of Zanzibar Irrigation Master Plan

In consideration of the policies and strategies stipulated in the Vision and the ASP and also the study results, the “*Sustainable Irrigation Development*” was selected as a purpose of the ZIMP with emphasis on comprehensive measures through “*Effective Use of National Resources*”, to largely contribute to attainment of the overall goal of ASP.

“*Sustainable Irrigation Development*” means the establishment of technically and financially self-reliant irrigation schemes through institutional and organizational strengthening/reform, with focus on the following objectives:

Objectives of Sustainable Irrigation Development

Required Conditions	Objectives
Technical Self-reliance	<ul style="list-style-type: none"> - Capacity building of staff of DARI, RADO and Extension Workers - Raising of technical knowledge of farmers on O & M and water management - Application of appropriate irrigation development level - Execution of environmental conservation
Financial Self-reliance	<ul style="list-style-type: none"> - Improvement of government financial situation by reform of taxation system - Strengthening and support of micro-finance to farmers - Enlargement of opportunity on private sector investment in irrigation development
Institutional/Organizational Strengthening	<ul style="list-style-type: none"> - Definition on roles and responsibility of Irrigation Section, Local Government Authority, and WUAs under decentralization - Strengthening/reform of DARI, RADOs and DADOs - Legal framework strengthening for WUAs (legal status, land tenure, water right, ownership and responsibility of irrigation infrastructure) - Institutional strengthening for raising technical ability (extension services and training) - Institutional strengthening for raising financial capability (collection of water fee and O & M cost, micro-finance) - Promotion and support programme of private sector (creation of attractive climate for investment, Incentive of tax for BOT introduction, long and stable security of tenure)

6.2.3 Strategies of Zanzibar Irrigation Master Plan

(1) Lessons Learnt from ZIDP Implementation

There are three major issues which caused the unsatisfactory implementation of the ZIDP. These are its incompleteness, lack of endorsement of financial requirement for its implementation, and weak initiatives for its promotion (as discussed in Sub-clause 4.2.3). The ZIMP shall therefore be prepared in due consideration of these constraints as lessons learnt from the unsuccessful implementation of the ZIDP.

(2) Irrigation Development by Integration of Subject-wise Improvement and Scheme-wise Development

The ZIMP proposes the two concepts of Subject-wise Improvement and Scheme-wise Development, and the integration of them as a strategic approach to sustainable irrigation development. The Subject-wise Improvement aims at the creation of an appropriate environment for sustainable irrigation development, mainly from a viewpoint of enhancing quality. The Scheme-wise Development aims at the expansion of irrigation areas and variation using effective use of national resources. In the Scheme-wise Development Programme, the ZIMP gives

a priority to construction of small-scale irrigation schemes. The Subject-wise Improvement and Scheme-wise Development Programme will be prepared considering five elements; "Economically Sound", "Technical Appropriate", "Socio-logically Sustainable", "Institutionally Reliable" and "Environmentally Friendly".

(a) Economically Sound

The ZIMP is concerned with the economic soundness in terms of limited capital. Both the government and farmers are facing difficult situations and the appropriate use of the limited capital in irrigation development will assist the financial viability.

(b) Technically Appropriate

The ZIMP emphasizes the importance of appropriate technologies for irrigation development. In the selection of appropriate technologies, consideration will be given to simple and low-cost technology while focusing on technical soundness. This will assist the farmers in O&M and facilitate dissemination of the technical solutions through extension services.

(c) Socio-logically Sustainable

The ZIMP puts farmers first and considers them as not only the beneficiaries, but also the major driving force for irrigation development. Active participation and empowerment of farmers is essential for sustainable, bottom-up irrigation development.

(d) Institutionally Reliability

The ZIMP emphasizes the importance of institutional reliability for irrigation development. A partnership between government and farmers is essential for sustainable irrigation development, and will require a capacity of both parties to fulfill their respective duties. The ZIMP will be formulated paying attention to institutional reliability to heighten the capacity of the partnership and also the ownership.

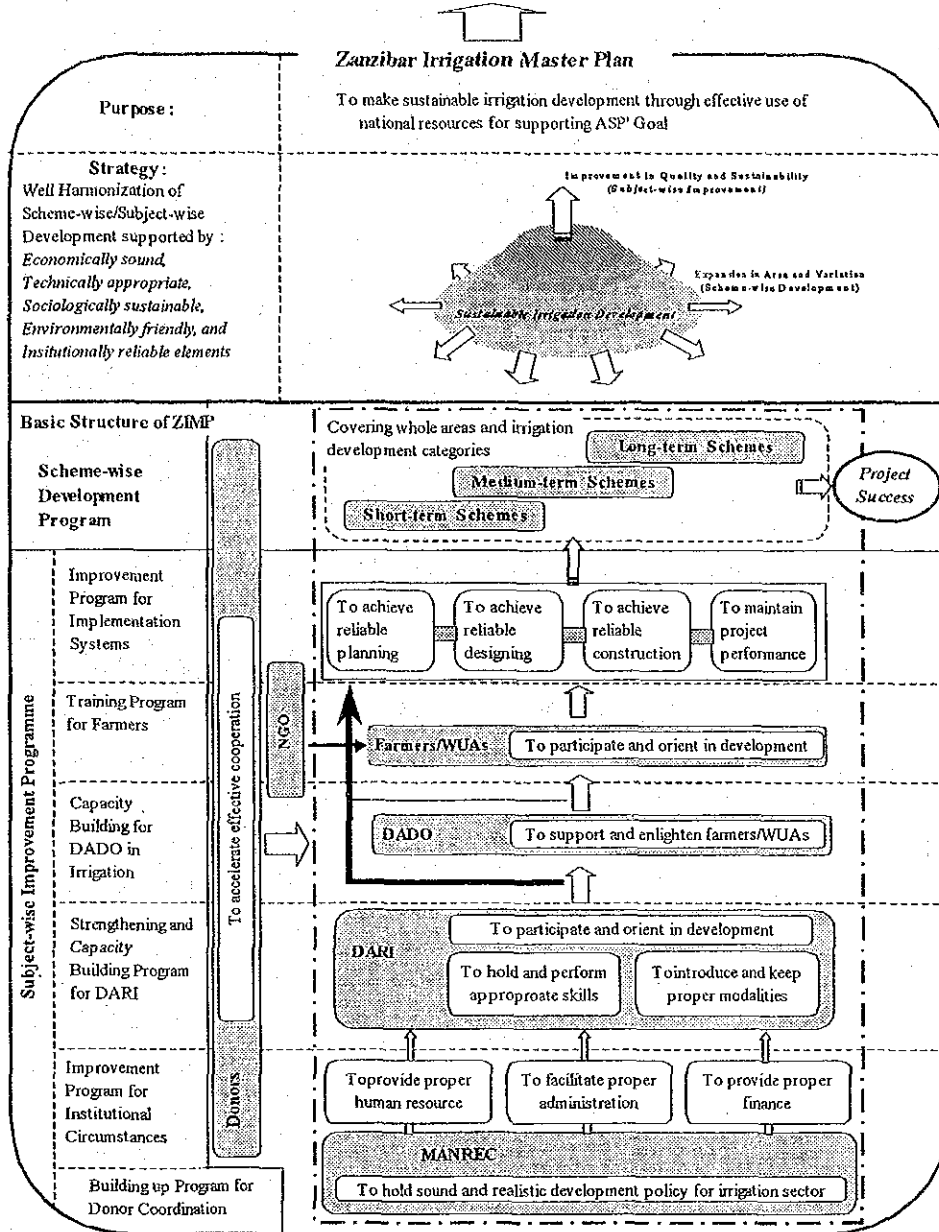
(e) Environmentally Friendly

The ZIMP actualizes environmentally sustainable management of water and land use. A well-managed water and land use philosophy fosters agricultural production and sustainable ecological systems. It brings about environmentally appropriate conditions for farmers' living.

The following figure shows the concept of the ZIMP.

ASP

Overall Goal :	To prompt sustainable development of the agricultural sector economic, social and environmental benefits of its people
Sub-sector Objective :	To enhance the development of irrigation in a cost-effective, efficient and sustainable manner



6.3 Framework for Zanzibar Irrigation Master Plan

6.3.1 Policy Framework

The sustainable irrigation development in Zanzibar, namely self-reliant irrigation development could not be realized without strong support by the government. Until now, the government has made some effort to create the enabling environment for involvement of the private sector including farmers. However,

the progress has not been steady. Further efforts should be made to strengthen the policy framework for reform, focusing on the following issues:

(1) Legal Access to Land

Zanzibar had a complicated land tenure system. The core problem was the lack of tenurial security resulting in a decline in agricultural production. In order to settle the problem, the government has provided legislative intervention such as preparation of Land Adjudication Act, Land Surveyors' Act, Registered Land Act, Land Transfer Act and Land Tribunal Act. However, customary laws still play an important role. Registration of land parcels has not progressed well. On the other hand, the ASP recommends the involvement of the private sector in agriculture, including irrigation. From this viewpoint, these acts should be reviewed and modified or strengthened to increase the private sector's sense of security and to promote its active participation in agriculture and irrigation development.

(2) Establishment of Water Rights Act

At present, Zanzibar has no laws for stipulating water rights. A legal basis is indispensable for ensuring irrigation development and also for avoiding any water conflict among related stakeholders. Zanzibar has ample water resources on the whole; however, topographic conditions restrict usable water for irrigation. In addition, increasing population pressure will create a competitive situation between irrigation water needs and domestic water requirements. In order to avoid any water conflict and from a viewpoint of social environment, a Water Rights Act should be prepared urgently.

(3) Legal Framework for Irrigators' Groups

Presently the irrigators' groups in Zanzibar are generally classified into three categories, (i) registered irrigators' cooperative society (ICS), (ii) registered irrigators' association (IA), and (iii) non-registered group. Neither the cooperative nor the association is necessarily an optimum organizational form for the users of irrigation. The cooperative is primarily a business-oriented organization and the association is applicable to any type of social activities. The rights and obligations of the irrigators' group members cannot always be clearly and uniformly defined under the present legal framework. A new legal framework exclusively for the irrigators' groups is very important and necessary for securing their ownership and self-reliable irrigation development.

(4) Favorable Taxes and Tariff for Irrigation Development

The high rates of interest for lending, taxes and energy tariffs are not presently attractive for the irrigation sub-sector. These are critical issues for private

investment to the irrigation sub-sector. The government should review them and set rates which will result in profitable and increasing agriculture, and which would lead to promotion of irrigation development.

(5) Close Communication with International Community

International communities such as multi- and bi-lateral donors and international agricultural institutions, play an important role in providing financial and technical assistance to support Zanzibar's irrigation development. Without this assistance, it is difficult or even impossible to achieve the sustainable irrigation development. The communication with multi- and bi-lateral donors and international agricultural institutions should be strengthened.

6.3.2 Macro-economic Framework

(1) Macro-economic and Policy Framework

Pillars of the framework and specific targets adopted for the projection of the financial resources envelope for the ZIMP are summarized below:

Pillars	Specific Measures/Targets
Stable and sustainable overall economic development	GDP growth rate
Accelerated and sustainable development of crop production	Allocation of Development Fund (Local and Foreign Funds) to MANREC
Expanded and improved irrigation program/projects	Allocation of Development Fund (Local and Foreign Funds) to irrigation projects implemented and/or managed by Rice and Inputs Division of Commission of Agriculture, Research and Extension of MANREC
Stable and increased donor assistance	Financial assistance of foreign donors, both multi-lateral and bi-lateral, to irrigation/water management projects

(2) Projection of the Financial Resources Envelope for ZIMP

Through the analysis of allocation of development expenditure from 1992/93 – 2002/03, the following assumptions regarding percentages and multipliers, and fixed amounts have been adopted for the projection of the financial resources envelope.

Summary of Assumptions in Base Case

Item of Budget	Actual Percentage/Multiple of Total GOT Development Expenditure (Local and Foreign)	Assumption
Local Fund of GOZ Development Budget	Average share of local fund portion to the GOZ Development Expenditure for 7 years (1992/93 - 2000/01) is 17.31%, excluding 2 years of 1995/96 and 1996/97 because the multiple of these 2 years are irregularly small.	20.0%

Local Fund of Development Budget for Irrigation Development	Average share of local fund allocated to irrigation development executed under Rice and Inputs Division of Commission for Agriculture, Research and Extension of MANREC for the period of 1992/03 – 1999/03 is 1.89%. Considering the past records and expecting a little increase because of the priority and importance of the sub-sector, the share of is assumed to be 2.0% throughout the period of ZIMP.	2.0%
Foreign Fund of Development Budget for Irrigation Development	Foreign assistance during 1995 – 2000 remained stagnant because of “aid-boycott” by many bilateral donors. It would be because of this particular reason that actual foreign funds allocated irrigation projects are in small amounts. It is not appropriate to use the average multiplier calculated based on the past figures. 6 times should be appropriate for the Base Case because the multiplier in 1999/00, which is the latest one, is 5.18, and assuming the increasing trend of development assistance from foreign donors.	6.0 times
Personnel	In budget of 2002/03, personnel expenditure of entire MANREC is Tsh 2,558,828 thousand for 3,483 personnel. Share of the number of staff of Rice and Inputs Division (164 personnel) who are directly involved in irrigation projects is 4.7%. During the ZIMP, a quarter (25%) of their personnel expenditure (emolument) should be the responsibility of the ZIMP.	Tsh 30,066 thousand to be allocated and increase in proportion with annual GDP growth rate.
Maintenance of Irrigation Facilities	Budget of maintenance expenditure for entire MANREC for 2002/03 is Tsh 664,101 thousand, out of which 10% is assumed to be used for the maintenance of irrigation facilities.	Tsh 66,410 thousand to be allocated and increase in proportion with annual GDP growth rate.

Variable indices applied to the resource envelope projection should be (i) GDP growth rate, (ii) budget allocation to irrigation development from MANREC budget, (iii) contribution by foreign donors.

(3) Financial Resources Envelope

(a) Initial Investment/Development Budget

Using indices assumed above, the calculation has been carried out and the result is Tsh. 1,183 million in Base Case, which is US\$ 1.2 million converted at Tsh. 950/US\$, over 18 years of ZIMP implementing period.

(b) Operation and Maintenance Budget

The calculation has been carried out and the result is Tsh. 3,230 million, which is US\$ 3.4 million converted at Tsh. 950/US\$, over 18 years of ZIMP implementing period.

Financial resources envelope including (a) and (b) is Tsh. 4,291 million, or US\$ 4.5 million equivalent. The calculation is shown in Table 6.3.1. As can be seen in these figures, development budgets are significantly smaller than the operation and maintenance budget. This imbalance would occur due to less aid assistance by donors. In this Study, therefore, total budgets of development and operation and maintenance mentioned above are considered as an available amount for irrigation development including operation and maintenance without its separation.

(4) Sensitivity Analysis

Three scenarios, Base Case, High Case, and Low Case, are analyzed. Each scenario has the following indices:

Indices for Each Scenario

Variable	Base Case	High Case	Low Case
GDP Growth Rate	2003/04-2005/06: 5.0%; 2006/07-2010/11: 7.0%; 2011/12-2020/21: 9.0%	1.0%p.a. above Base Case	4.5% p.a. for the entire ZIMP period
Irrigation Development Budget (Local Fund portion)	2.0% (of GOZ Development Budget)	3.0%	2.0% (No increase)
Foreign Donors Contribution to Irrigation Projects (Fund portion)	6 times (of Local Funds)	9 times	3 times (Current situation)

The results of the sensitive analysis are summarized in the table and figure below:

Results of Sensitive Analysis

Scenario	Financial Resources Envelope (million Tsh.)	Equivalent US\$ (million US\$)
Base Case	4,164	4.4
High Case	6,203	6.5
Low Case	2,746	2.9

Table 6.3.2 and 6.3.3 show the High Case and Low Case, respectively, and summary of three cases are given below:

Summary of Projected Budget for Respective Cases

Year	Base Case		High Case		Low Case	
	Tsh.(10 ⁶)	US\$ (10 ⁶)*	Tsh.(10 ⁶)	US\$ (10 ⁶)*	Tsh.(10 ⁶)	US\$ (10 ⁶)*
2003/04	117	123	158	166	102	108
2004/05	123	129	168	176	107	112
2005/06	129	136	178	187	112	118
2006/07	138	145	192	202	117	123

2007/08	148	156	207	218	122	128
2008/09	158	167	224	235	127	134
2009/10	169	178	242	254	133	140
2010/11	181	191	261	275	139	146
2011/12	197	208	287	302	145	153
2012/13	215	227	316	332	152	160
2013/14	235	247	347	366	159	167
2014/15	256	269	382	402	166	175
2015/16	279	293	420	442	173	182
2016/17	304	320	462	487	181	191
2017/18	331	349	509	535	189	199
2018/19	361	380	559	589	198	208
2019/20	393	414	615	648	207	218
2020/21	429	451	677	712	217	229
Total	4,164	4,383	6,203	6,529	2,746	2,891

* : Equivalent cost

6.3.3 Demand Projection in Crops

(1) Food Policy for Irrigation Sector

It is obvious that there is a close relationship between alleviation of poverty and agricultural activities in the area where the agriculture creates employment opportunity. The rural areas, where agriculture activities are prevailing, show the closest relationship. The agricultural development being capable of providing both food and income to the poor, will surely play an important and straightforward role for the alleviation of poverty in rural villages.

In the poor villages of Zanzibar, the only way for improving the food conditions and securing an increase in income, which are the two main challenges of the country, is the continuous improvement of agricultural production by making effective use of resources. The development of irrigation, in particular, is highly expected to provide a stable food supply as well as a stable source of income, capable of realizing much-desired alleviation of poverty.

(2) Basic Assumption for Staple Food Demand Forecast

The main staple foods in Zanzibar are rice, cassava, banana, maize, sweet potato and yams. An average per capita consumption of staple foods has not been studied recently. In-depth surveys or studies on food consumption have not been undertaken.

A survey for demand forecasting of rice was carried out by FAO in 1980. Although any demand forecasting surveys for other important staple foods have not been undertaken since, food need assessment estimates were made in 1992. The results are as shown Table 6.3.4 and summarized in the below table.

In the Study, a demand estimate for staple food products was made again using the currently available data, to clarify the positioning of the irrigation sector in the overall agricultural development, and to examine the relevance of the reinforcement and promotion of irrigation sector from the point of food supply. The assumption employed in the estimate is to keep the current pattern of food intake of 2,160 Kcal in the future (staple foods, protein, fat, etc.).

Per Capita Consumption

Commodity	Kg/year/person (Unmilled)
Maize	24
Rice	90
Wheat	37
Pulses	26
Cassava	89
Bananas	109
Potatoes	56

Source: Food Need Assessment in 1992, Status of Irrigation Development in Zanzibar, 2001

(3) Staple Foods Demand Forecast

In accordance with the scenario set in the above, the future demand of staple food products has been assessed. The result is given in Table 6.3.4, and summarized below:

Staple Foods Demand Forecast (Unit: ton)

Crops	Year			
	2005	2010	2015	2020
Maize	25,927	30,371	35,652	41,939
Rice	97,226	113,695	133,695	157,270
Wheat	39,971	46,822	54,964	64,656
Pulses	28,088	32,902	38,623	45,434
Cassava	96,146	112,626	132,210	155,523
Bananas	117,752	137,935	161,920	190,472
Potatoes	60,496	70,866	83,188	97,857

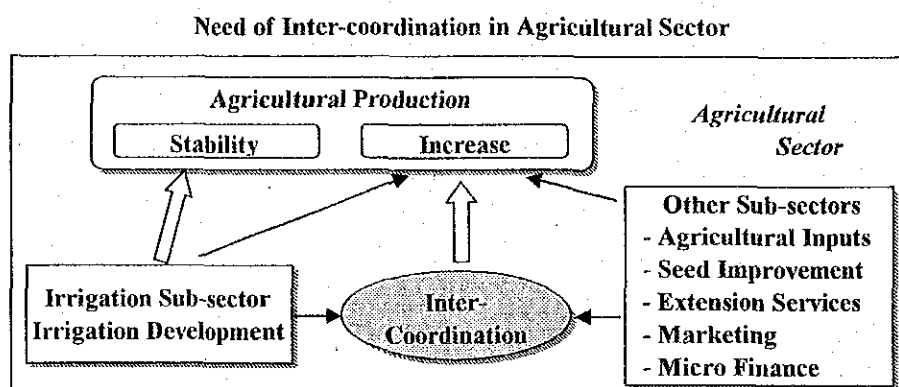
Source: JICA Study Team estimated based on the population forecast and per capita consumption in Zanzibar.

In spite of a rather pessimistic assumption with calorie intake kept at the current level, the pressure from the increased population would require a high rice demand of 8.5 times the current production of 18,500 tons in 2000/01.

Judging from the availability of natural resources in Zanzibar, it is difficult or rather impossible to meet the self-supply in these foods. In such severe situations, however, it is important to increase the food production as much as possible through maximum use of available national resources, to decrease the import amount in foods and to save foreign currency used for the importing of foods.

6.3.4 Need of Inter-sectoral Coordination in Agricultural Sector

Irrigation is an essential tool for stabilization and increase of agricultural production. As discussed in Sub-clause 6.1, there is no doubt that irrigation itself contributes to the stabilization of agricultural production. However, in relation to improvement of agricultural production, irrigation functions as a catalyst to bring about the physiologically suitable environment for enhancing the agricultural production. Irrigation itself could not realize the remarkable increase of agricultural production without assistance and interventions from other sub-sectors such as agricultural inputs, extension services, marketing and micro finance. These other sub-sectors, therefore, require to be developed under close inter-coordination with the irrigation sub-sector, to make multiplier effect toward increase of agricultural production.



6.4 Basic Plan for Irrigation Development Level

6.4.1 Concept of Guideline of Irrigation Development Level

The function of a guideline for irrigation development level is to provide an indication of principles on technical decision making for irrigation scheme implementation. It is not a formal document which must be followed to the letter. Additionally, it should not be a criterion for scheme selection or prioritization. The criteria for scheme selection has been prepared in several irrigation development projects/programmes and is generally based on an intention that schemes identified as being below a standard shall not be developed. However, the guideline for irrigation development level should be essentially different from a document outlining the criteria for scheme selection. The guideline for irrigation development level is based on a concept that farmers in each area may develop irrigation to the extent that suits their own needs. Farmers will develop systems within allowable range of irrigation development corresponding to the development potential of their own areas. The guideline for irrigation development level could show a possible and most suitable modality of irrigation

development by irrigation development pattern recognizing the potential and limitations of irrigation development of the relevant area.

6.4.2 Classification of Irrigation Development Type

In Zanzibar, irrigation development level differs for each variant of the irrigation schemes. It is realistic to classify irrigation development level by categorization of irrigation development type, sub-divided into some conspicuous modalities of irrigation practice and sorts of irrigation system.

In the ZIDP, no concrete description on irrigation development type was given. Only priorities on infrastructural improvement including irrigation facilities were proposed as follows:

- Rehabilitation of Existing Schemes: Required repairs and allowable extensions to the existing schemes was aimed at, emphasizing importance of improvement of water management. Perimeter drainage and side slope protection was also highlighted.
- New Irrigation Schemes: Community based promotion and fulfillment of scheme implementation was proposed. No proposal on modality and method of irrigation was given.

No informative guidelines on irrigation development methods and irrigation development level were given in the ZIDP. This information, namely a proposed irrigation development modality and irrigation development level for Zanzibar is provided in this ZIMP.

Referring to classifications of irrigation types in the Mainland analyzed in this Study and also by considering scheme style, kind of water source, and scale of scheme, irrigation development types in Zanzibar are classified into the following types:

Classification of Irrigation Development Type

Scheme Type	Rehabilitation of Existing Scheme			New Irrigation Scheme		
	Water Resources	Ground water	Surface Water	Rain Water Harvesting	Ground water	Surface Water
Individual irrigation	-	R-I-S	R-I-W	-	N-I-S	N-I-W
Small-scheme	R-S-G	R-S-S	-	N-S-G	N-S-S	-
Medium-scale	R-M-G	R-M-S	-	N-M-G	N-M-S	-
Extensive-scale	R-E-G	R-E-S	-	N-E-G	N-E-S	-

Note: above irrigation development pattern is shown in (Scheme type) – (Scale of scheme) – (Water source), where, (Scheme type), R: Rehabilitation of existing scheme, N: New irrigation scheme (Scale of scheme), S: Small-scale, M: Medium-scale, E: Extensive-scale (Water source), S: Surface water, G: Groundwater, R: Rainwater harvesting

According to related statements of the GOZ, “water harvesting” is broadly interpreted as supply of irrigation water from surface water. This is the meaning

used in this study. The scheme type of "individual irrigation" has a special characteristic. The size of the individual irrigation is smaller than the small-scale scheme, and would be implemented on the basis of farmers' initiative without public intervention. Farmers could apply individual irrigation as far as a water source is available around their farmlands.

These classifications may be sub-divided by water abstraction method. The irrigation types categorized as "for surface water", could be sub-divided into "by diversion weir" and "by dam reservoir". Such classifications would be utilized as required, and it might not always be considered the general case.

6.4.3 Guideline of Irrigation Development Level

Guideline of irrigation development level will consider a number of indicators by irrigation development type. Seven indicators on irrigation development level have been selected after considering Sustainability, Adaptability and Feasibility of scheme implementation, namely, (i) Project scale, (ii) Water resources availability, (iii) Satisfying site condition, (iv) Type of irrigation facilities, (v) Requirement for land development works, (vi) Allowable costs, and (vii) Project life. Applicable indications in these indicators are outlined as follows:

Guidelines of Irrigation Schemes Implementation by Irrigation Type

Items	Irrigation Type			
	Pump Irrigation	Canal Irrigation with Dam Reservoir	Canal Irrigation with Diversion Weir	Watering
Irrigated area (Dry season)	X_1	X_1	X_1	X
Irrigated area (Rainy season)	X_2	X_2	X_2	-
Water resources	Groundwater: discharge $> 2.0 \times X_1$ /sec Lifting head $<$ about 30 m.	Stream flow:	Stream flow: low flow discharge or spring yield $> 3.0 \times X_2$ /sec	Individual impounding, spring or well
Site conditions	Site having exploitable groundwater yield more than the above	Proper dam site having storage capacity of more than $11,000 \times X_2$ m ³	Proper weir site for construction	-
Proposed modality of water resources development facilities	Appropriate and manageable pumping set with high efficiency	Concrete (or fill) dam with proper spillway (silt excluder if necessary)	Concrete (or gabion) weir	-
Type of canal	Conduit or lining canal	Lining canal	Earthen canal or partly lining canal	-
Land development	As required	As required	Not required in general	-
Allowable costs	\sim US\$8,000 $\times X_2$	\sim US\$8,500 $\times X_2$	\sim (US\$3,000 $\times X_1$ + US\$5,000 $\times X_2$)	\sim US\$2,000 $\times X$
Project life	\sim 25 years	30 \sim 50 years	\sim 30 years	-
Remarks	Proper subsidizing for operation costs is required for sound farm financial viability	Perimeter drainage and side slope protection is required	Perimeter drainage and side slope protection is required	Farmers can do individually depending on its possibility

(1) Project Scale

"Project scale" is the command area where irrigation services are provided. Generally, three classes of irrigation scheme, namely, small, medium and extensive scale (bigger than the medium) are stipulated, and specified as follows:

Indications in Project Scale

Irrigation class	Command area (ha.)	Remarks
Small-scale	~50	<i>Assuming to adopt single block for irrigation rotation</i>
Medium-scale	50~100	
Extensive-scale	100~	

Designated values of irrigation area in the above table are assumed to be applied for rice cultivation.

(2) Water Resources Availability

Water resources availability is the most important factor for the formulation of scheme implementation. Irrigable area of schemes during dry season is determined by the availability of water resources. For pump irrigation, not only quantitative availability but also required head for lifting should be considered because it is directly related to a burden in scheme operation.

(3) Satisfying of Site Condition

Proposed site should satisfy required physical conditions in order to ensure feasibility of the project implementation. For the case of dam construction, appropriate topographical and geological situations are essential for feasibility of scheme implementation. Irrigable area in dry season is limited by the secured storage capacity of dam reservoir.

(4) Type of Irrigation Facilities

Types of irrigation facilities have several ranges of options depending upon solidarity of facilities and convenience for water utilization. A significant factor is the affordability of the scheme. For the case of pump irrigation, advanced and good facilities might be selected as long as adequate economic viability of the scheme is observed. For the case of surface water irrigation, expected benefits are important.

(5) Requirement for Land Development Works

If water-standing paddy cultivation is introduced into the irrigation development, proper land development works such as land leveling and on-farm works are required. The past data shows that a cost of the land development works ranges from US\$4,000/ha to US\$8,000/ha.

(6) Allowable Cost

The allowable cost of scheme implementation is a topical subject. Project costs will vary corresponding to the circumstances of the project. The range of affordable cost for irrigation projects is subject to the affordability and admissibility of the project executor concerned, and the project economics. It

would be decided at the minimum one among the values. Standard allowable unit costs are indicated in the guideline shown above. Irrigation scheme should be designed optimally to meet planning requirement. The indicated range of allowable unit costs by irrigation development type implies that the optimal plan of scheme implementation might be settled within the range of costs.

(7) Project Life

Project life is a life expectancy of the constructed irrigation facilities, which is optimally selected taking expected project performance and circumstances surrounding the project. Generally, the project life is related to an optimized point of the relationship between inputs and outputs of the Project, in an economic sense. However, in some cases, optimality hides other factors, such as capability of implementation, possibility of acquisition of required inputs, stability of project conditions etc. It is at best 50 years. For the case of pump irrigation, it is restricted by the life expectancy of pump equipment. In other cases project life expectancy can be less than estimated, for instance due to overflowing reservoir by sedimentation for the surface irrigation by dam reservoir.

6.5 Basic Plan for Institutional Development

6.5.1 Basic Concept

The basic concept of the institutional development for the ZIMP is to realize a practical and reliable institutional setting for the sustainable and self-reliant irrigation development. The institutional setting can be compared to a kind of engine to smoothly operate the irrigation development procedure and the mechanism composed of the various participants, that is, the Central Government, the Local Government Authorities, the Irrigators' Organizations, Private Companies, NGOs, Donors etc.

Without the engine, i.e. the practical and reliable institutional setting, the irrigation development projects/programmes will lose their momentum and control. Consequently they must again encounter the persistent constraints already identified in the ZIDP in 1997 and other documents. A smooth running and co-ordinated institutional development among the various players will definitely become a crucial prerequisite for successful achievement of sustainable and self-reliant irrigation development.

6.5.2 Roles of the Central Government, Local Government Authorities and Farmers' Organizations

The roles and functions of irrigation farming among the relating governmental organizations were reviewed in Chapter 4.3.7. The co-operation of them is essential to achieve sustainable self-reliant irrigation development. They are

presently not yet performing well however.

The main objective of institutional development in the ZIMP is to provide a more effective and more fitting institutional framework for the various participants of irrigation development and to support them achieving good performances of their demarcated roles and functions.

The MANREC, including the CARE and the DARI, will be basically responsible for formulating and reviewing policy, laws, procedures, regulations and guidelines on irrigation farming. The RADO has basically a supervision function for the DADOs and inter- and intra-regional coordination, in particular to coordinate irrigation development with other development activities. The RADO basically needs strengthening of coordination functions with relevant organizations

The LGAs' role, in fact the DADOs' role, is of critical importance for actualization of self-reliant irrigation development. One of their main roles is based on the guidance from the Central Government to provide technically and financially feasible and replicable models and/or methods of irrigation development to the irrigators' organizations (farmers) and, in addition, to assist and encourage the irrigators' organizations to operate and maintain the irrigation schemes by themselves.

The role of irrigators' organizations will become crucially important with the farmers-oriented irrigation development. They will play a main role in operating and maintaining the irrigation schemes and achieving self-reliance. However, they need significant support from the DARI, the RADOs and DADOs at least for the short and medium terms.

6.5.3 Institutional Development Components

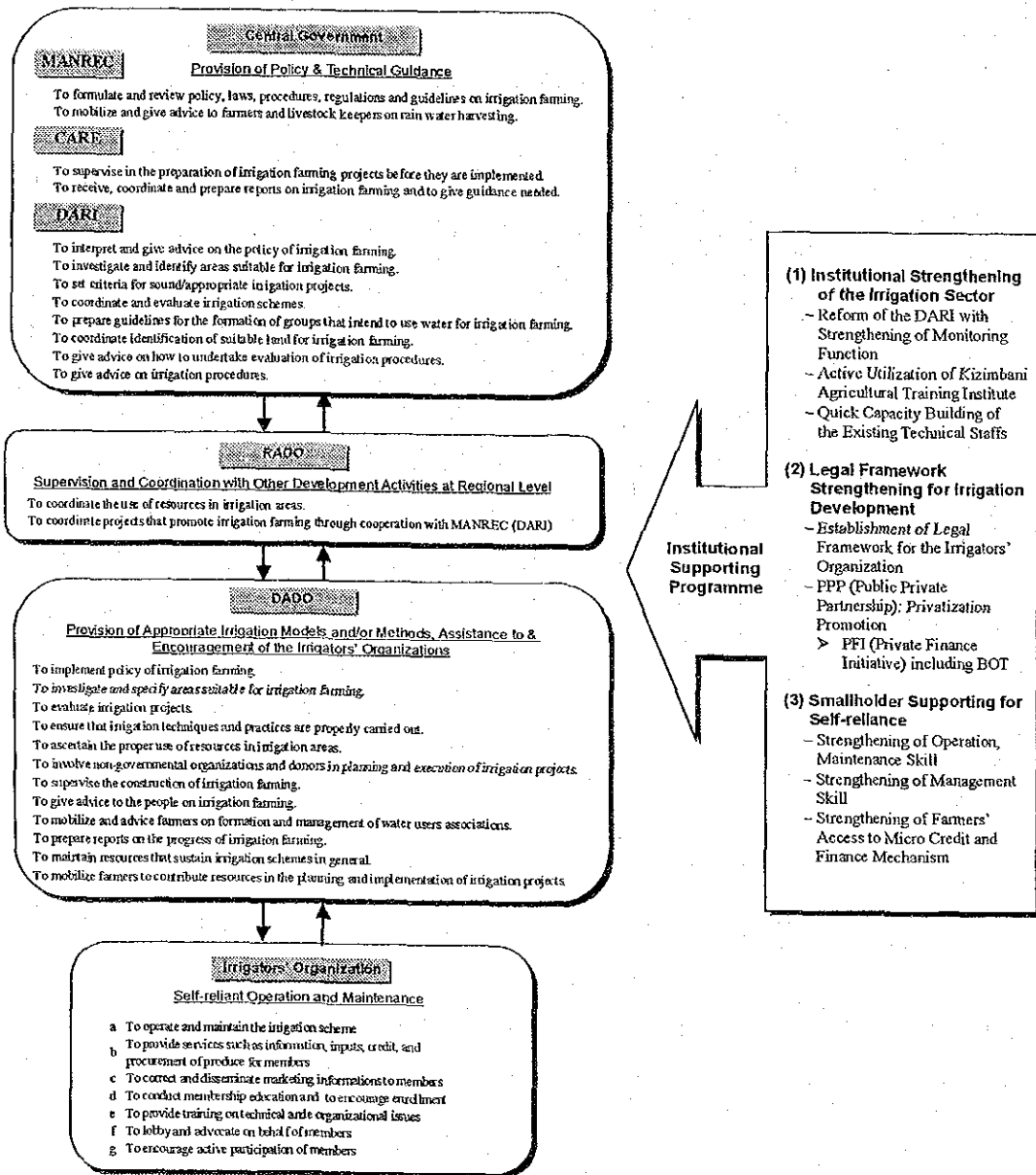
The following three groups of the institutional development components are identified.

- (1) Institutional Strengthening of the Irrigation Sector including the DARI, the RADOs and the DADOs
 - Reform of the DARI with Strengthening of Monitoring Function
 - Active Utilization of Kizimbani Agricultural Training Institute
 - Quick Capacity Building of the Existing Technical Staffs
- (2) Legal Framework Strengthening for Irrigation Development
 - Establishment of Legal Framework for the Irrigators' Organization
 - PPP (Public Private Partnership): Privatization Promotion
 - PFI (Private Finance Initiative) including BOT

(3) Smallholder Supporting for Self-reliance

- Strengthening of Operation, Maintenance Skill
- Strengthening of Management Skill
- Strengthening of Farmers' Access to Micro Credit and Finance Mechanism

Institutional Development Components and Demarcated Roles of Central Government, RADOs, DADOs, and Irrigators' Groups



6.6 Basic Plan for Agricultural Development

6.6.1 Target Crops for Irrigation Development

In order to increase the export earnings through the development of alternative export crops by diversifying Zanzibar's agricultural exports away from clove mono-crop economy, the government launched the ZCCFSP in 1991. No single export crop was, however, found capable of replacing clove as the main cash crop. The ZIDP then concluded that the food security crops to be included for planning purposes should be rice, banana and sweet potato with additional options for a pulses and vegetables. In selecting target crops it should be noted that there are opportunities for tourist hotels and restaurants to source more of their food requirement locally especially for staples and vegetables.

Among those candidate crops, emphasis should be given to rice because most of the past irrigation development study was focusing on rice cultivation. Most of the candidate schemes were thus selected from the viewpoint of the suitability for rice cultivation. The total potential area for irrigation development is, however, limited to 8,521 ha in both islands. Since there is land (estimated to be around 17,000 ha) suitable for rainfed rice, the production of this crop should also be promoted in order to contribute to food self-sufficiency.

Since water resources come mainly from surface flow on Pemba, rice cultivation from gravity irrigation seems most appropriate subject to financial and economical viability. In Unguja, where water resources are mainly groundwater, irrigated rice is rarely financially viable due to the high pumping and equipment cost. Financial subsidies would be indispensable to sustain such pumping schemes for rice cultivation. Pulses and vegetables are therefore recommended as the target crop options for local market. A small proportion of high value crops should also be introduced in response to the local food requirement for tourist hotels and restaurants.

6.6.2 Land Use Plan

(1) Agro-ecological Zone

Unguja and Pemba have traditionally been divided into two broad agro-ecological zones referred to as the plantation area and the coral rag area. This classification fails, however, to describe the increasing complexity and geographical diversity of farming systems in Zanzibar.

The new classification of farming systems developed by the ZCCFSP in collaboration with other departments of the then MALNR incorporates a better understanding of soil types and their fertility. This classification can be a useful

tool for agricultural research and especially for planning purposes.

Thorough study based on the above mentioned agro-ecological zoning for the irrigation development has already been carried out and most of the suitable areas for the irrigation development were selected and inventorized as candidate schemes. It can therefore be concluded that the land use plan for irrigated agriculture is almost covered under the proposed schemes.

(2) Cropping Pattern

The present and future cropping pattern for each candidate scheme was presented as a result obtained through inventory survey under the current master plan study. Out of 57 candidate schemes, 11 schemes are already irrigated. The cropping intensity was compared between irrigated and non-irrigated schemes and also between Unguja and Pemba.

For the irrigated schemes, rainy season paddy under irrigated area was completely irrigated and some dry season paddy was also irrigated. Together with limited rainfed beans in dry season, the present cropping intensity ranged from 107% to 200% with the average of 118%. For the non-irrigated schemes, rainy season paddy was completely rain-fed. Together with some rain-fed beans in the dry season, the present cropping intensity ranged from 100% to 148% with the average of 110%. It is obvious from this present cropping pattern that irrigated schemes have a higher cropping intensity than the non-irrigated schemes.

Although double cropping can be introduced with irrigation, the future cropping intensity is largely affected by the water availability during the dry season. The cropping intensity for each scheme was therefore assessed considering the water availability mainly from reservoir capacity. According to the results, more than 150 % of the average cropping intensity can be anticipated in general. Higher cropping intensity can be expected in Unguja than in Pemba due mainly to the heavy reliance on ground water resources. The overall alteration of cropping intensity for both islands is shown as follows.

Present and Future Cropping Intensities

Average Present Cropping Intensity (112%)			
Unguja		Pemba	
Rainy season (100%)	Dry season (14%)	Rainy Season (100%)	Dry Season (6%)

Water Availability During Dry Season

Average Future Cropping Intensity (157%)			
Unguja		Pemba	
Rainy Season (100%)	Dry Season (64%)	Rainy Season (100%)	Dry Season (32%)

Source: JICA Study Team

6.6.3 Farming System Improvement Plan

(1) Farming System

The most important contribution of irrigation development is to increase cropping intensities and this is also the desire of farmers who wish to introduce irrigation schemes. Once irrigated, the cropping intensity can be increased on the land wherever resources permit. Other contributions of irrigation development are of course to stabilize and increase the crop yield per unit area. Irrigation development is also helpful for the production of certain kind of high value crops including chili and vegetables that should be adopted into smallholder farming systems.

Proper farming practices should be adopted to take full advantage of irrigated agriculture and promote the productivity of crops cultivated based on the proper application of farm inputs. It is thus indispensable to apply certified seeds of high yielding varieties or improved varieties with proper dosage of fertilizer and agro-chemicals under sufficient supporting services such as research and extension. The detailed plan on input supply and supporting services will be described in the following clauses.

(2) Input Supply

The procurement of transportation means was carried out in order to establish suitable input delivery mechanism under the Zanzibar Smallholder Support Project. Furthermore, various seminars were held for input traders to promote the farm inputs supply for smallholders. The transfer of responsibility of input distribution to private sector has, however, not yet been fulfilled.

Under such circumstances, there is a possibility to improve input supply in connection with the integration of tourism and agriculture. Farmers always need production inputs such as seeds, fertilizer, agro-chemicals, irrigation equipment and also stable market. If tourist hotels supply local farmers with seeds, chicks and even left-over food, farmers in turn can sell vegetables and eggs to the hotels under a symbiotic partnership. Tourist hotels can thus be encouraged to invest in local production by pre-financing the supply of inputs to local farmers.

(3) Farmers Supporting System

As already mentioned, tremendous efforts have been carried out to find alternative export crops to diversify from clove mono-crop economy under the ZCCFSP. Although no export crops could get close to the compensation of the lost clove revenue, four potential export crops of mango, vanilla, papaya and chili were identified. In order to continue this program, further research should be

continued to develop alternative crops. Since chili was selected as one of the potential crops with good irrigation potential in the ZIDP, more research should be carried out for further development.

Various research activities were carried out in order to improve the productivity of food crops such as maize and cassava with germplasm collection and multiplication under the ZSSP. Nothing has been done, however, for irrigated paddy. Improved seed production and distribution of irrigated paddy should therefore be established in Zanzibar in order to provide farmers with appropriate varieties.

Many extension activities including demonstration plots, training and seminars have so far been achieved under the assistance of UNDP and IFAD. Further strengthening of extension services is considered essential for the successful development of irrigated agriculture. Extension officers are required to give guidance concerning the proper farming practices to farmers and to show the effect of proper application of farm inputs under irrigated conditions.

6.7 Priority Grouping of Inventorized Irrigation Schemes

6.7.1 Preparation of Criteria

(1) General

As for irrigation development, no criteria/guideline for scheme prioritization has been developed to select suitable schemes to meet the objective of the programs. Thus, criteria are to be developed so that the schemes can be evaluated by various aspects, such as technical factors, economical factors, environmental aspects, and social aspects.

(2) Criteria for prioritization of inventorized schemes

(a) Factors for Prioritization

In consideration of five elements for sustainability of the irrigation development as mentioned in Sub-clause 6.2.3, prioritization shall be made by using the factors, such as:

- Technical factors
- Economic factors
- Environmental factors
- Ease of implementation
- Social factors

(b) Technical factors

The schemes shall be evaluated in technical viewpoints, such as slope,

possibility of salinity and alkalinity problem in soil, occurrence of flood, and drainage problem.

(c) Economic factors

The level of economic viability can be represented by EIRR. EIRR may be supplemented by size of potential area, water abstraction method. In addition, financial viability of farmers can be considered based on incremental benefits with irrigation.

(d) Environmental factors

The schemes shall be prioritized according to possibility of environmental status, such as sedimentation, water-borne diseases, and water quality.

(e) Factors for ease of implementation

The ease of implementation for each scheme shall be evaluated based on accessibility to the site, including distance from main road and road condition in rainy season.

(f) Social factors

The readiness for implementation shall be directly related to the social aspects such as formation of farmers' organization for irrigation, farmers' abilities for operation and maintenance of the schemes, existence of water right, because these factors are fundamental requirement for commencement of the rehabilitation / construction works.

Considering the above, the criteria for prioritization have been prepared, as shown on the following page:

Criteria for Scheme Prioritization

Factors for Evaluation		Points	
1	Technical Factors (20 points)	1. Slope (6 points)	
		(a) Flat (less than 0.5%)	6
		(b) Mild (0.5 - 2.0%)	5
		(c) Moderate (2.0 - 4.0%)	4
		(d) Steep (more than 4.0%)	3
		2. Salinity / Alkalinity of Soil (10 points)	
		(a) Observed	0
		(b) Not observed	10
		3. Damage by flood (2 points)	
		(a) Observed	0
		(b) Not observed	2
		4. Drainage Problem (2 points)	
(a) Observed	0		
(b) Not observed	2		

2	Economic Factors (40 points)	1. Size of potential area (10 points)	
		(a) Less than 500 ha	4
		(b) 500 - 1000 ha	6
		(c) 1000 - 2000 ha	8
		(d) More than 2000 ha	10
		2. Water abstraction method (10 points)	
		(a) Gravity	10
		(b) Pump	5
		3. EIRR (15 points)	
		(a) Less than 8.0%	3
		(b) 8.0 - 12.0 %	6
		(c) 12.0 - 16.0 %	9
		(d) 16.0 - 20.0 %	12
		(e) More than 20.0 %	15
		4. Financial Viability (5 points)	5
3	Possibility of Environmental Status Factors (10 points)	1. Sedimentation (5 points)	
		(a) Serious	0
		(b) Fair	1
		(c) Little	4
		(d) None	5
		2. Water-borne Diseases (2 points)	
		(a) Serious	0
		(b) Fair	1
		(c) None	2
3. Water quality (3 points)			
(a) Serious	0		
(b) Fair	1		
(c) Little	2		
(d) None	3		
4	Ease of implementation (5 points)	1. Accessibility to site	
		(a) Serious	5
		(b) Fair	3
		(c) Little	1
5	Social Factors (25 points)	1. Organization set-up (4 points)	
		(a) Established	4
		(b) Not yet established	0
		2. Establishment of O&M committee (2 points)	
		(a) Organization set-up	2
		(b) Not yet established	0
		3. Linkage with village (2 points)	
		(a) Good	2
		(b) Poor	0
		4. Operation body of schemes (3 points)	
		(a) Farmers' organization	3
		(b) Other bodies	1
		5. Training for O&M (2 points)	
(a) Satisfactory	2		
(b) Not satisfactory	1		
6. Maintenance of scheme (2 points)			
(a) By Farmers' organization	2		
(b) By Other bodies	0		
7. Existence of water right (8 points)			
(a) Existence	8		
(b) Non-existence	0		
8. Average farm size (2 points)			
(a) 0 - 1.0 ha per household	2		
(b) Others	0		

6.7.2 Analysis of Inventorized Schemes for Priority Grouping

(1) General

The answered questionnaires in the inventory survey involve a lot of questionable data or are completely lacking in such basic data as potential irrigable area, project costs, which are needed to estimate irrigation benefit as well as EIRR. In order to solve the problem, cross-checking and supplementary data were required. In particular, development costs, irrigation benefits and EIRR were cross-checked and supplemented.

(2) Estimate of Rehabilitation / Construction Cost

The project costs for rehabilitation, improvement and construction for each category were assumed and supplemented based on the previous performance of irrigation development.

Unit Project Costs by Type of Works

Unit : US\$/ha

Type of Irrigation	Rehabilitation	Restoration	New Construction
Gravity by Dam	3,000	5,000	6,000
Gravity by Diversion weir	2,000	2,500	3,000
Pump by Groundwater	2,500	4,000	5,000

Source: JICA Study Team

(3) Estimate of Irrigation Benefits

The irrigation benefits were defined as the difference of net crop production values for the future with and without project conditions, and were calculated according to the following equations.

- Net crop production values =
 { (unit yield of paddy x economic farm gate prices) – production cost per ha }
 + { (unit yield of maize x economic farm gate prices) – production cost per ha }
 + { (unit yield of beans x economic farm gate prices) – production cost per ha }
- Irrigation benefits =
 net crop production value (under with-project conditions)
 - net crop production value (under without-project conditions)

The proposed cropping pattern and crop budget for each crop are based on the Basic Plan for Agricultural Development in Clause 6.6.

(4) Calculation of EIRR

EIRR were calculated on the basis of supplemented costs and estimated benefits under the following basic assumptions:

- Conversion factor to economic construction cost is 0.8.
- Conversion factor of agricultural inputs and labour force are based on the

report on "The Study on the Smallholder Irrigation Projects in Central Wami River Basin, Morogoro" in 1998.

- Economic annual O&M cost is 0.5 % of the economic construction cost,
- Constriction period is 3 years for small-scale schemes, 4 years for medium-scale schemes, and 5 years for large-scale schemes,
- Build-up period is 3 years after completion of construction works
- Project economic life is 50 years for the large-scale schemes, 15 years for the water harvesting schemes, and 30 years for the other categories of the schemes.
- Replacement cost is estimated at 1% of the economic construction cost in every 10 years after completion of the construction works.

The supplemented financial cost data were converted to economic costs by applying a conversion factor of 0.8.

6.7.3 Priority Grouping of Inventorized Schemes

(1) Objectives

Priority grouping of the inventorized schemes aims to facilitate the formulation of an 18-year scheme-wise development program for the ZIMP. In order to utilize the nation's resources effectively for irrigation development, the proposed schemes should be investigated, planned, designed and implemented in a proper manner in accordance with the proposed criteria. Only those schemes that pass the screening criteria should proceed to implementation.

The implementation schedule of the ZIMP should therefore be based on the priority groupings which will classify the inventorized schemes into 4 groups, namely, "A" group, "B" group, "C" group, and "D" group. The qualified schemes ("A" group) will be prioritized in accordance with the agreed guidelines for prioritization.

(2) Criteria and Results of Priority Grouping

Fifty-seven schemes are classified into four groups according to the criteria for prioritization as shown right:

Criteria for Prioritization

Points	Group
Over 70	"A" Group
61 - 70	"B" Group
51 - 60	"C" Group
Below 50	"D" Group

6.7.4 Results of Priority Grouping

The results of the priority grouping are given in Table 6.7.1 and summarized as follows:

Summary of Priority Grouping

	Group	Nos.	Potential Area (ha)
(1)	"A" Group	4	810
(2)	"B" Group	11	1,237
(3)	"C" Group	29	3,320
(4)	"D" Group	6	3,154
	Total	57	8,521

The general features of the "A" Group schemes are as follows:

Distribution of "A" Group Schemes by Region

Region	Nos.	Potential Area (ha)
North 'A' - Unguja	2	650
North 'B' - Unguja	-	-
Urban West - Unguja	1	120
North Pemba	1	40
South Pemba	-	-
Total	4	810

6.8 Alternative Study for Development Target

As mentioned in Sub-section 6.6.1, the maximum farming area for paddy cultivation is estimated at 17,000 ha for all Zanzibar by 2020. This means that the irrigation area would be developed while the rainfed area would decrease, because potential irrigation areas are included. The inventory survey presents the potential area of 8,521 ha for 57 irrigation schemes. In this case, rainfed area for paddy cultivation would become 8,479 ha. In Sub-section 6.3.2, financial resources for implementation of the ZIMP are examined for the three different cases by referring to the past expenditures, namely High Case, Base Case and Low Case. Based on these data, possible paddy production is calculated for comparison with projected demand of 157,270 tons (paddy base) mentioned in Sub-section 6.3.3. The results are tabulated below:

Comparison of Projected Demand of Paddy with Each Case at 2020

Case	Cost *	Irrigated Area	Rainfed Area	Total Production (ton)	Balance with Demand
Full Development	20.3	8,521 ha	8,479 ha	40,854	- 116,416
High Case	4.8	2,383 ha	14,617 ha	23,118	- 134,152
Base Case	3.2	1,953 ha	15,047 ha	22,186	- 135,084
Low Case	1.5	1,066 ha	15,934 ha	21,248	- 136,022

* : required development cost of schemes in Million US\$

As can be seen in the above table, even the case of "full development" could not achieve the projected demand of paddy in 2020. In addition, this case would require an extremely high budget of US\$ 20.3 million by 2020 as compared with the required development cost of irrigation schemes for the High Case of US\$ 4.8 million. From this analysis, and also in consideration of utilizing the available

budget to decrease the quantity of imported rice as much as possible, the High Case, which would bring about the irrigation development area of 2,383 ha, has been selected for preparation of the development programme for the year 2020. Details of this are discussed in Chapter 7.

As mentioned in the sensitivity analysis in Sub-clause 6.3.2, Low Case means the application of current financial situation to the irrigation development, which shows the small budget mainly due to low aide assistance by donors. If such financial situation continues, in the future the GOZ will face so severe deficit of paddy. It is therefore expected that the GOZ will arrange more budget to the irrigation development, by keeping close communication with the donors.

CHAPTER 7 IRRIGATION DEVELOPMENT PROGRAMME

7.1 Development Scenario for the Year 2020

The ZIMP aims to produce a sustainable irrigation development through the effective use of national resources resulting in an increase of agricultural productivity. The development programme to implement the ZIMP targets the establishment of sustainable irrigation development system by 2020 in the following staged timeframe:

- Short Term : 2003 – 2007
- Medium Term : 2003 – 2012
- Long Term : 2003 – 2020

The ASP states the need for structural reform of the agricultural sector to promote private sector involvement in production, marketing and processing. The ASP also states that the government shall give effort only to the provision of public services that can not be provided by the private sector, and shall promote and support initiatives of the private sector including farmers' association and NGOs under the government's ownership.

The sustainable irrigation development requires a successful three-way partnership comprising the government's ownership, the co-operation and participation of the farming community and involvement by the private sector. As discussed in Sub-clause 3.3.1, the government faces a number of financial constraints and therefore requires co-operation and participation by other parties. The government's ownership is essential since the irrigation development is required for the betterment of Zanzibar.

In Sub-clause 6.3.2 and Clause 6.8 of this Main Report, the investment amount for irrigation development is studied for three cases (high case, base case and low case) using the past actual expenditures and the assumption of increase in proportion of GDP growth rate. As a result, the High Case is recommended from a viewpoint of full use of possibly available resource.

The basic plan for agricultural development discussed in Clause 6.6 of this Main Report as well as in the ZIDP, proposes an irrigation development emphasizing an increase of rice production as the preferred option, from the economical and financial viewpoints, but also considering the beneficial effects of improvements to staple food and cash crop.

In consideration of these viewpoints, necessary interventions and phasing, the JICA Study Team elaborates the stage-wise development scenario for

Subject-wise Improvement and Scheme-wise Development focusing on improvement in quality and expansion in area respectively.

Stage-wise Irrigation Development Scenario

	Short Term (2003-2007)	Medium Term (by 2012)	Long Term (by 2020)
Development Target	To Establish Sustainable Irrigation Development System by 2020		
Key Issue for each Term	Reform	Ownership	Self-reliance
Subject-wise Improvement			
Strategic Approach	<ul style="list-style-type: none"> - Reform of environment for creation of government's ownership and involvement of private sector - Establishment of appropriate technologies on irrigation development in cost-effective concept - Arrangement of environmental issues on irrigation development 	<ul style="list-style-type: none"> - Establishment of irrigation development system under government's ownership - Application of appropriate technologies on irrigation development in cost-effective concept - Establishment of environmental protection method on irrigation 	<ul style="list-style-type: none"> - Establishment of self-reliant irrigation development by private sector and public sector partnership - Establishment of easy access system from farmers on technical support - Spread of environmental protection method established
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		
Activities	Give priority to construction of small-scale irrigation and water harvesting schemes		
Expected Annual Growth Rate of GDP	5.0 %	7.0 %	9.0 %

The Short Term (2003 – 2007) is regarded as “Reform” time toward establishment of self-reliant irrigation development. The enabling environment for involvement of the private sector will be created. The irrigation development will focus on further effort for the establishment of irrigation development by participatory approach system as the first step of self-reliant irrigation development. To fulfill these targets and also to realize the successful irrigation development under decentralization, tailor-made improvement programmes will be prepared and simultaneously executed in this period. The environmental issue is also important for irrigation development. The Water Right Act shall be studied and options prepared in order to avoid any water conflict in advance. The Scheme-wise Development will start with rehabilitation and construction of small-scale irrigation schemes.

The Medium Term (by 2012) will be a crucial period for irrigation development. The irrigation development system will require gradual transfer from the farmers’ participatory approach to the farmer-oriented approach, to move toward the self-reliant irrigation development under the government’s and farmers’ ownership. The scheme-wise development will progress focusing on rehabilitation

of small-scale irrigation schemes and development of water harvesting schemes.

The Long Term (by 2020) program will aim at the establishment of self-reliant irrigation development by full involvement of private sector under the partnership of public sector. For this, it is essential to create the enabling circumstances by involvement of the private sector and execution of public support function. Also required by that time, are attractive rates of lending interest, tax incentives, and desirable energy tariffs and oil prices to the private investors for agricultural development including irrigation development. The scheme-wise development will continue in the same concept, aiming to reduce the rice deficit as much as possible and saving foreign currency required for rice import.

7.2 Institutional Supporting Programme

7.2.1 Stage-wise Development

As mentioned in Sub-clause 6.5.1, the institutional development is based on the stage-wise programme. The programs have three steps for the short, medium and long terms based on the stage-wise development scenario. The basic objective of the institutional development for each term is as follows:

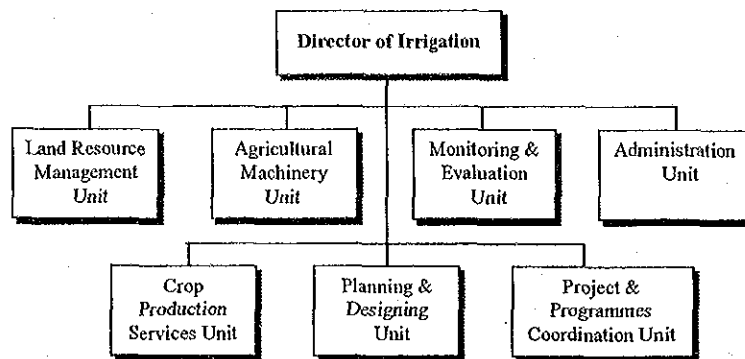
- Short term (2003-2007) : To reform the existing institutional setting for better performance of participatory irrigation.
- Medium Term (by 2012): To execute farmers-oriented irrigation development under the government ownership.
- Long Term (by 2020) : To support realizing self-reliant irrigation development through the PPP (Public Private Partnership).

7.2.2 Strengthening of Irrigation Sector

The Institutional Strengthening of the DARI has the following three subcomponents:

- Reform of the DARI with Strengthening of Monitoring Function
- Active Utilization of Kizimbani Agricultural Training Institute (KATI)
- Quick Capacity Building of the Existing Technical Staff

Presently a possible reform plan is informally under consideration in the CARE. It is to promote the DARI to a new department, i.e. the Department of Irrigation. Strengthening of the DARI including this idea should be given serious consideration.



Possible Institutional Reform Plan of the DARI

Source : the DARI

Currently, monitoring and evaluation functions are weak. Provision of effective feedback data is crucial to evaluate and achieve socio-economic effectiveness of irrigation development with environmental consideration. Strengthening of those functions should be included in the strengthening of the DARI.

The second subcomponent, “Active Utilization of Kizimbani Agricultural Training Institute (KATI)” should be regarded as one of main pillars for capacity building of the governmental staffs in the future. Through reviewing and rearranging the present curriculum including irrigation farming, programmes for senior and junior technical staffs of the governments including the DARI, the RADO, the DADO should be strengthened to provide training opportunities for irrigation farming relating to their educational levels and necessities.

The KATI will play a major role in capacity building of the staff in the long-term. However, the second subcomponent may take time before actualization, as it requires an amount of preparatory work for implementation. Therefore, the third subcomponent, “Quick Capacity Building of the Existing Technical Staff” is a short-term programme to respond urgently to the necessity for upgrading the technical level of existing technical staffs of the DARI, the RADO and the DADO. It should be implemented immediately.

In the DARI presently only 2 of 29 technical staff hold Master’s degrees and 8 staff hold Bachelor of Science, Post Graduate Diploma or Advanced Diploma, which are all similar. The others hold only National Diploma, which is generally granted to completion of two-year technical education after senior high school.

The quick capacity building programme for the DARI, the RADO, the DADO technical staff through providing long and short-term training opportunities, seminars and workshops in-country and abroad to upgrade their technical and project management skills should be prepared in the next five years.

A task force of the experts should be organized to make a strengthening plan of the Irrigation Sector focusing on the three subcomponents. The plan for the first and second subcomponents should be a stage-wise program responding to the Short Term (2003-2007), the Medium Term (by 2012) and the Long Term (by 2020). The promotion of the DARI to the Department should be effected in the short term, because it must be the important first step toward sustainable and self-reliant irrigation development and a trigger of other institutional developments.

7.2.3 Strengthening of Legal Framework for Irrigation Development

(1) Background

A reliable legal framework is a prerequisite for successful farmers-oriented irrigation development. It should provide a secure legal environment for farmers and other private stakeholders to participate and invest in irrigation development. Legal status of irrigators' group, land tenure and water rights, as well as ownership of and responsibility for irrigation infrastructure should be clearly defined for irrigation development. Presently these items are defined disconnectedly by a number of separate laws or regulations.

It has become important to establish a sound legal framework to empower farmers and the other private sectors to enable them to secure their ownership, i.e. to take full responsibility for all decisions and matters involved in development, operation and management of the irrigation schemes.

(2) Establishment of Legal Framework for the Irrigators' Organization

The irrigators' group (IG) is a basic private organization and a principal activator for irrigation development. Presently the IGs are generally classified into three categories, (i) registered irrigators' cooperative society (ICS), (ii) registered irrigators' association (IA), and (iii) non-registered group.

Presently, according to the inventory survey, there are 21 irrigators' groups, which have their own group names and operate as IG in 57 irrigation sites of Zanzibar. Only 11 IGs are registered groups: 7 as cooperative and 4 as association among the 21 IGs. The status of the others is not clear.

Neither cooperative nor association is necessarily an optimum organizational form for the IG. The cooperative is primarily a business-oriented organization and the association can be applicable to any type of social activities. The rights and obligations of the irrigators' group members can't be always clearly and uniformly defined under the present legal framework. A new legal framework exclusively for the irrigators' groups seems to be very important and necessary for securing their

ownership and self-reliant irrigation development.

A consultancy work for establishment of the legal framework, possibly a new Act, Ordinance or Regulations, should be undertaken through the initiative of the DARI in cooperation with the relevant governmental agencies, lawyers and technical specialists.

(3) PPP (Public Private Partnership): Privatization Promotion

The institutional development target at the third stage of the ZIMP is to support realization of self-reliant irrigation development through the PPP (Public Private Partnership). The investment by the private sector (farmers' organizations and private companies) in irrigated farming will be one of important alternatives in the future and play an important role for irrigation development. The MANREC in cooperation with relevant governmental agencies needs to prepare favorable and attractive legal and institutional framework for the private investors.

For the PPP, there are several possible schemes. The applicability and feasibility of each privatization scheme such as DBO, BTO as well as BOT should be carefully explored and compared based on the present situation of the private sector. Furthermore, the investment guidelines for the private sector should be established for direct private investment for irrigation development.

7.2.4 **Smallholder Supporting for Self-reliance**

Extension services for the irrigators' groups through the DADO should be continuously given a high priority for actualization of self-reliant irrigation development. The following subcomponents should be put emphasis on in the training programs for them.

- Strengthening of Operation and Maintenance Skills
- Strengthening of Administrative, Financial and Technical Management Skills

"Strengthening of Farmers' Access to Micro Credit and Finance Mechanism" is also mentioned as an important subcomponent of smallholder supporting activities. This subcomponent, however, should be integrated into a comprehensive rural development strategy and plan for effective actualization. Therefore, the ZIMP recommends that relevant agencies explore this in an integrated manner.

7.2.5 **Monitoring and Evaluation of ZIMP at each Development Stage**

The performance of the ZIMP itself should be carefully monitored and evaluated at each development stage, in the same way as an irrigation development scheme needs good operation and maintenance for satisfactory performance. Necessary feedback through a reliable monitoring and evaluation mechanism should be provided so the ZIMP can be revised in future. The role of monitoring and

evaluation of the ZIMP should be assigned to the DARI.

7.2.6 Supporting Programme

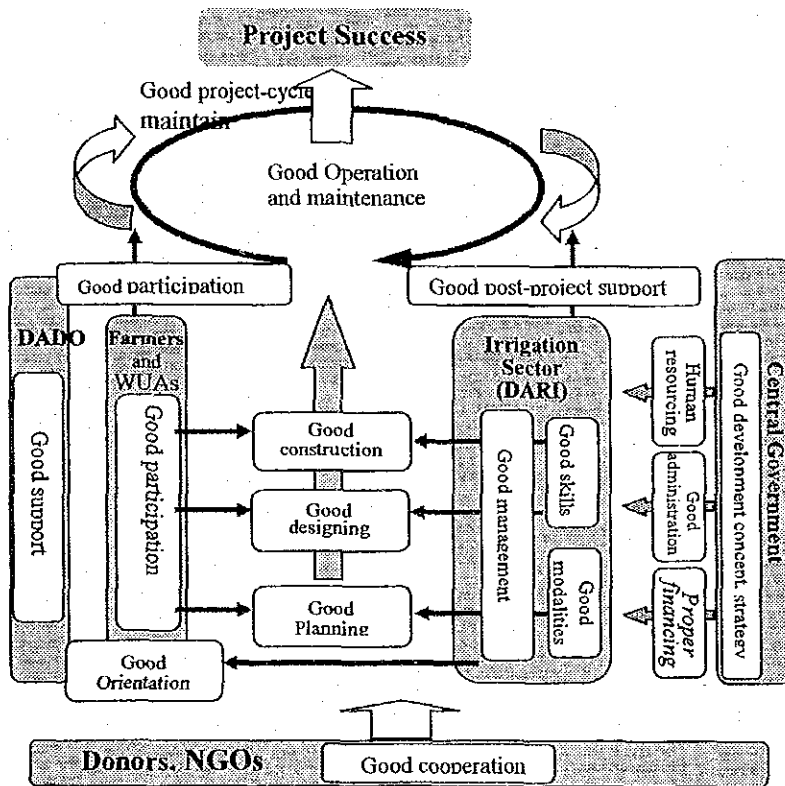
The supporting programme for institutional development is included in the Subject-wise Improvement Programme, which is discussed in Clause 7.3.

7.3 Subject-wise Improvement Programme

7.3.1 Outline of Subject-wise Programme

Irrigation schemes shall succeed by good performances in all circumstances surrounding irrigation development as shown in the following schematic figure: Failures of schemes are not always caused by isolated problems but rather by loss of linkages between related activities.

**Required Good performances
in Whole Circumstances Surrounding Irrigation Project Success**



In order to promote irrigation development effectively and to sustain its operation, the system of project cycle management which includes processes in project implementation and operation, should be streamlined as a linked chain.

Scope of irrigation development in Zanzibar is not like a large scale business. The management system for irrigation development needs to operate on a small

scale. The Subject-wise Improvement Programme is a series of arrangements to improve the management system, necessary for successful scheme implementation and operation. The Subject-wise Improvement Programme would be thus formulated at a conservative level to meet most insistent requirements taking the development scope into consideration.

7.3.2 Formulation Procedure

“Demand driven” and “Consistency in the whole undertakings” are put as the basic principles for the formulation of the Subject-wise Improvement Programme in the ZIMP.

To attain the “Consistency in the whole undertakings”, a rational task flow and close linkage between interested parties for irrigation development is considered. A general view of the task flow and linkage between parties concerned was shown in the figure “Required Good Performances in Whole Circumstances Surrounding” in the above Sub-clause. Consistency in the series of components proposed herein is carefully secured by continuously keeping the conceptual feature shown in the figure in mind.

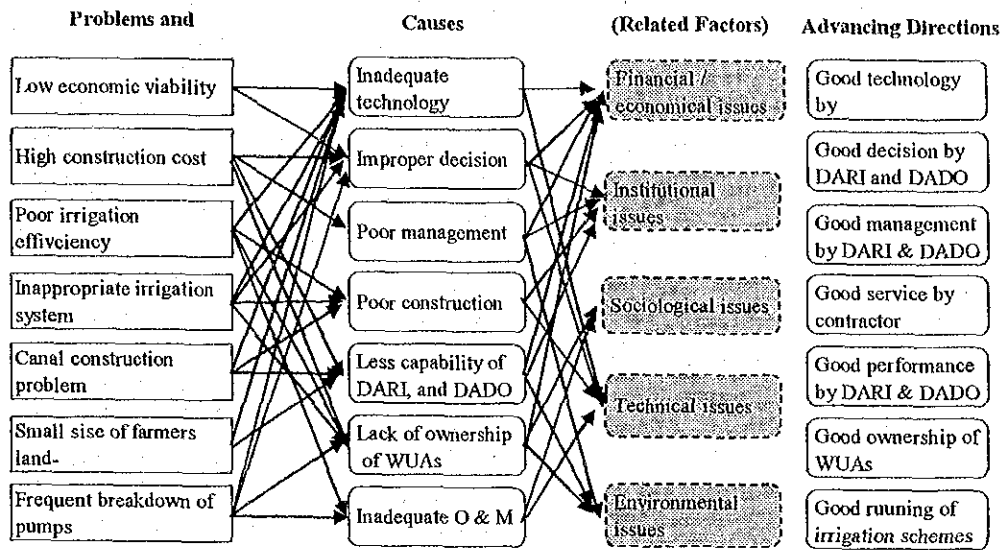
To attain the “Demand driven” aspect soundly and to achieve the formulation without any substantial omissions, all valid results obtained through investigations into problems and constraints are to be carefully analyzed. Although the ZIDP was not a perfect plan for immediate implementation, identification of problems and constraints has been undertaken. Along with other information such as the strategic papers, problems and constraints summarized in Clause 4.2 of this Main Report, problems and weakness areas can be identified and demands can be improved

7.3.3 Components of Subject-wise Programme

Problems and constraints identified in those investigations are seemingly complicated and sometimes duplicate each other

In order to reduce these complications, all significant problems and constraints identified were classified into several advancing directions of subjects, namely, “for good technology held in IS”, “for good decision done by IS”, etc. Relations between the identified problems, causes and those advancing directions are summarized in the following figure:

Relation between Problems/Constraints and Advancing Directions



The advancing directions are sub-divided into several themes at the process of irrigation development, namely, "Investigation and Survey", "Scheme Selection", "Planning", and "Designing". In this way, many numbers of themes are distributed on the texture between the directions and the developing processes as shown in Figure 7.3.1. Relations between the themes and significant problems and constraints also can be compared to the schematized outcomes on the NIMP for the Mainland.

Taking this relationship of themes into consideration, components were formulated so as to relieve and improve the problematic situations. Generally, a project shall succeed under the conditions of "good organization (including good resources)", "good rules", "good tools", "good information" and "good motivation", etc. Concepts of these five aspects of conditions were introduced for identifying and formulating of components. As shown in Figure 7.3.1, a total of 23 groups of components were identified so as to cover any requirement of improvement, which were categorized in five groups of I to V.

Some groups of components are not able to fulfill the objectives by themselves, and require the integrated approach with other plural components. Consequently, re-grouping of components was made, and finally a list of 31 components was formed, as shown Table 7.3.1.

This ZIMP will hopefully be implemented at the same time as implementation of the NIMP. The Subject-wise Improvement Programme in the NIMP would cover some components of the ZIMP, and these could be applied to the ZIMP's components in order to save costs and to promote further close relation between

both the governments. Twenty-three components of the Subject-wise Improvement Programme in the ZIMP, concerning preparation of technical guidelines and technical studies, should be covered by the related components in the NIMP, and eight components should be implemented separately under the ZIMP. The components to be implemented in the ZIMP are outlined in Table 7.3.2.

7.3.4 Improvement Programme for the Year 2020

(1) Development Target

The Subject-wise Improvement aims at the creation of a foundation for establishment of self-reliant irrigation development by public sector and private sector partnership. This programme will be mostly executed in the Short Term and Medium Term since it is required prior to the next stage target. In the Short Term (by 2007), the executed programme will focus on fundamental themes such as institutional aspects and technical aspects for the central government and farmers. In the Medium Term (by 2012), consideration is to be given the further strengthening of the government and farmers ownership on irrigation development.

(2) Development Programme

Thirty-one components are proposed in the Subject-wise Improvement Programme. These components will be implemented step by step in view of the following:

- Cross-cutting components for all irrigation schemes,
- Fundamental issues for irrigation schemes,
- Harmonization with the Stage-wise Development Scenario,
- Sound linkage with future transition of the scheme implementation types, and
- Orderly relation of each component in consideration with whole context of the Subject-wise Improvement Programme

As a result, 27 components will be executed or started in the Short Term, and the remaining 4 components in the Medium Term. Out of them, only 8 components that are shown in bold letter in the below table, will be independently conducted in Zanzibar and the remaining 23 components will be carried out together with the Mainland as mentioned in Sub-clause 7.3.3.

List of Subject-wise Improvement Programme in Short-Term

No.	Ref.	Components
1	I-1	DARI, RADO and DADO Institutional Improvement Programme
2	II-1	DARI Working Mandate Formulation Programme
3	II-2	Regulatory Networking System Establishment between RADO/DAD and DARI
4	II-3	NGO's Intervention in Irrigation Development Encourage Programme

5	II-4	Cooperation Channelling within Irrigation-Sector Establishment Programme
6	II-5	Sub-sectors Coordination System Establishment
7	III-1	Survey and Investigation Guideline Establishment Programme
8	III-2(1)	Planning Guideline Establishment Programme
9	III-2(2)	Designing Guideline Establishment Programme
10	III-3(1)	O&M Guideline Establishment Programme
11	III-3(2)	Monitoring & Evaluation Guideline Establishment Programme
12	III-4	Farmers' Participation in Irrigation Development Programme
13	III-5	Village Irrigation Development Guideline Establishment Programme
14	III-6	Farmers' O&M Manual Establishment Programme
15	III-7	Establishment of DADP Formulation Guideline for Irrigated Agriculture Development
16	IV-1	Technical Manuals Handling Guideline Establishment Programme
17	IV-2	Information and Database Improvement Programme
18	IV-3	Irrigation Development Contractors and Consultants' Listing Programme
19	IV-5	Existing-scheme Monitoring System Establishment Programme
20	V-1(1)	Irrigation Technology Research Center Establishment Programme
21	V-1(2)	Perennial Irrigation Method Improvement Programme
22	V-1(4)	Small Dam Technology for Irrigation Development Establishment Programme
23	V-1(5)	Environmental Assessment Study for Irrigation Practice in Tanzania
24	V-1(6)	Study of River-Basin Approach in Irrigation Development
25	V-3	Farmers' Participation Training Programme
26	V-4(1)	Irrigated Agriculture Training Programme for Rice Production Increase
27	V-4(2)	Irrigated Agriculture Training Programme for Cash Crops Production Increase

List of Subject-wise Improvement Programme in Medium-Term

No.	Ref.	Components
1	IV-4	LGA Networking System Establishment Programme
2	V-1(3)	Flood Irrigation Development Programme
3	V-2	Hydraulic Experimental Center Establishment Programme
4	V-5	Integrated Irrigation Development Model establishment Programme

Figure 7.3.2 shows the details of implementation schedule.

7.4 Scheme-wise Development Programme

7.4.1 Selection of Schemes to be Developed

As discussed in Clause 6.8, the possible irrigation development areas by 2020 are estimated at 2,383 ha under the "High Case" of financial resource. These areas are included in the 16 irrigation schemes which are selected from the "A", "B" Groups and parts of "C" group as discussed in Clause 6.8 of this Main Report. The breakdown of 16 irrigation schemes is as follows:

Irrigation Development Areas by 2020

Type of Development	No(s).	Total Potential Area
Surface by dam reservoir	12	1,349 ha
Surface by diversion weir	3	432 ha
Groundwater by pump	1	602 ha
Total	16	2,383 ha

Source: JICA Study Team

Appendix F presents the details of stage-wise development of 57 prioritized irrigation schemes.

7.4.2 Development Programme for the Year 2020

The development programme for the year 2020 in both the Unguja and Pemba areas is shown below.

Accumulated Irrigation Development Area in the Unguja Island

Development Target At each Term	Short Term	Medium Term	Long Term
	2003 - 2007	by 2012	By 2020
(a) Surface by dam reservoir	250 ha	650 ha	900 ha
(b) Surface by diversion weir	90 ha	132 ha	432 ha
(c) Groundwater by pump	178 ha	178 ha	602 ha
Total	518 ha	960 ha	1,934 ha

Source: JICA Study Team

Accumulated Irrigation Development Area in the Pemba Island

Development Target At each Term	Short Term	Medium Term	Long Term
	2003 - 2007	by 2012	By 2020
(a) Surface by dam reservoir	106 ha	106 ha	449 ha
(b) Surface by diversion weir	-	-	-
(c) Groundwater by pump	-	-	-
Total	106 ha	106 ha	449 ha

Source: JICA Study Team

By the year 2020, seven schemes will be developed in the Unguja Island while the number of the schemes in the Pemba is nine.

7.5 Cost Estimate for ZIMP Implementation

(1) Subject-wise Improvement Programme

As mentioned above, there are two approaches to the implementation of the Subject-wise Improvement Program. One is to target Zanzibar only, and the other is for a combined Mainland and Zanzibar program. The former, which includes the costs for all 31 components would require US\$355,000 in total. The latter, based on the eight components unique to Zanzibar only, would require US\$105,000. Annually required cost is thus estimated as follows:

Annually Required Cost for Subject-wise Improvement Programme

Items	'03	'04	'05	'06	'07	'08	'09	'10	'11-'20	Total
Independent	30	45	45	45	56	68	46	20	-	355
Together	18	18	18	21	18	6	3	3	-	105
Total	48	63	63	66	74	74	49	23	-	460

Unit: Thousand US\$

(2) Scheme-wise Improvement Programme

The project cost for the irrigation schemes was estimated by referring to the guidelines on irrigation development level discussed in Clause 6.4. The estimated project costs for the 16 irrigation schemes selected in Sub-section 7.4.3 are tabulated below:

Annually Required Cost for Scheme-wise Development

Items	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	Total
Total	12	24	87	149	149	137	137	161	261	361	371	437	501	502	563	615	696	802	5,964
GOZ ¹	10	19	69	119	119	110	110	129	209	289	297	350	401	401	451	492	557	642	4,774
Farmers ²	2	5	17	30	30	27	27	32	52	72	74	87	100	100	113	123	139	160	1,190

Unit: thousand US\$, 1: 80 % of project cost, 2: 20 % of project cost

(3) Operation and Maintenance Cost

Two operation and maintenance costs are considered. One is for a surface scheme, and the other is for a pump scheme. By referring to existing data, the following operation and maintenance costs were assumed:

Unit Operation and Maintenance Cost

Scheme	Government	Farmers	Total
Surface Scheme	US\$ 5/ha/year	US\$ 10/ha/year	US\$ 15/ha/year
Pump Scheme	US\$ 331/ha/year	US\$ 17/ha/year	US\$ 330/ha/year

Based on the unit operation and maintenance costs, the required cost for operation and maintenance of irrigation schemes were estimated as shown below:

Annually Required Cost for Operation and Maintenance

Items	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	Total
Total	61	61	61	61	61	62	62	62	62	62	62	62	65	66	66	75	83	83	1,177
GOZ	57	57	57	57	57	57	57	57	57	57	57	57	58	58	58	67	74	74	1,073
Farmers	4	4	4	4	4	5	5	5	5	5	5	5	7	8	8	8	9	9	104

Unit: thousand US\$,

(4) Total Implementation Cost

Total required cost for implementation of the ZIMP including operation and maintenance is estimated at US\$7.59 million and includes farmers' contribution of US\$ 1.29 million, US\$ 0.46 million for Subject-wise Improvement, US\$ 4.77 million for Scheme-wise Improvement, and US\$ 1.07 million for operation and maintenance cost. The breakdown is tabulated below:

Breakdown of Project Cost

Year	Government	Government			Total	Balance	Farmers' Contribution
	Budget	Subject	Scheme	O & M			
'03	166	48	10	57	115	51	6
'04	176	63	19	57	139	37	9
'05	187	63	69	57	189	-2	21
'06	202	66	119	57	242	-40	34
'07	218	74	119	57	250	-32	34
'08	235	74	110	57	241	-6	32
'09	254	49	110	57	216	38	32
'10	275	23	129	57	209	66	37
'11	302		209	57	266	36	57
'12	332		289	57	346	-14	77
'13	366		297	57	354	12	79

'14	402		350	57	407	-5	92
'15	442		401	58	459	-17	107
'16	487		401	58	459	28	108
'17	535		451	58	509	26	121
'18	589		492	67	559	30	131
'19	648		557	74	631	17	148
'20	712		642	74	716	-4	169
Total	6,529	460	4,774	1,073	6,307	222	1,294

Unit : Thousand US\$

7.6 Appropriateness of Investment to Irrigation Development

The implementation of the ZIMP consisting of 31 components of Subject-wise Improvement Programme and 16 irrigation schemes of Scheme-wise Development Programme, will require about US\$6.30 million over 18 years (government portion only). This implementation would bring about the following benefits to Zanzibar:

(1) Creation of Job Opportunity

Through implementation of the irrigation schemes, a stable water resource for irrigation will be ensured. This will pave the way for an increase in agricultural production, and will encourage farmers to invest in capital and agricultural inputs such as the purchase of seeds, fertilizers, agricultural chemicals and labour, aiming at higher production. The required agricultural labour force would increase by 62 man-day/ha to 176 man-day/ha, which would require additionally about 222,000 man-days at full development in the year 2020. This is a job opportunity creation in rural areas and will lead to a re-activation of rural area activities.

(2) Poverty Reduction of Smallholders

In Zanzibar, most of the poor live in rural areas, and are engaged in agriculture. Average farm income for a one crop season would be estimated at US\$ 143/ha (Tsh.136,000/ha) without irrigation development, while with irrigation, would increase to an estimated US\$ 450/ha (Tsh.427,000/ha). Such an increase in farm income, approximately three times current levels, would contribute to poverty reduction.

(3) Saving of Foreign Currency for Rice Import

As discussed in Sub-clause 6.7, the ZIMP implementation could not result in full self-sufficiency of rice by 2020. However, the implementation would increase additionally the rice production to about 10,000 tons at 2020. This production would make a saving of foreign currency of about US\$ 2.3 million at 2002 current price (Tsh.220/kg), due to reduction in rice importation. The ZIMP implementation would therefore contribute to saving a large amount of foreign

currency.

From the above results, it is judged that investment of US\$ 6.3 million to the ZIMP implementation is appropriate from a national viewpoint.

7.7 Need of Updating of ZIMP

The ZIMP provides the overall framework and strategies for irrigation development toward the year 2020, and is generally consistent with the Zanzibar Vision 2020. The ZIMP is formulated using currently available data and information. This means that it should be updated based on the actual progress of scheme-wise development and subject-wise improvement. In order to reflect the actual progress accurately, the monitoring is essential as discussed in Sub-clause 7.2.5. In particular, the monitoring should focus on the effect of subject-wise improvement, and its results should be reflected with an update of the ZIMP. The monitoring and update of the ZIMP should be carried out by the central government, namely DARI of MAREC in cooperation with DADO.

7.8 Tentative PDM of ZIMP

Based on the study results mentioned above, a tentative PDM for implementation of the ZIMP was prepared as shown in Table 7.8.1.