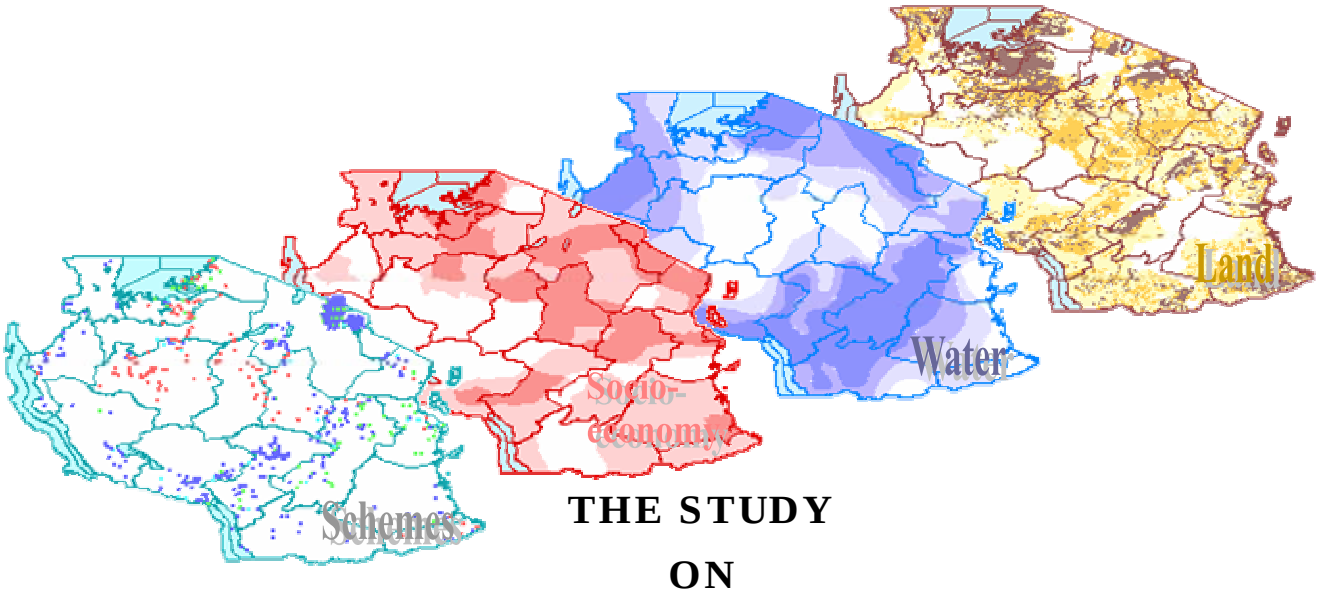
No.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF AGRICULTURE AND FOOD SECURITY (MAFS)



THE STUDY

ON

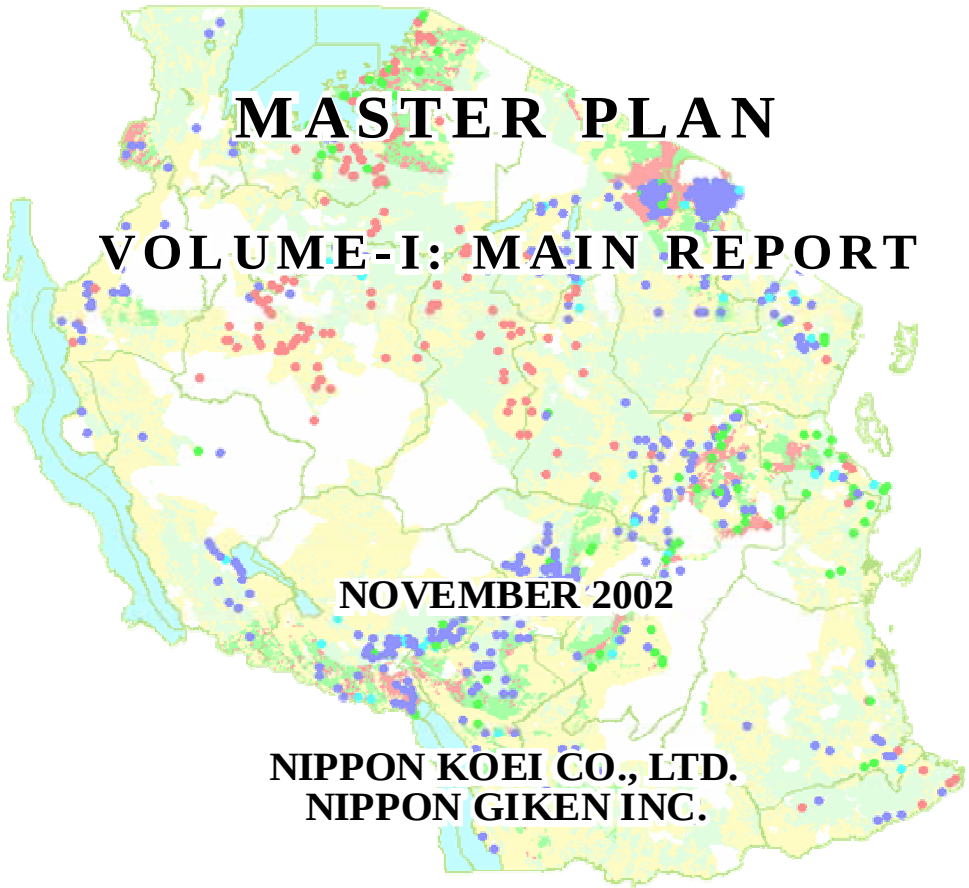
THE NATIONAL IRRIGATION MASTER PLAN

IN

THE UNITED REPUBLIC OF TANZANIA

MASTER PLAN

VOLUME-I: MAIN REPORT



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

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VOLUME-I: MAIN REPORT

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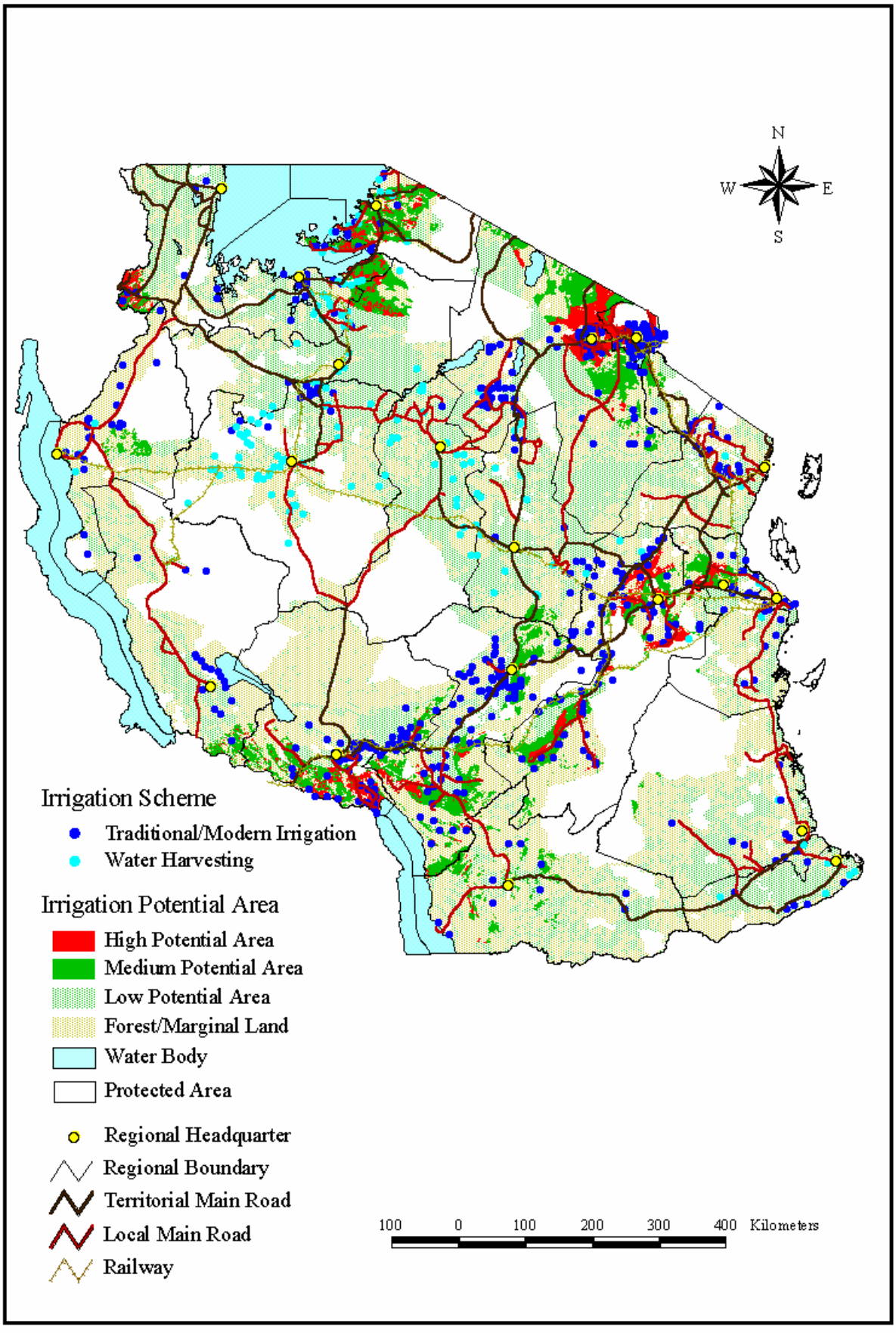
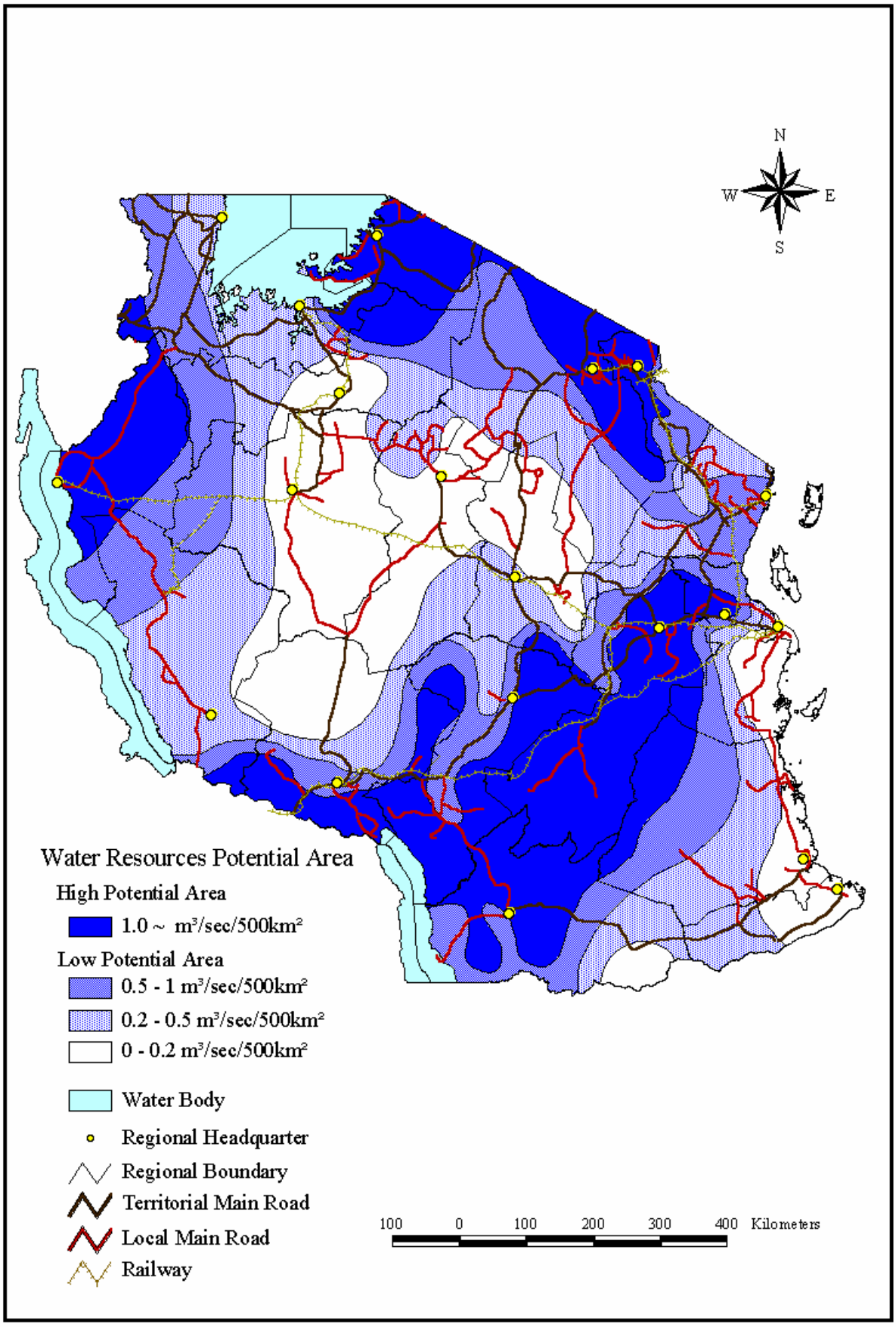
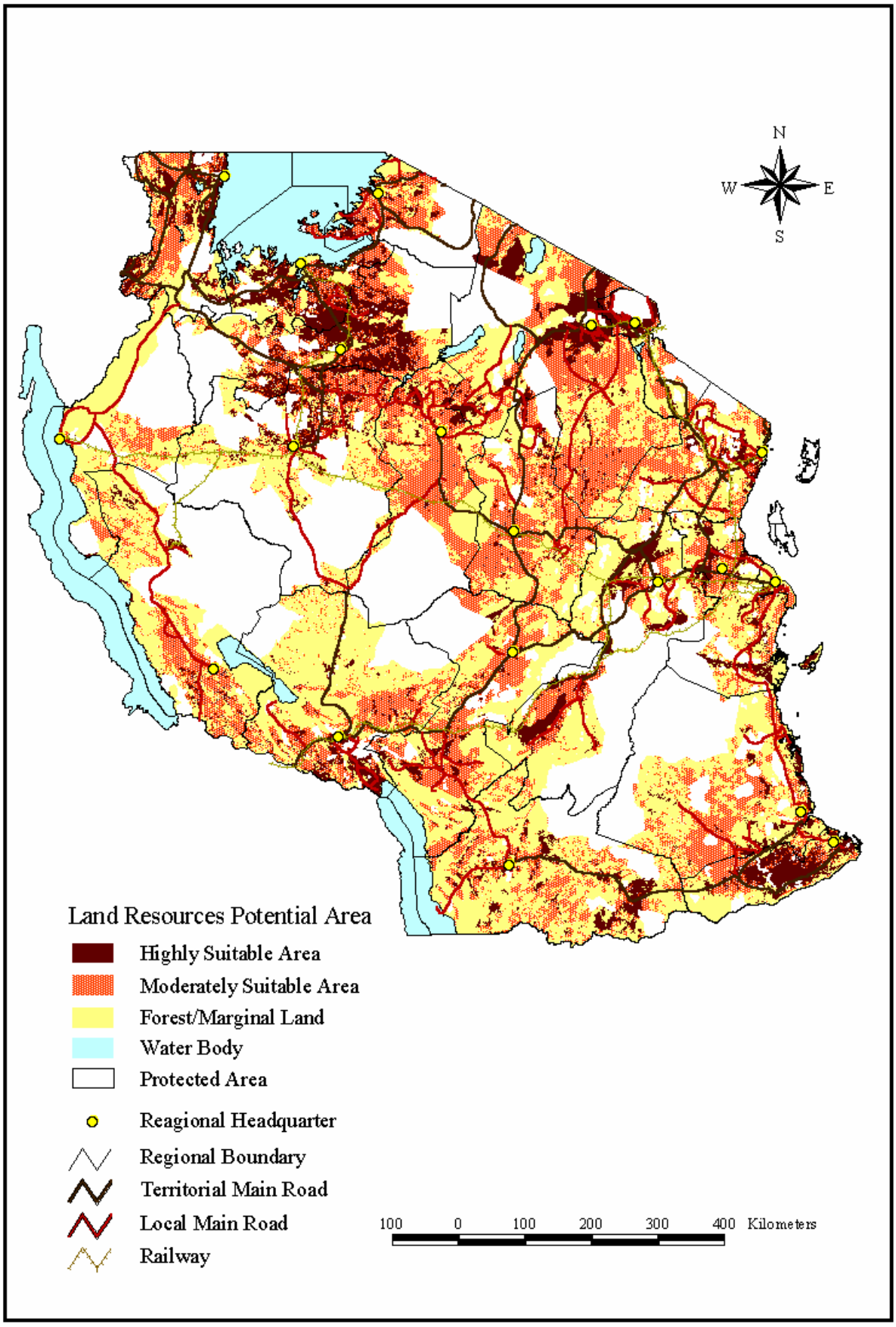


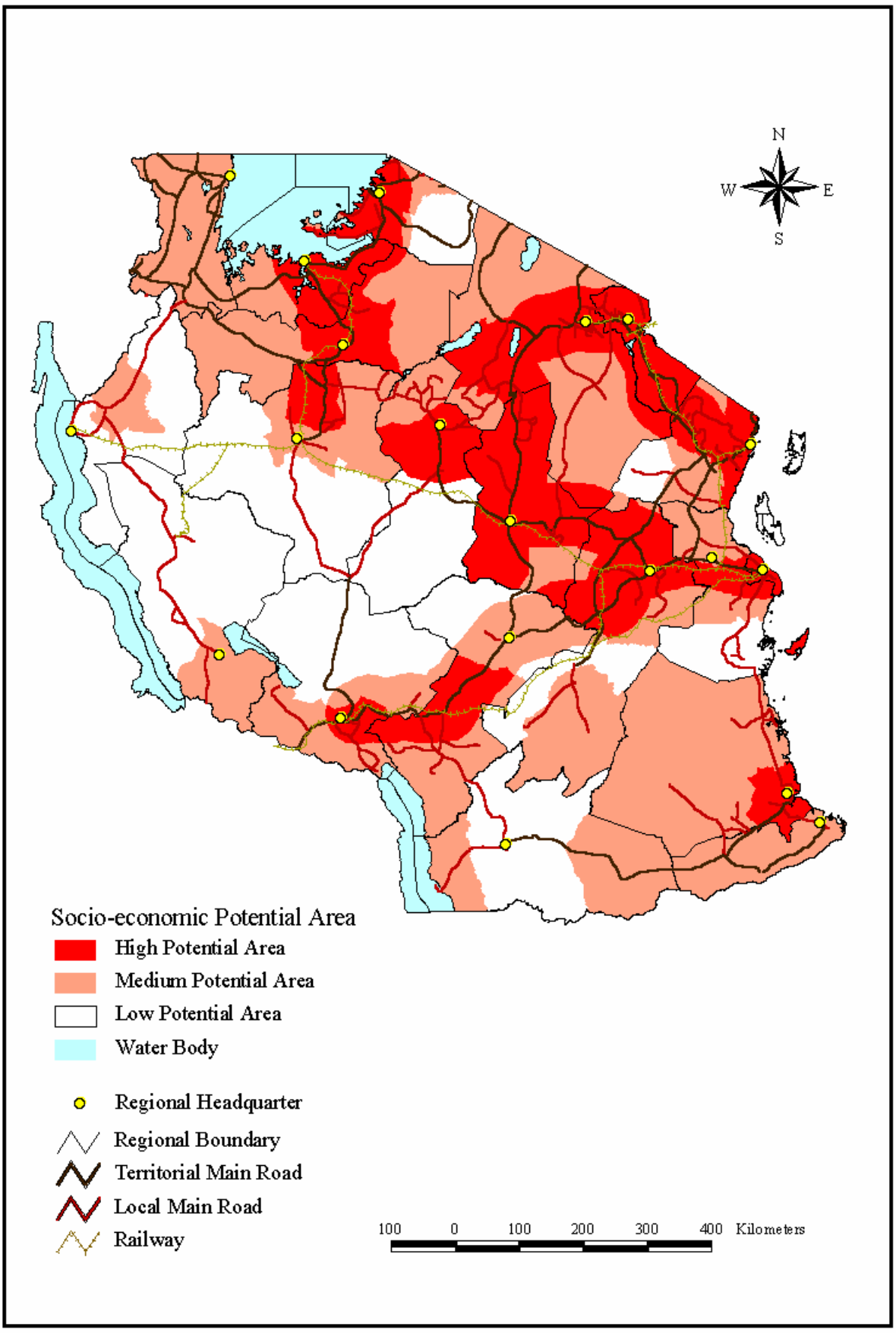
Distribution of Irrigation Schemes on Irrigation Development Potential Map



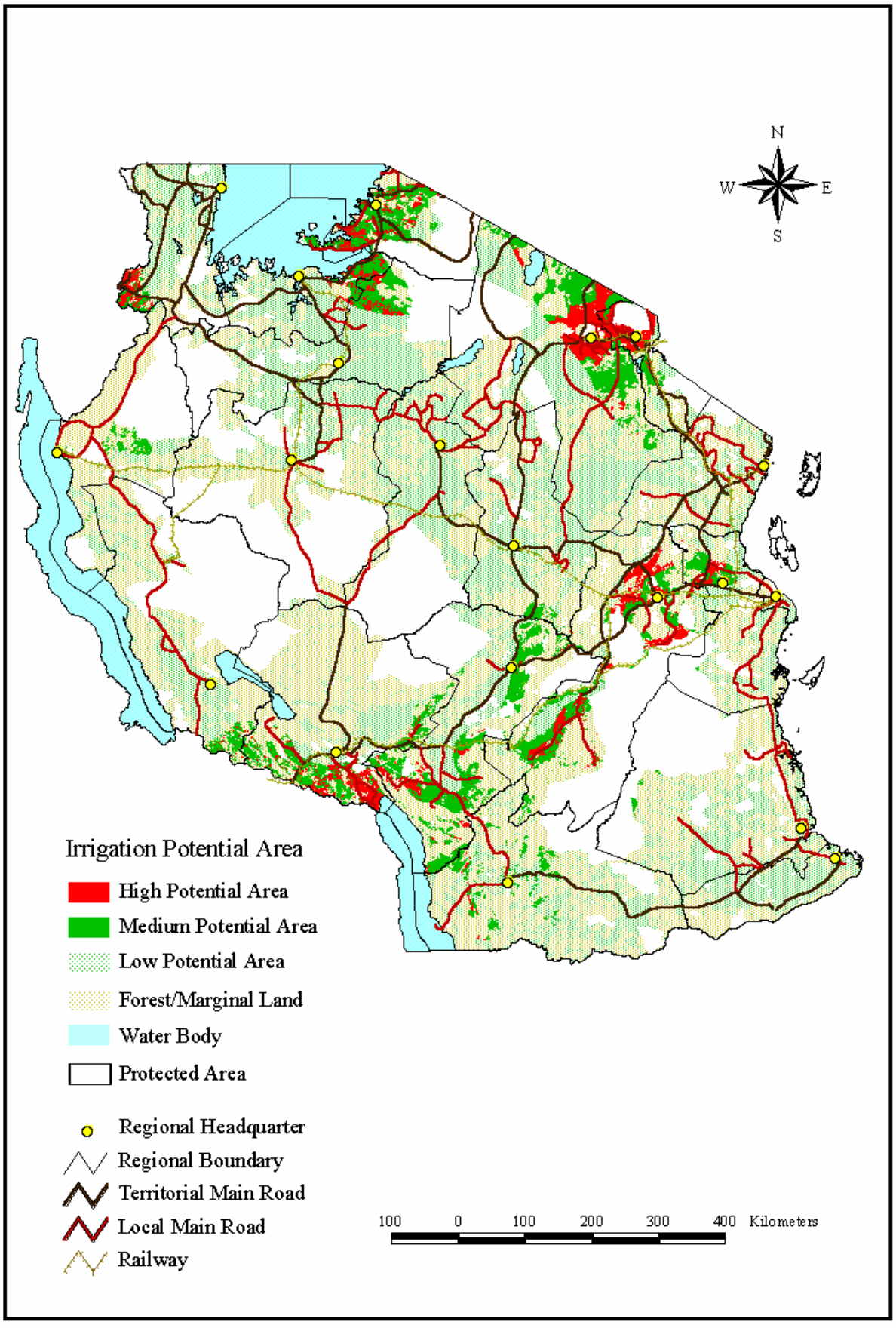
Water Resources Potential Area



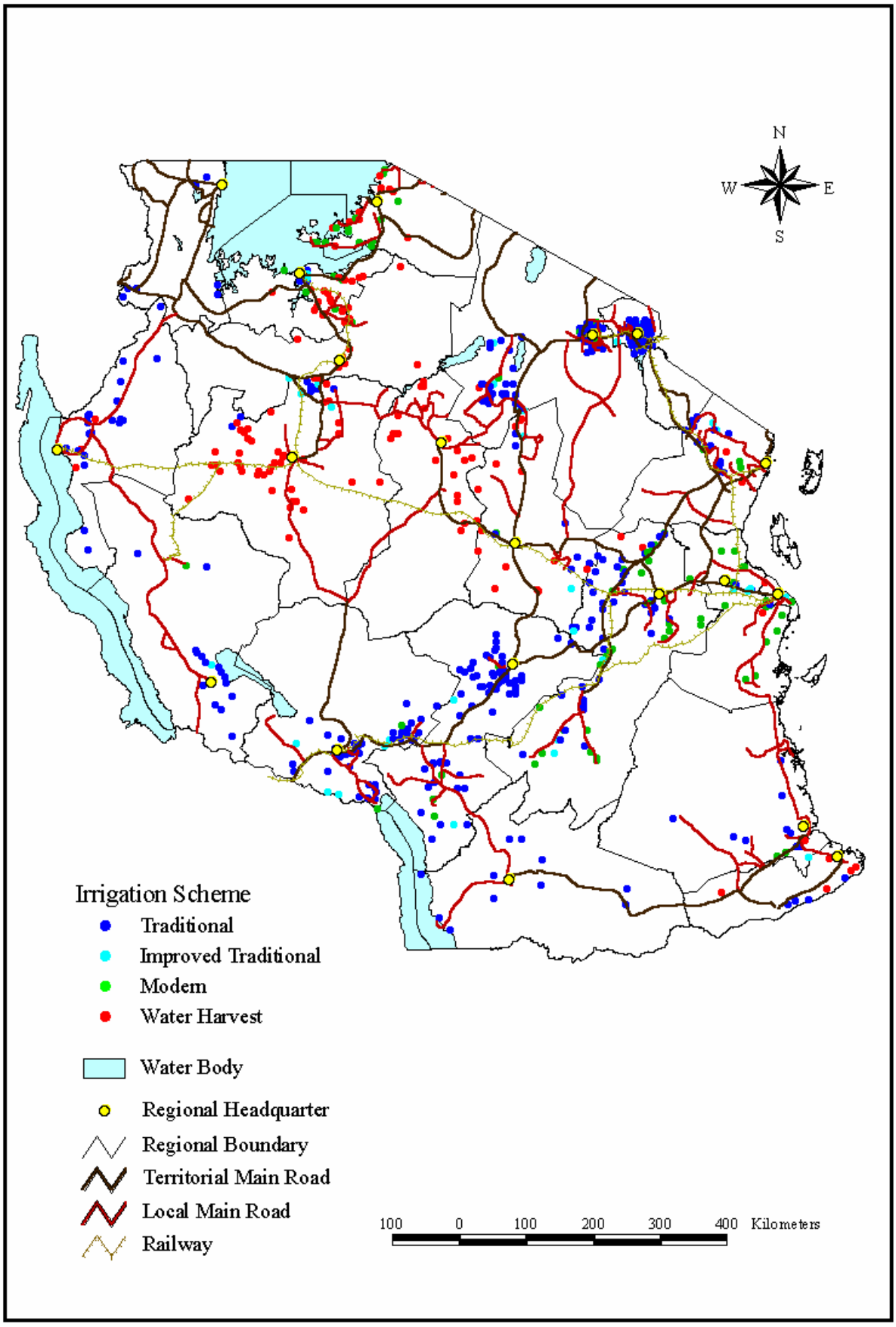
Land Resources Potential Area



Socio-economic Potential Area



Distribution of Irrigation Potential Area



Distribution of Irrigation Schemes

ABBREVIATIONS

ADB	African Development Bank
ADF	African Development Fund
AGITF	Agricultural Input Trust Fund
APCC	Agricultural Policy and Coordination Committee
ASDS	Agricultural Sector Development Strategy
ASDP	Agricultural Sector Development Programme
ASMP	Agricultural Sector Management Programme
ASPS	Agricultural Sector Programme Support
BFI	Base Flow Index
BoT	Bank of Tanzania
BOT	Build-Operate-Transfer
BTO	Build-Transfer-Operate
BWO	Basin Water Office
CAS	Country Assistance Strategy (of The World Bank)
CDF	Comprehensive Development Framework
CRDB	Co-operative Rural Development Bank
CSO	Civil Society Organization
DAC	Development Assistance Committee
DADC	District Agriculture Development Committee
DADP	District Agricultural Development Plan
DALDO	District Agriculture and Livestock Development Officer
DANIDA	Danish International Development Agency
DAWASA	Dar es Salaam Water and Sewerage Authority
DBO	Design-Build-Operate
DED	District Executive Director
DMFIS	District Micro Finance Institution Supervisors
DOD	Disbursed Outstanding Debt
DPLO	District Planning Officer
DPMC	District Programme Management Committee
DPU	District Programme Unit
DRC	Domestic Resource Coefficients
DSM	Dar es Salaam
EOI	Embassy of Ireland
EOJ	Embassy of Japan
EU	European Union
FAO	Food and Agriculture Organization
FAIDA	Financial and Advisory Institutions for Development Assistance
FDI	Foreign Direct Investment
FINNIDA	Finnish International Development Agency
GIS	Geographic Information System
GOJ	Government of Japan

GON	Government of the Netherlands
GDP	Gross Domestic Product
GOT	Government of Tanzania
GOZ	Government of Zanzibar
GTZ	German Agency for Technical Cooperation
HDI	Human Development Indicators
HBS	Household Budget Survey
HIPC	Highly Indebted Poor Countries
HRDS	Human Resource Development Survey
IBRD	International Bank for Reconstruction and Development
ICC	Inter-minestrical Coordination Committee
IDA	International Development Agency
IFAD	International Fund for Agricultural Development
IRA	Institute of Resource Assessment
IS	Irrigation Section
ISID	Institutional Support for Irrigation Development Project
JICA	Japan International Cooperation Agency
KATC	Kilimanjaro Agriculture Training Center
KATRIN	Kilombero Agricultural Training and Research Institute at Ifakara
LG	Local Government
LGA	Local Government Authority
LGRP	Local Government Reform Programme
M&E	Monitoring and Evaluation
MAC	Ministry of Agriculture and Cooperatives
MAFS	Ministry of Agriculture and Food Security
MANREC	Ministry of Agriculture, Natural Resources, Environment and Cooperatives
MCM	Ministry of Cooperative and Marketing
MDI	Multilateral Debt Fund
MIT	Ministry of Industry and Trade
MLHS	Ministry of Land and Human Settlements
MOF	Ministry of Finance
MTEF	Medium Term Expenditure Framework
MWLD	Ministry of Water and Livestock Development
NAEP-II	National Agricultural Extension Programme, Phase II
NAFCO	National Agricultural and Food Corporation
NBS	National Bureau of Statistic
NEAP	National Environmental Action Plan
NGO	Non-Government Organization
NIDP	National Irrigation Development Plan
NIMP	National Irrigation Master Plan
NMS	National Minimum Standard
NORAD	Norwegian Agency for Development
PCM	Project Cycle Management

PER	Public Expenditure Review
PFI	Private Finance Initiative
PIDP	Participatory Irrigation Development Programme
PMO	Prime Minister's Office
PO-PC	President’s Office-Planning Commission
PO-RALG	President’s Office -Regional Administration and Local Government
PRGF	Poverty Reduction and Growth Facility
PPP	Public Private Partnership
PRSP	Poverty Reduction Strategy Paper
PS	Permanent Secretary
PSAC	Programmatic Structural Adjustment Credit
PSRP	Public Services Reform Programme
PWMI	Poverty Welfare Monitoring Indicators
RAS	Regional Administrative Secretary
RBM	River Basin Management
RBMSIIP	River Basin Management and Smallholder Irrigation Improvement Project
RDS	Rural Development Strategy
RIPARWIN	Project for Raising Irrigation Productivity and Releasing Water for Inter-Sectoral Needs
RUBADA	Rufiji Basin Development Authority
SADCC	Southern African Development Co-ordination Conference
SCSRD	Sokoine University of Agriculture Centre for Sustainable Rural Development
SDPMA	Smallholder Development Project for Marginal Areas
SIDA	Swedish International Development Agency
SGR	Strategic Grain Reserve
SMS	Subject Matter Specialist
SNV	Netherlands Development Organization
SOFRAIP	Soil Fertility Recapitalisation and Agricultural Intensification Project
SPFS	Special Programme for Food Security
SUA	Sokoine University of Agriculture
SWA	Sector Wide Approach
TANESCO	Tanzania Electric Supply Company
TANSEED	Tanzania Seed Company
TAS	Tanzania Assistance Strategy
TBS	Tanzania Bureau of Standards
TDV	Tanzania Development Vision 2025
T&E	Training and Extension
T&V	Training and Visit
TIC	Technical Inter-minestrical Committee
TOSCA	Tanzania Official Seed Certification Agency
TIP	Traditional Irrigation Improvement Programme
TTCL	Tanzania Telecommunication Company Ltd.

UDS	University of Dar es Salaam
UNDP	United Nations Development Programme
UNFPA	United Nations Fund for Population Activities
USAID	United States Agency for International Development
VEO	Village Extension Officer
VEW	Village Extension Worker
VPO	Vice President's Office
WB	World Bank
WUA	Water Users Association
WUG	Water Users Group
ZIO	Zonal Irrigation Officer
ZRF	Zonal Research Fund

MEASUREMENT UNITS

Extent

cm^2 = Square-centimeters (1.0 cm x 1.0 cm)
m^2 = Square-meters (1.0 m x 1.0 m)
km^2 = Square-kilometers (1.0 km x 1.0 km)
a = Are(100 m^2 or 0.01 ha.)
ha = Hectares (10,000 m^2)
ac = Acres (4,046.8 m^2 or 0.40468 ha.)

Volume

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

Length

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

Weight

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

Currency

US$ = United State Dollars
US$1.0 = J¥125 = Tanzanian Shillings 950 (as of August, 2002)
J¥ = Japanese Yen
Tsh = Tanzanian Shillings

Time

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

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MAIN REPORT

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MASTER PLAN

MAIN REPORT

CHAPTER 1 INTRODUCTION

1.1 Authority

This Master Plan Report (the Report) was prepared in accordance with the Scope of Work for the Study on the National Irrigation Master Plan in the United Republic of Tanzania (the Study) agreed between the Ministry of Agriculture and Food Security, the United Republic of Tanzania (MAFS) and the Japan International Cooperation Agency (JICA) on April 10, 2001. The Report presents the results of the master plan study on irrigation development executed in the Phase 1 Works period from November 4, 2001 to September 6, 2002.

1.2 Background and Objectives of the Study

1.2.1 Background

Agriculture plays the most important role in the Tanzanian economy. In 1998, it absorbed over 70% of the total labor population[1] and generated 48% of GDP and 65% of export exchange earnings[2]. On the Mainland, 10.0 million ha are cultivated at present although potential agricultural area would be estimated at 44 million ha, equivalent to about 46% of the 94.8 million ha of the Mainland area. Out of 1.0 million ha[3] assessed as area suitable for irrigation, only 0.2 million ha[4] is currently irrigated. This shows that land and water resources are not presently effectively utilized.

Cereals in Tanzania are maize, sorghum, paddy and wheat. These, especially maize and paddy, are mostly cultivated by smallholder farmers and production is remarkably low due to dependence on rainfed agriculture. In the seven years from

[1] *Agriculture: Performance and Strategies for Sustainable Growth.*
[2] *Page 11 of the Economic Survey 2000*
[3] *Agriculture: Performance and Strategies for Sustainable Growth.*
[4] *Agriculture: Performance and Strategies for Sustainable Growth.*

1992/93 to 1998/99, cultivated areas and crop production of maize and paddy, which are the staple foods in Tanzania, have largely fluctuated year by year depending on weather conditions[5].

The Household Budget Survey executed in 1991/2[/6] showed a lower income in rural areas than in urban areas, identifying a severe poverty situation in rural area. Over 87% of all poor people live in rural areas where agriculture is the mainstay for livelihood. The proportions below the poverty line for basic needs and food requirements were 41% and 23% in rural and urban areas respectively. The recent Household Survey in 2000/01 also presents a similar poverty situation, although improvements of 2% to 3% have been achieved, respectively. From the analysis of the Food Security Department, MAFS, the cereal deficit for the year 2001/02 would be 820,000 tons at the national level[7]. In this regard, the expansion of cultivated area to increase crop production is thus an indispensable issue for agriculture in Tanzania.

In 1994, the National Irrigation Development Plan (NIDP) was prepared aiming at more stability and an increase in food production. The NIDP proposed implementation of 147 irrigation schemes and alleviation of many constraints. Since 1994, some constraints have been alleviated with external support; however, a significant number have still remained. There have also been a number of government policies formulated after the preparation of the NIDP, such as "Agriculture and Livestock Policy, 1997", "Tanzania Development Vision 2025", and "Agricultural Sector Development Strategy (ASDS)", which have had a direct effect of irrigation development in Tanzania. This situation creates a need to revise the NIDP.

The GOT requested the Government of Japan (GOJ) to extend the technical assistance for the revision of the NIDP. In response to this request, the GOJ dispatched the Preliminary Study Team from March 2001 to April 2001, to hold a series of discussions with the GOT, and both sides agreed on the Scope of Work (S/W) as per Attachments 1 and 2.

1.2.2 Objectives of the Study

The Study is to be executed phase-wise in three stages. The objectives of each phase are as follows:

Phase 1

- Formulate the Master Plan for Irrigation Development at national level with

[5] *Basic Data Agriculture and Livestock Sector, 1992/93 - 1998/99*
[6] *Household Budget Survey 2000/01(draft version as of June 2002)*

target year of 2017.

Phase 2

- Prepare the Action Plan for candidate irrigation schemes selected in the Master Plan Study.

Phase 3

- Conduct the Verification Study for the bottleneck items for successful implementation of the schemes.

Phase 1 to Phase 3

- Carry out the technology transfer for counterpart personnel through on-the-job training in the course of the Study.

This Report presents only the results of the Phase 1 activities.

1.3 The Study Area

Phase 1

- Mainland of Tanzania.

Phase 2 and 3

- Candidate irrigation schemes selected in the Master Plan Study.

1.4 Works Performed in Phase 1

The completed Phase 1 Works are largely divided into two categories. The first is to prepare the basic concept for the master plan based on analysis on data collected, which was carried out during 3 months from November 5, 2001 to February 1, 2002. In this period, an inventory survey was also conducted for the irrigation schemes to be rehabilitated and to be newly constructed on the district basis. The second works category is to formulate the master plan for irrigation development taking into consideration the results of inventory survey, problem analysis and PCM workshops, which were conducted for 4 months from May 11, 2002 to September 6, 2002. These results were compiled in the Report.

1.5 Technology Transfer

The counterpart personnel assigned for the master plan formulation are as follows:

Counterpart Personnel Assigned

JICA Study Team	Position	Counterpart Personnel
Mr. H. Shimazaki	Team Leader/Development Policy	Eng. A. H. Simba*
Dr. S. Matsushima	Irrigation Drainage Plan/Water Management	Eng. M. Futakamba
Mr. H. Ohnuma	Farm Management	Ms. R. Kweka
	Land Use Plan	Mr. R. Rushomesa
Dr. M. Osada	Institution/Organization/Management	Mr. R. R. Komanga
Mr. E. Maeda	Macro-economy/Assistance Trend	Mr. D. Mafuru
Mr. T. Igawa	Irrigation and Drainage Facilities	Eng. Masenza

[7] *A Statistical Analysis of the 2000/01, Final Food Crop Production Forecast for Food Security*

Mr. Y. Ogata	Agro-economy/Marketing	Mr. D. Mafuru
Mr. Y. Ando/ Mr. T. Kuroda	Coordinator	Not Assigned

** : Chief Counterpart Personnel*

Prior to commencement of the Study, the JICA Study Team submitted the Plan of Technology Transfer to the MAFS on November 21, 2001. This Plan was agreed by the MAFS, and thus the technology transfer was carried out through the on-the-job training and bi-weekly meeting as mentioned in it.

1.6 Steering Committee Meetings

During Phase 1, the Steering Committee meetings were held three times, namely for the Inception Report on November 6, 2001, for the Progress Report 1 on January 26, 2002 and for the Draft Master Plan Report on August 27, 2002. The meetings were attended by staff of Prime Minister's Office, RUBADA, Presidents' Office, Ministry of Finance, Ministry of Lands, Ministry of Water and Livestock Development, MEM, POPP, MNRT, SOFRAIP, and MAFS. The Embassy of Japan, JICA Tanzania Office and DANIDA also sent their staff to the meetings. The results of respective meetings were compiled in the Minutes of Meetings as shown in Attachments 3 to 5. The Report contains the comments raised in these Steering Committee meetings.

1.7 Website for the Study

The website for the Study was established on the official one of the MAFS, aiming at sharing of data and information on the Study. This includes the basic concept of the master plan, the schedule and progress of the Study, results of irrigation potential, and objectives of the master plan. The content would be updated from time to time. The website for the Study can be accessed using the following URL:

http://www.kilimo.go.tz/projects/nimp/nimp.htm

CHAPTER 2 NATIONAL SOCIO-ECONOMIC CONDITIONS AND DEVELOPMENT POLICIES

2.1 Overview of Macro-economic Performance

Since 1995, Tanzania's structural reforms have advanced steadily. Tanzania's economic policy has been basically supported by the IMF/PRGF and World Bank/PSAC and guided by a poverty reduction strategy. Tanzania reached the completion point under the IMF-World Bank's HIPC Initiative in November 2001. As a result Tanzania will benefit from not only debt relief of US$3 billion, but also increasingly favorable donor assistance which would be utilized for economic and social development. A significant amount is expected for budget support and balance of payment support in the budget of 2002/03, which would improve government fiscal balance. The government has committed itself to create a more favorable macro-economic climate, and to provide a credible basis for sustainable improvements in the lives of the people. Fortunately, there are signs that Tanzania will remain a strong favourite partner of international donors.

The government has made considerable progress towards achieving macro-economic stability. The GDP growth rate jumped in 1995 to 3.6% from 1.4% in the previous year. It remained higher than 3% up to 2000 after a sharp decline by 0.9% in 1997 mainly due to severe weather conditions. Overall, the economy has retained steady growth for the last three years of 1998 to 2000, namely 4.0%, 4.7%, 4.9%, respectively; despite continued unfavorable weather conditions and low world prices for most of the country's export products. GDP growth rate is estimated to rise to 5.9% in 2002 (calendar year), 6.3% in 2003 and 7% in 2004. Other economic conditions such as inflation and domestic revenue and foreign exchange reserves are also expected to improve.

Major Economic Indicators

Description	1996	1997	1998	1999	2000
GDP at constant prices (Tsh. bn)	1,401.7	1,448.2	1,505.8	1,577.3	1,654.4
Real GDP growth (%)	4.2	3.3	4.0	4.7	4.9
Per capita GDP at factor cost (Tsh)	122,205	147,026	170,733	193,440	n.a.
(US$)	210	240	256	259	n.a.
Consumer price inflation (av; %)	21.0	16.1	12.9	7.7	5.9
Population (m)	28.3	29.1	30.0	30.9	31.9
Exports of goods fob (US$ m)	764.1	715.3	589.5	539.9	661.4
Imports of goods fob (US$ m)	1,213.1	1,164.5	1,365.3	1,416.0	1,334.5
Current account balance (US$ m)	-510.8	-629.8	-956.4	-807.1	-370.7
Foreign exchange reserves excl. gold (US$ m)	440.1	622.1	599.2	775.5	974.2
Total external debt (US$ bn)	7.4	7.1	7.6	8.0	7.4
Debt service ratio, paid (%)	19.1	13.2	20.8	15.6	18.8
Exchange rate (av) Tsh/US$a	580.0	612.1	664.7	744.8	800.4

(Source: EIU Country Report August 2001; Economic Survey 2000 Planning Commission; Bank of Tanzania Economic and Operational Report FY1999)

2.2 National Development Policies

2.2.1 Tanzania Development Vision 2025

The Tanzania Development Vision prepared in 2000, lays out the long-term development goals and perspectives. The Development Vision envisages that the people will be living by 2025 in a substantially developed society with a high quality of livelihood, having reached the level of a middle-income country where abject poverty will have disappeared. The economy will have been transformed from a low productivity agricultural economy to a semi-industrialized one led by modernized and highly productive agricultural as well as industrial and service activities in rural and urban areas. Consistent with this vision, Tanzania in 2025 should be a nation imbued with the five main attributes: high quality livelihood; peace, stability and unity; good governance; well educated and learning society; and competitive economy capable of producing sustainable growth and shared benefits.

Food self-sufficiency and food security are articulated as the top goal of the first attribute, high quality livelihood. The Development Vision puts a macro-economic growth target at 8% per annum or more, providing a macro-economic stability manifested by a low inflation economy and basic macro-economic balances.

2.2.2 Tanzania Assistance Strategy (TAS)

The TAS prepared in 2000, is a coherent national development framework for managing external resources to achieve the development strategies. The sub-title of TAS, “A Medium Term Framework for Promoting Local Ownership and Development Partnership” well indicates the background of its formulation. It provides a three-year strategic national framework articulating the following development issues: national development agenda; policy framework; best practices in development cooperation; priority areas/interventions; and framework for monitoring the implementation of the TAS.

Whereas the Poverty Reduction Strategy Paper (PRSP, described below) provides a medium-term strategy for poverty reduction in the context of the HIPC Initiative, the TAS provides a broad strategic national framework within operation of the PRSP.

2.2.3 National Poverty Eradication Strategy (NPES)

Tanzanian economy had staggered from the late 1970s and 1980s, and even up to mid-1990s. The NPES prepared in 1998, reported that the government efforts to address poverty hardly resulted in achievement for a number of reasons. The

government has a new resolve to reduce abject poverty by 50% by the year 2010 and total eradication of abject poverty by 2025, (which became the overall goal of NPES). In order to implement this resolve, the government has formulated the NPES. In its preface "the NPES emphasizes the importance of economic growth and improvement in social services. As one of the priority areas in "Policies and Strategies for Creating Capacity for Poverty Eradication" in the NPES, the agriculture sector has been given the utmost importance. The NPES states "Investment in agriculture should be promoted and enhanced." As regards irrigation, it states that "Encouraging increased investment in smallholder irrigation systems" is also part of the "Strategies for Agriculture Development".

2.2.4 Poverty Reduction Strategy Paper (PRSP)

The Tanzanian PRSP was prepared and finalized in June 2000 under the initiative of the Tanzanian government with assistance of international partners. The PRSP presents a sector-wide development strategy in each sector by duly reflecting the objectives and priorities set in it. It emphasizes that international resources provided should be utilized in the way consistent with Tanzania's development policy objectives and channeled through specific projects in such a way as to ensure effective implementation of each project/program with maximized output toward poverty reduction. The PRSP provides a medium-term (five years), strategy to reduce poverty and is part of the Enhanced HIPC Initiative. This strategy requires the government to cut back on spending but it allows for various poverty-focused extra-budgetary activities and promotes a range of non-financial measures that should make an impact on poverty. The PRSP has brought a range of ideas and plans together, which are categorized into four groups. These four groups, and ideas and plans included in respective groups are given below:

- Macroeconomic Stability and Structural Reforms
  Private Sector Development, Tax Reform, Export Growth, Safety Nets for Valuables, and Good Governance
- Priority Sectors
  Education, Health, Water, Agriculture, Roads, and Legal System
- Cross Cutting Programme
  HIV/AIDS, Local Government Reform, Rural Development, and Poverty Monitoring and Evaluation
- Emerging Issues and Supplementary Programmes
  Gender, Environment, Employment, Urban Poverty, and Child Labor and Out-of-School Children

2.2.5 Decentralization Policy

(1) Background

The government started on reforming its public service in the early 1990s. In the first step, however, its efforts toward the reform were concentrated at the Central Government level. The government developed a separate decentralization program in 1996, the Local Government Reform Agenda 1996-2000 with a view of empowering the Local Government Authorities (LGAs) and allowing them more autonomy for socio-economic development and services provision. In addition, in 1998, the government released the Policy Paper on Local Government Reform. The policy framework of the local government reform in Tanzania is made up of these two documents. In order to implement the policy, the Local Government Reform Programme (LGRP) was established and the Action Plan and Budget, July 1999-June 2004 was developed by the government. It has been updated each year in the form of an annual Action Plan and Budget, approved by the Programme's Common Basket Fund Steering Committee.

(2) Implementation Progress

Phase I of the programme implementation began on January 2000 in 38 district councils chosen from among the 114 councils. According to the MTP (*the Medium Term Plan and Budget July 2002-June 2005, Local government Reform Programme*), implementation of the reforms has been delayed from the original plans and furthermore, expectations at that time were unrealistically high and the plans were over-ambitious. These comments imply some modification and/or adjustments of the original plans are necessary. However, it also points out some major achievements, such as the followings:

- There is a clear policy statement on reform, supported by the highest levels of government.
- Legislation to enable the reforms has been enacted.
- Regulations to support the reforms have been passed.
- Information on the reforms has been disseminated to all local authorities and to the public.
- Regional administration has been restructured in line with its new role.
- 38 LGAs have begun the process of restructuring their organizations.
- Work on improving financial management in LGAs and on fiscal decentralization is underway.
- The work of building capacity in LGAs is underway.
- Attitudes towards reform are slowly changing among government officials

and members of the public.

(3) Phasing of Reforms

The PSRP (Public Service Reform Programme) shows a series of broad reform phases to 2011 and local government reform should also be seen in this 9-year time frame as follows:

- 2002-2005: The LGPR as set out in the MTP.
- 2005-2008: Local government reform, now mainstreamed in PO-RALG, continues with central government support.
- 2008-2011: Strengthened LGAs themselves continue the reforms.

In the current plan, the concept of phasing of the reforms in LGAs has been fundamentally changed. The MTP envisages a different type of phasing, with all LGAs free to implement reforms, and central support being provided on a demand basis. In terms of fiscal decentralization, only those LGAs that meet agreed criteria will qualify in the first instance. However, all LGAs will be assisted to meet the criteria, and in many reform activities, in particular in the area of capacity building.

2.2.6 Rural Development Strategy (RDS)

In Tanzania, development of the rural areas is a key issue for its social and economic development. About 80% of the population in Tanzania resides in the rural areas, where poverty is prevailing. In order to improve living standards of the rural people, the government launched the formulation of the RDS focusing on the following lessons learned from the past rural area development policies and strategies:

- Failure of building up the necessary capacity that was needed to bring about a sustainable development in the rural areas.
- Less benefit to the majority of Tanzania, particularly those living in the rural areas by past macro-economic achievements.
- Unsatisfactory performance of the agricultural sector, the economic base of the rural areas.
- Absence of a comprehensive rural development strategy.
- Need for a rolling rural development strategy, which translates the TDV into a medium-term implementation programme.
- Need of emphasizing economic diversification in the rural areas.
- Need of recognizing the inter-relationship between the rural economy and the urban markets.

In the RDS which was finalized in December 2001, the proposed cohesive strategy for rural development consists of four strategic interventions: (i)

promoting widely shared growth, (ii) increasing opportunities and access to services, (iii) reducing risks and vulnerability, and (iv) good governance. The RDS mentions the strategic approaches by "Quick Wins", "Medium-term Win", and "Long-term Win" for implementing these strategic interventions, taking into consideration the problems and constraints envisaged.

With regard to irrigation development, the RDS proposes the specific objective in the long-term wins, which is to promote profitable irrigation infrastructure, and also three actions of encouragement of farmers to form the Water Users Associations (WUAs), assistance for the WUAs to access credit, and organization of relevant training modules for members of WUAs.

2.3 Administration and Current Economic Situation

2.3.1 Administration and Population

The Mainland administratively consists of 20 regions, 3 municipalities, 114 districts, 2,363 wards, and 9,288 villages according to the Regional Socio-economic Profile prepared in 1997. The President's Office, Planning and Privatization provides the following projection of population estimated using 1988 population census as a baseline data and based on assumptions on future birth, deaths, internal and international migration.

Mainland Population Projection

Description	2002	2005	2010	2015	2017
Mainland Total	34,021,000	37,267,000	43,380,000	50,496,000	53,464,000
Growth Rate (%)	Projected annual growth rate : 3.08%				

Note: Rounded by the JICA Study Team

2.3.2 Current Economic Policies, Reforms and Strategies

The government has targeted several key areas in which strategic actions will need to be taken to create conditions favorable for higher economic growth, focusing on poverty reduction. The table below is a summary of current policies, reforms and strategies related to agricultural sector.

Summary of Current Economic Policies, Reforms and Strategies

Objectives	Reforms/Measures	Key Components
Improving market efficiency and productivity, and eventually improvement in macroeconomic performance, especially in agriculture sector	-Financial Sector Reforms -Tight money policy -Liberalisation of foreign exchange rate	- New bank license issuance and privatisation of government banks - Control of money supply - Increase of exports and foreign exchange inflows
Promotion of exports	-Agriculture Sector Reform -Development of new export commodities	-Production increase of traditional and non-traditional crops -Mining and horticulture
Increasing investment, both domestic and foreign investors	-Parastatal Sector Reforms -Private sector development	-Privatisation of government owned enterprises -Private sector
Efficient channeling of	-Tax Reforms	-Government revenue enhancement

government resources towards faster economic growth and poverty alleviation	-Integrated Financial Management System (IFMS) -Parastatal Sector Reforms -Public Service Reform Programme (PSRP)	-Government expenditure management and control -Restructuring and privatisation of public enterprises. -Reduction of government employment; and other 4 components
Debt servicing and debt sustainability, and economic development and poverty alleviation	Enhanced HIPC Initiative and PRSP	-Agreement of PRGF with IMF -Attainment of Completion of Enhanced HIPC Initiative and PRSP -Increase of budgetary allocations for poverty reduction

Source: Memorandum of Macro-economic Development" prepared by Ministry of Finance

The structural reforms have been largely aimed at establishing a favorable environment for increased investment. At early stages, changes to legal and regulatory frameworks were the focus; the government has embarked on accelerating the pace of privatization of state-owned enterprises.

2.3.3 Foreign Trade and Balance of Payment

Trade Balance has been in deficit for a long time. The deficit in 2001 is likely to increase again after a drop in 2000. The value of export in 2001 is expected to increase by 17%, but imports are also likely to increase by 12%, thus trade balance deficit is likely to increase by 6%. However, both the current account and overall balance are expected to improve significantly due to increased grants from foreign donors.

Balance of Payment (unit: million US$)

Items	1995 Actual	1996 Actual	1997 Actual	1998 Actual	1999 Actual	2000 Actual	2001 Expected
Good Balance	-657.6	-448.8	-395.4	-777.5	-824.9	-671.7	-713.3
Export (fob)	682.9	763.8	752.6	588.5	543.3	663.2	776.4
Import (cif)	1,340.5	1,212.6	1,148.0	1,366.0	1,368.2	1,334.9	1,489.7
Current Account	-646.4	-461.2	-558.6	-993.1	-793.4	-382.0	-413.5
Overall Balance	-382.0	-231.2	-633.4	-646.0	-372.7	-35.5	55.0

Source: Economic Survey 2001

Foreign Direct Investment (FDI), to the country has been increasing steadily since 1995, reflecting improved business environment for foreign capital. The table shows the trend of influx of FDI.

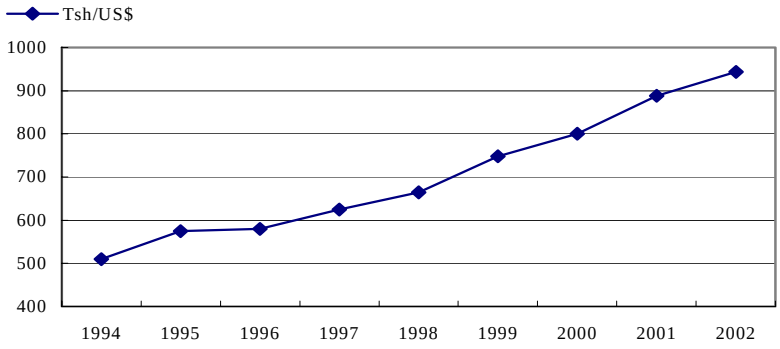
Growing FDI

Year	Amount (US$ million)
1996	149
1997	155
1998	172
1999	183
2000	193
2001	224

Source: The Economic Survey 2001

Foreign exchange rate against US$ has continued to depreciate as shown in the following figure:

Trend of Exchange Rate



Source: Economic Survey 2001; Bank of Tanzania

2.3.4 Government Finance

To cope with large fiscal deficits, the government has been committed to increasing tax revenue on one hand and imposing tight fiscal outlays on the other. Backed by various tax collection measures, the trend of domestic revenue is on upward trend, but strengthening of tax collection capability and the broadening of tax base will become more important. The government's fiscal discipline has improved since the introduction of a cash-budgeting system from FY1996/97, which has imposed tight spending constraints on ministries. But the government will definitely remain dependent on donor inflows, particularly for development expenditure to cover its budget deficit as the level of the government revenue has remained quite low.

Summary of Government Finance (Mainland) (Unit: Tsh. billion)

Description	1997/98 (actual)	1998/99 (actual)	1999/00 (actual)	2000/01 (actual)	2001/02 (expected)
1. Domestic Revenue	627.5	689.3	777.6	929.6	1,026.1
(1) Tax Revenue	586.2	616.3	685.1	827.8	934.7
(2) Non-tax Revenue	41.3	73.0	92.5	101.8	91.4
2. Total Expenditure	856.2	927.7	1,168.8	1,307.2	1,545.6
(1) Recurrent Expenditure	670.0	791.2	808.9	1,021.0	1,250.8
(2) Development Expenditure	186.6	136.5	359.9	286.3	317.4
(3) Special Fund for Songosongo					3.0
3. Deficit/Surplus (1 – 2)	-228.7	-238.4	-391.1	-377.6	-519.6
4. Financing	237.1	201.5	476.0	377.6	544.9
(1) External Source	256.2	223.8	488.1	380.6	584.5
(2) Internal Sources	-19.2	-22.3	7.9	20.4	-5.5

Source: The Economic Survey 2001; for Development Expenditure, Local Funds, and Foreign Funds, figures in 2001/02 are obtained from Planning Department of MAFS.

2.4 Socio-economic Setting

2.4.1 Consumption, Income and Employment

The changes of labour force at an annual average rate of 2.4% in 1999 and 2000 are as shown in table below. Over half of the labour force is aged 15–29 years,

and only 8.5% of workers are educated to secondary level or above. Women comprise more than half of the labour force. It is estimated that about 400,000 to 500,000 new entrants join the labour market every year.

Labour Force

Year	Males	Females	Total	Percentage Chang
1966	6,991,631	7,604,137	14,631,768	-
1997	7,234,453	7,886,176	15,120,529	3.3
1998	7,465,722	8,118,526	15,584,248	3.1
1999	7,576,040	8,330,138	16,006,178	2.7
2000	7,876,171	8,530,576	16,406,747	2.4

Source: Planning and Privatization

Agriculture is the largest employer, mostly through self-employment on smallholdings. The informal sector is an important source of employment and income. Unemployment in the period April–June 2000 was 16% for the whole country, 36% in urban areas and 9% in rural areas. The definition of unemployed includes people with unreliable jobs, those who work less than 40 hours per week, and farmers who were not engaged in any agricultural activity during the season.

Information from the household income survey includes a wide variety of types and sources including employment, self-employment and payment in kind. Information was collected as gross revenue for many sources; hence average per capita receipts may be well above per capita expenditure. The correlation between income and expenditure per adult equivalent has an r-square coefficient of 0.596 (significant at the 1% level). The table below shows the mean per capita receipts for different sources. Per capita income is highest in Dar es Salaam, at nearly Tsh. 41,000, and lowest in rural areas at Tsh. 14,134.

Mean Per Capita Household Monthly Income by Source

Income Source	Dar es Salaam	Other Urban	Rural	Mainland
Employment in cash	15,251	7,936	1,261	2,982
Employment paid in kind	218	156	75	94
Non-farm self-employment	20,868	14,026	3,722	6,138
Agricultural income	431	3,923	7,387	6,510
Producers co-operative	316	195	33	72
Interest and dividends	21	59	7	15
Rent received	408	365	59	122
Transfers	1,041	1,058	770	826
Other receipts	2,213	2,709	821	1,169
Total	**40,767**	**30,426**	**14,134**	**17,928**

Source: Household Budget Survey 2001

Wages and other income from employment provide 41% of household income in Dar es Salaam and 24% in other urban areas. Income from self-employment represents almost 30% of income in Dar es Salaam, and 33% in other urban areas. In rural areas, 60% of income is from agricultural sources with off-farm income

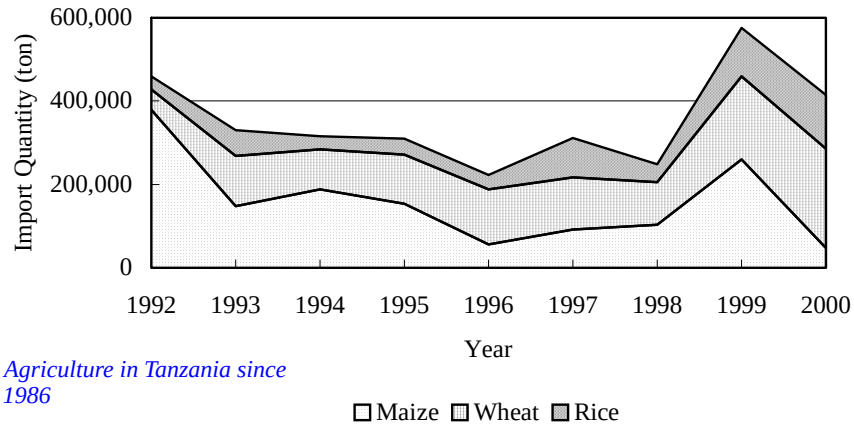
being important in rural areas.

Rural households display a diversity of income sources. By contrast, over one third of households in Dar es Salaam depend on a single source.

2.4.2 Food Deficit

In order to ensure a stable food supply and also to secure access by all consumers to their nutritional needs, the government once took the responsibility of production, marketing and distribution of food crops. A number of institutions and agencies have been involved in procurement, importation, storage and distribution of food cops until 1986. Such organizations were, however, unable to supply the food needs and had to depend on imports and food aid to meet the production deficit. In 1991, the Food Security Act was passed and the government has moved from a controlled economy to a market economy. Information on the commercial and food aid imports and exports during the past decade was obtained from the Food Security Department and the result was summarized in Table 2.4.1. The following figure shows the import quantity of major food crops.

Import Quantity of Major Food Crops



Source : Agriculture in Tanzania since 1986

Although the amount fluctuates from year to year, the import quantity of maize shows decreasing trend. In the case of wheat and rice, however, the import quantity is gradually increasing. When import and export amounts are compared to production, the imported amount of maize and rice is 7% and 15% of the production amount on average, respectively. The export amount of maize and rice are negligible. In the case of wheat, however, import amount usually exceeds the production and a substantial amount is also exported. In addition to these major cereals, beans are imported when necessary and cassava is exported when there is surplus.

Table 2.4.2 shows the result of food supply analysis and self-sufficiency ratios from 1992/93 to 2002/03 (projection) by regions and is summarized in the following table.

Frequency of Self-sufficiency Status of Stable Foods

Region	Surplus 120≦SSR[*1]	Self Suf. 100≦SSR<120	Deficit SSR<100
1. Arusha	1	0	7
2. Coast/DSM	0	0	8
3. Dodoma	0	1	7
4. Iringa	5	3	0
5. Kagera	3	1	4
6. Kigoma	0	2	6
7. Kilimanjaro	1	1	6
8. Lindi	2	1	5
9. Mara	0	2	6
10. Mbeya	4	3	1
11. Morogoro	0	3	5
12. Mtwara	4	1	3
13. Mwenza	2	4	2
14. Rukwa	8	0	0
15. Ruvma	5	2	1
16. Sinyanga	5	1	2
17. Singida	3	1	4
18. Tabora	2	0	6
19. Tanga	0	2	6
Total	**45**	**28**	**79**

**1:* *Self Sufficiency Ratios*
Unit: *Year*
Source: *Food Security Bulletin, Ministry of Agriculture, Crop Monitoring and Early Warning Unit, 1992/93 – 2002/2003*

According to the table, in recent years the Mainland is not self-sufficient for cereals, but is self-sufficient for non-cereals at a national level. Out of 19 regions, 10 regions have experienced food deficit more than four out of eight years. The food self-sufficiency rate by the regions fluctuates often and is more pronounced in the drought years when many regions experience food shortage. Moreover, the table shows that there is a clear difference on the supply capability of the staple-food crops among the regions. For example, in Arusha, Coast, and DSM, Dodoma, Kigoma, Kilimanjaro, Mara, Tabora and Tanga, the quantity of production is constantly less than demand. In contrast, the regions which have attained stable self-sufficiency or the regions that have produced a surplus are Iringa, Mbeya, Mwenza, Rukwa, Ruvuma, Shinyanga.

According to the report which directs its attention to people's nutrition status, per capita food production or per capita food availability is not a good measure of food security or nutritional status. Table 2.4.3 shows the rate of child malnutrition according to place or region (Tanzania Demographic and Health Survey, 1996). Among three different indexes (rate of moderate stunting, wasting and underweight) that are shown in the table, the moderate stunting rate is useful to evaluate the nutritional status because the measure is less affected by

seasonal and annual variation. The regional pattern in moderate stunting indicates that malnutrition is highest in Iringa, Lindi, Mtwara, Tanga and Mbeya. Iringa, Mbeya, and Ruvuma are regions where production of staple-food is stabilized and self-sufficiency exists. The statistic data on staple-food production is inconsistent with the study result on nutrition status. This situation shows that while excessive staple-food crops are produced and circulating commercially, the poverty class cannot access sufficient food, even in a granary zone.

2.4.3 Poverty Status

Poverty is pervasive and deep in the Mainland as is shown by the Household Budget Surveys carried out in 1990/91 and 2000/01.

Poverty is in principle described in two aspects: income poverty (less than one US$ per day) and non-income poverty. As well, poverty lines are explained in two ways: food poverty line and basic needs poverty line. The food poverty line defined in HBS 2000/01 represents food consumption pattern of the poorest 50% of the population, which is adjusted to be equal to 2,200 kilo calories per day in caloric value, and then this calorie amount is further adjusted to be valued in monetary terms. The food poverty line and the basic needs poverty line calculated in the said survey are tabulated below:

Poverty Lines per Adult Equivalent for 28 Days

Poverty Line	Area			
	Dar es Salaam	Other Urban Areas	Rural Areas	Mainland
Food Poverty Line				
HBS 2000/01	Tsh. 6,719	Tsh. 5,607	Tsh. 5,107	Tsh. 5,295
HBS 1991/92	Tsh. 3,031	Tsh. 2,387	Tsh. 1,958	Tsh. 2,083
Basic Needs Poverty Line				
HBS 2000/01	Tsh. 8,313	Tsh. 6,386	Tsh. 6,348	Tsh. 7,253
HBS 1991/92	Tsh. 3,045	Tsh. 2,419	Tsh. 2,116	Tsh. 2,777

Sources: HBS 2000/01 Draft Final Report National Bureau of Statistic

The percentage of the population below the two poverty lines in 1991/92 and 2000/01 are shown below:

Incidence of Poverty in Mainland

Poverty Type	Dar es Salaam		Other Urban Area		Rural Area		Mainland	
	'91/92	'00/01	'91/92	'00/01	'91/92	'00/01	'91/92	'00/01
Food Poverty (%)	13.6	7.5	15.0	13.2	23.1	20.4	21.6	18.7
Basic Needs Pty. (%)	28.1	17.6	28.7	25.8	40.8	38.7	38.6	35.7

Sources: HBS 2000/01 Draft Final Report National Bureau of Statistic

Thirty six percent of the total population falls below the basic needs poverty line and 19% below the food poverty line in 2000/01. Both of them represent a decrease by 2.9% compared with those in 1991/92. Rural areas have the highest

population below the poverty lines: 20.4% in food poverty and 38.7% in basic needs poverty. These percentages are evidence of a wide gap of poverty incidence between urban and rural.

Fifty nine percent of children aged seven to thirteen years are in school, with the remaining 41% not studying. Illiteracy rate is 29% in 2000/01. The remaining 71% are literate in at least one language. Women, particularly in rural areas, are more likely literate. Fifty three percent of the households in rural areas still depend on unprotected sources of drinking water.

In the Mainland poverty is mainly a rural phenomenon. Incomes are lower and poverty is more widespread and deeper than in the urban centers. Another aspect of the issue of poverty in the Mainland is that the poor are concentrated in subsistence agriculture. Farmers in rural areas are in general poorer than non-farmers. According to the 1991/1992 HBS, the poverty incidence for household whose head works in their own farm is 57%. The PRSP provides a composite deprivation index, which makes evident the division of "Most Deprived Region" and "Least Deprived Region" in the country.

Regional Variation in Poverty as of 1999

Indicator	L.D.R.*[3]	M. D.R*[4]	Most Deprived Regions
Per capita GDP in 1997 (Tsh.)	371,811 (US$608)	95,623 (US$156)	Kagera, Kigoma, Dodoma, Kilimanjaro,
Literacy rate (%)*[1]	96.4	68.1	Shinyanga, Arusha, Singida, Kigoma
Gross primary school enrollment rate (%)	100	63.0	Kagera, Kigoma, Rukwa, Tabora, Dodoma
out of which, Boys	99.0	65.0	Tabora, Dodoma, Kagera, Kigoma, Rukwa
out of which, Girls	100	60.0	Tabora, Dodoma, Kagera, Kigoma, Rukwa
Life expectancy (years)	59	45	Dodoma, Morogoro, Mtwara, Kagera, Rukwa, Iringa
out of which, Men	57	44	Dodoma, Morogoro, Mtwara, Kagera, Rukwa, Iringa
out of which, Women	62	45	Dodoma, Morogoro, Mtwara, Kagera, Rukwa, Iringa
Infant mortality (per 1000)	52	130	Dodoma, Lindi, Kagera, Mtwara
Under-5 mortality (per 1000)	78	220	Dodoma, Lindi, Kagera, Mtwara
Low birth weight	4.7	15.6	Mara, Ruvuma, Mtwara
Severe malnutrition	2.7	14.7	Iringa, Lindi, Kagera, Singida
Food security (cereal equivalent) *[2]	590	177	Coast, Dodoma, Morogoro, Tanga

Note **1: For women the most deprived regions were Shinyanga, Tabora, Coast and Kigoma.*
**2: Availability of cereal equivalent levels (in kilograms) during 1992 – 96.*
**3: Least Deprived Region*
**4: Most Deprived Region.*

2.4.4 Gender Issue

Women play an important role in irrigation activities. Women between 15 and 59 years old contribute to 63% of agricultural labour supply. Any agricultural

development, including irrigation, could not be discussed without the involvement of women. Women are often faced with some constraints in land acquisition, crop cultivation, and participation in WUAs and training, which are highly relevant to irrigation development.

Women in Tanzania have legal rights to land, and the law has a legal structure based on equity. In principle, women can legally acquire land through the village government. However, married women are unlikely to exercise that right because their husbands are considered by all parties as the landowner (customary law).

In cultivation of crops, there is a tendency that men concentrate on cash crop production on their plots (shamba la Baba), while women cultivate family food crop on their plots (cambia la mama). The cambia la mama is more likely to be on rainfed than irrigated land, which results in less benefit to women. Land improved by being provided with irrigation often undergoes a shift from maize to rice cultivation, for economic reasons, and this brings about a negative impact to the family as a whole due to the smaller food field plots resulting in food shortage.

In general, women are rarely represented in water users' committees, and according to reports from several irrigation schemes, women have very little influence on water management. However, in reports from improved traditional and modern schemes, the trend is different. There is a remarkable change following the sensitization of farmers on gender issues. Men are now accepting women as equal partners in water management. Women, however, have often had fewer chances to participate in training. To improve this situation, consideration should be given to facilitating women contributing to the preparation of training program.

CHAPTER 3 SECTORAL DEVELOPMENT POLICIES AND ECONOMIC CONDITIONS

3.1 Sectoral Development Policies

3.1.1 Agriculture and Livestock Policy

Faced with fundamental economic and social changes during the 1980s and mid-1990s in Tanzania, it had become clear that it would be difficult for the agriculture sector to operate with its old traditions and instruments. In order to address structural changes challenging environments in the sector, the Agriculture and Livestock Policy, 1997 was prepared. Until the Agricultural Sector Development Strategy was finalized in 2001, Agriculture and Livestock Policy, 1997 has been the core development guideline for the sector.

3.1.2 Agricultural Sector Development Strategy (ASDS)

The primary objective of the ASDS was to create an enabling and cooperative environment for improving the productivity and profitability of the agricultural sector as the basis for improved farm incomes and reducing rural poverty in the medium and long-term. Various innovative and practical actions are included in the ASDS as part of its strategy. Among them is a focus that agricultural productivity and profitability comes first. Other actions include: the promotion of private sector/public sector and processor/contract grower partnerships, and the participatory implementation of the strategy through District Agricultural Development Plans (DADPs). The ASDS is intended to assist the attainment of the objectives envisaged in the PRSP. It proposed a realistic target for the overall agricultural sector to grow by 5 % per year on an average over the 3-year period 2005/07. The total indicative costs of implementing the ASDS would be estimated at US$ 255.3 million.

3.1.3 Agricultural Sector Development Programme (ASDP)

After completion of the ASDS in October 2001, the lead ministries in the agricultural sector, namely, the Ministry of Agriculture and Food Security, Ministry of Cooperative and Marketing and Ministry of Water and Livestock Development, decided to prepare the ASDP.

The Inter-ministerial Coordination Committee (ICC) consisting of Permanent Secretaries of the lead and collaborating Ministries and representatives of the private sector is the authority agency for the ASDP. The Technical Inter-ministerial Committee (TIC) was established to act as the Secretariat for the ICC.

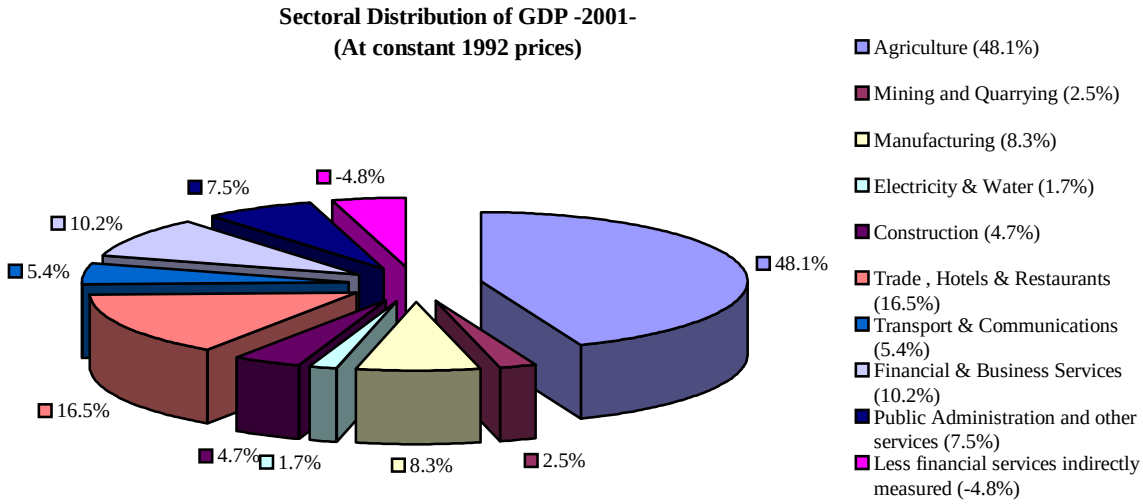
The ASDP is a five-year rolling programme, and will be revised and updated annually. The government technical team and consultants under supervision of the TIC are in charge of preparation of the ASDP.

The ASDP, which is still in draft form as at the end of August 2002, documents twenty-two sub-programmes for implementation. Of these, the sub-programme entitled irrigation and water management is taken up under the theme of Public and Private Roles in Improving Supporting Services, to reduce climatic risk of crop failure due to droughts and allow better crop intensities to ensure sustainable crop production and productivity. The preparation of the NIMP is positioned as one of four priority interventions in this sub-programme.

3.2 Sectoral Economic Analysis

3.2.1 Overall Characteristics

Despite the efforts of structural reforms, the country's per capita income is only US$259 in FY1999. The economy is heavily dependent on agriculture (primarily, coffee, cotton, tea, cashew-nuts, sisal, maize, rice, wheat, cassava, and tobacco), which accounts for 48% of its GDP and provides 65% of its foreign exchange earnings. Manufacturing accounts for only 8% and is limited to processing agricultural products and light consumer goods. The mining sector has good potential, but has yet to be fully developed. Tourism is one of the country's dynamic sectors and has shown significant growth in recent years. The service sector is increasingly becoming an important source of employment.



Source: The Economic Survey 2000

3.2.2 Sectoral Distribution of Government Expenditure

The government appears to have put top policy priorities on education, transport (roads) and health sectors, and not on the agriculture sector, as noted from the Economic Survey 2000. Percentages of those three sectors against total

government expenditure in 2000/01 (estimate) are 19.0%, 5.5% and 5.2%, respectively. The percentage of agricultural sector in the same year is only 2.6%, and that has even decreased from the peak of 4.6% in 1998/99 and 3.9% in 1999/00. To fill in the shortage of the government budget, there have been out-of-budget financial resources coming in from foreign donors. According to the UNDP Tanzania Development Co-operation Report 1999, approximately half of donor money is reflected in the government budget, and the remaining will go directly to projects/programme as out-of-budget funds.

3.2.3 Agricultural Sector and Irrigation Sub-sector

Tanzania's agricultural sector, consisting of crops, livestock, fisheries, forestry and wildlife, contributed 48.2% to GDP and 65% of foreign exchange earnings in 2000. The sector's annual growth rate declined by 0.7%, from 4.1% in 1999 to 3.4% in 2000 but increased by 2.1% in 2001 due to mainly good weather conditions. The ASDS put the growth target of the sector at 5% per year in average over 3-year period, 2005 – 2007, but actual growth rates have never reached this level since 1988 except in 1990, 1995 and 2001, as evidenced in the table below. Considering its dominant share in the whole economy, enhanced growth in the sector is critical to the attainment of the development target of the whole country.

Growth Rate of Agriculture Sector – at constant 1992 prices – (unit: %)

Description	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01
Agriculture	2.2	3.9	5.5	3.6	1.2	3.1	2.1	5.8	3.9	2.4	1.9	4.1	3.4	5.5
Crops	2.0	4.3	6.4	3.9	0.7	3.1	2.0	6.8	4.2	2.3	1.8	4.5	2.9	5.9
Livestock	2.8	2.7	3.0	2.7	2.7	2.7	1.4	2.7	2.7	2.7	1.9	3.5	3.9	3.3
Forestry & Hunting	2.7	2.7	2.8	2.7	2.7	2.9	2.7	2.7	2.7	2.7	1.2	2.4	4.8	3.6
Fishing	3.0	3.1	2.9	2.9	3.0	4.4	3.9	4.0	4.1	3.7	3.5	3.2	7.2	7.0

Source: The Economic Survey 2001; National Bureau of Statistics

Average share of irrigation development for the five year, 1998/99 – 2002/03, is 1.46% of the government's Development Expenditure (local cost portion), which is allocated to Crop Development Division of the MAFS.

3.2.4 Private Sector Development

The government has been shifting its roles and interventions from direct involvement in productive and commercial activities towards provision of social and economic infrastructure as well as providing technical assistance and advisory services. In order to speed up private investments, the government has implemented policies aimed at encouraging more private sector participation. Establishment of the Tanzania Investment Center in 1990 and the Presidential Parastatal Sector Reform Commission in 1993 are measures in line with this objective.

CHAPTER 4 BACKGROUND AND CONSTRAINTS IN IRRIGATION DEVELOPMENT

4.1 Natural Conditions

4.1.1 Land

Tanzania is located on the south-eastern coast of Africa and comprises the Mainland and some islands. Its total area is about 94.8 million ha, lying approximately between latitudes 1° and 12° south and longitudes 29° and 41° east. The cultivated area is estimated at about 10.0 million ha, or 10.7 % of the total land area.

4.1.2 Topography

Tanzania is characterized by a narrow coastal plain occupying the eastern seaboard of the Indian Ocean. Most of the country lies on the Great Africa Plateau with altitudes ranging between 1,000 m and 2,000 m above the mean sea level. The area in the north-east is characterized by a shelter-belt of block mountain topography and by highlands associated with volcanic mountains. Most of the other highlands are associated with the Rift Valley. Substantial portions of the three great lakes (Victoria, Tanganyika and Nyasa) are located within country's borders.

4.1.3 Meteor-hydrology

Tanzania has small seasonal temperature variations caused by the country's proximity to the equator. Mean temperatures range from 26 °C on the coast to 17°C on the Southern Highlands. Potential evaporation in the country varies from about 1,000 mm/year in the highlands to 2,200 mm/year in the dry plains at the center of the country, showing high potential evaporation rates in the areas with a little precipitation. The annual rainfall varies from 500 mm to 1,000 mm over most of the country with highest rainfall of 1,000 mm to 3,000 mm in the north-east of Lake Tanganyika basin and in the Southern Highlands. More than half of the country receives an average rainfall less than 800 mm. Most regions receive rain from December to April, and this is referred to as the "wet season". The "dry season" generally occurs in the months of June to October. Due to these meteorological characteristics, river run-off in the country is not steady. More than 30 % of rivers in Tanzania show intermittent or ephemeral river regime.

4.1.4 Groundwater

Groundwater is an important water source in Tanzania supplying more than 25 % of the domestic water consumption. Areas using groundwater are scattered

throughout the country. The hydro-geological formation and lithology is very complicated. In general, a potential zone of groundwater would be observed in the areas of some tectonic and major faulting formed as a result of tectonic movement of the Kilimanjaro volcanism. Furthermore, the Karoo sandstone near Tanga and the fault zones around Arusha are groundwater potential zones.

4.2 National Irrigation Development Plan (NIDP)

4.2.1 Philosophy of NIDP

The objectives of the NIDP were in line with the then agriculture policy; to contribute towards attaining "food security" and "economic growth" at all levels. Through identification of constraints in irrigation development, two sub-objectives, "Removal of the sectoral constraints" and "Rehabilitation, upgrading and development of irrigation infrastructure" were induced. Furthermore, the Plan proposed five major components for achieving the plan's objectives as follows:

General Structure of NIDP

Development Objectives	Sub-objectives	Five Major Components
Food Security at All Levels	Removal of sectoral constraints	Sector policy review and monitoring and sectoral coordination
		Institutional building
Economic Growth (by means of upgrading national capacities in the planning, execution, operation, maintenance and monitoring of sustainable irrigation schemes, the rehabilitation of particularly the traditional smallholder schemes along with the facilitation of the private sector, all in the context of sound environmental stewardship).		Planning and management information systems and research
		End user involvement, cost recovery and commercialization
	Irrigation Infrastructure (Rehabilitation, upgrading and development of irrigation infrastructure)	Infrastructure improvement (Planning studies, Implementation)

Source: NIDP, 1994

Under the above objectives, the NIDP was formulated with the specific modalities that irrigation development in Tanzania shall be "in affordable-scale**,** for smallholder, by simple and low-cost technology".

The NIDP was designed with a timeframe to the year 2014, with four components for the "Removal of the Sectoral Constraints" planned to be completed by 1999, and the remaining one component for "Irrigation Infrastructure" planned to be implemented for 147 ranked priority irrigation schemes by the year 2014.

4.2.2 Progress of Implementation of NIDP

The envisaged outputs of the NIDP have not been adequately achieved in the past 8 years since inaugurated as shown in Table 4.2.1. About 70 % of the components for the "Removal of Constraints" have not been completed to date,

and even those commenced have not yet achieved their expected target.

As for the other sub-objectives of "Irrigation Infrastructure", progress has not been satisfactory. Below are tabulated the irrigation development programme/projects already completed or under implementation since the NIDP was launched:

Irrigation Development Programme/Projects Related to NIDP

Name of Programme/Project	Period	Donors	Remarks
Pawaga Irrigation Project	1993 - 1995	UNCDF/UNDP/WFP	It commands traditional irrigated area of 2,000 ha. The project was mainly to construct a weir structure and was a phase I scheme proposed in the F/S.
Madibira Agricultural Smallholder Development Rice Project	1995 - 2000	ADB	It targets 3,000 ha. The irrigation system is now operational.
Rehabilitation of Kilimanjaro Traditional Irrigation Schemes	1987 -	UNDP	It covers traditional irrigation schemes of about 6,400 ha.
Smallholder Development Project for Marginal Area (SDPMA)	1992 - 1999	IFAD	Rehabilitation of smallholder irrigated schemes using water harvesting technology for 4,300 ha.(18 schemes).
Participatory Irrigation Development Programme (PIDP)	2000 -	IFAD	It expands from SDPMA to wider areas (7,000ha; 16 SDPMA schemes rehabilitation, 36 new schemes, 8 charco dam schemes) with integrated approaches.
River Basin Management and Smallholder Irrigation Improvement Project(RBM-SIIP)	1996 - 2002	World Bank	It covers traditional irrigation schemes in Pangani and Rufiji River Basins having about 4,000 ha.(15 schemes out of 34 identified areas).
Agricultural Sector Programme Support – Irrigation Component (ASPS-IC)	1998 - 2002	DANIDA	It is an upgrading project of smallholder traditional irrigation schemes (5 schemes) in Morogoro, Iringa and Mbeya Regions.
Special Programme for Food Security (SPFS)	1995 -	FAO	Once the Pilot Phase was phased out in 1998, it is now in Expansion Phase. Improvement of existing water abstraction and distribution system has been done together with iterative learning process.
Mwega Smallholder Irrigation Project	2000- 2002	Gov. of Japan	It targets 580 ha of irrigation development. Improvement work of irrigation system was completed in March, 2002.
Traditional Irrigation Programme (TIP)	1987 -	SNV (transformed into a trust fund of TIPDO)	It is a rehabilitation project of traditional irrigation schemes in Iringa, Dodoma, Tanga and Kilimanjaro with target of 8,000 ha.

Source: Internal information in Irrigation Section of MAFS

4.2.3 Problems and Constraints in Implementation of NIDP

The problems in irrigation development pointed out in the report of "Agriculture: Performance and Strategies for Sustainable Growth" February 2000, are as follows:

- Absence of hydrological data for irrigation planning
- Failure of development planners to appreciate the need for human, equipment and financial resources to implement irrigation projects
- Continued emphasis on sophisticated, expensive and uneconomic irrigation projects
- Poor project planning and inadequate project preparation
- Under-resourcing of irrigation services at national, zonal and regional levels
- Failure to develop extension packages for irrigated agriculture and the ineffectiveness of extension services to farmers
- Inadequate human resource development and lack of funding for training, leading to low staff motivation

Similarly, the Irrigation Section (IS) of MAFS reviewed the progress of the NIDP in 2001, focusing on current status of constraints clarified in the NIDP. Their reviews indicate the following problems:

Summary of Problems in Implementing NIDP Identified by IS

Constraints Identified in NIDP	Problems in NIDP Implementation
Marginalization and under-resourcing of the irrigation services	The constrains still remain. Irrigation sector continues to have low autonomy, and working conditions are unsettled being 'tossed about' by donors activities.
Badly defined institutional structures and responsibility	The coordination capacity of IS has faded due to a trend change within a short period. The levels of investment are not standard for different projects.
Inadequate operational support and farmer management mechanisms at completed irrigation schemes	The situation has been aggravated by the re-establishment of the local government. Unclear relationships and responsibilities for extension services and lack of harmonized O&M guidelines have hampered adequate operational support.
Shortage of national competence in project planning, designing and construction of irrigation schemes	Resources are not made available. Authority and criteria are poorly off for harmonization of the level of investment on irrigation development.

Source: Internal information in Irrigation Section of MAFS

Although more than 60 schemes out of 147 schemes, have been implemented or commenced, the schemes have not been directly selected from the high-ranked schemes proposed in the NIDP. Even the constraints specified in the NIDP have hardly been settled and still remained unresolved. Weakness of the institutional capability and vulnerability of the Irrigation Section were given great attention in the NIDP, and thus the NIDP aimed at elimination of the constraint through institutional building with a high priority. However, these very constraints have tended to hamper successful implementation of the NIDP. Root causes of the weakness are supposedly due to poor basic institutional circumstances. Strengthening should not be done part by part, but be undertaken comprehensively in a stream of efforts, as lessons are learnt from the NIDP implementation.

4.3 Water Policy and Type of Irrigation Development

4.3.1 Irrigation Water Use under the Country's New Water Policy

In general, it is compulsory to acquire a water right for irrigation water use in Mainland. The Water Utilization Act prescribes that "law requires that any person who intends to use the water of a river shall obtain a water right, and the law also requires that any person who wants discharge effluent and waste water in a water body shall obtain the water right". The issue of granting water rights is dealt with in accordance of Section 15 of the Act No.45 of 1974 and also the Regulations of 1997 made under Section 38 (2) of the Act.

Customary water use from traditional irrigation schemes is condoned and water rights are granted provided the application is prepared and submitted. However, pressures for irrigation water use will increase with the recent establishment of a new "National Water Policy". The National Water Policy was drafted in December 2001, and will be soon authorized. Shortly, the effective "Water Utilization Act" shall be revised in conformity with the philosophy presented in the Policy.

The Policy is likely to have a dramatic effect on water use for the irrigation sector. It requires that water resources development and management shall be dealt with in an effective manner in line with the concept of "water as a common use resource". There are two great threats for irrigation. One is that new irrigation water resources development will be restrained in competition with other water uses from a viewpoint of economic superiority. The other is that continuous irrigation water use may be hindered according to the attitude of the existing rights holder on water use or need of water for new users.

These new proposals for water resources development and management have been already incorporated in the RBMSIIP for Pangani and Rufiji River Basins. The RBMSIIP is under a basic development concept that no allocation of water is given to new irrigation water use, on the basis that the results of economic evaluation show that water use for hydro-power generating is much superior to that for irrigated agriculture. The only way to achieve irrigation development under this concept is to improve the irrigation efficiency and use the saved water for further irrigation development.

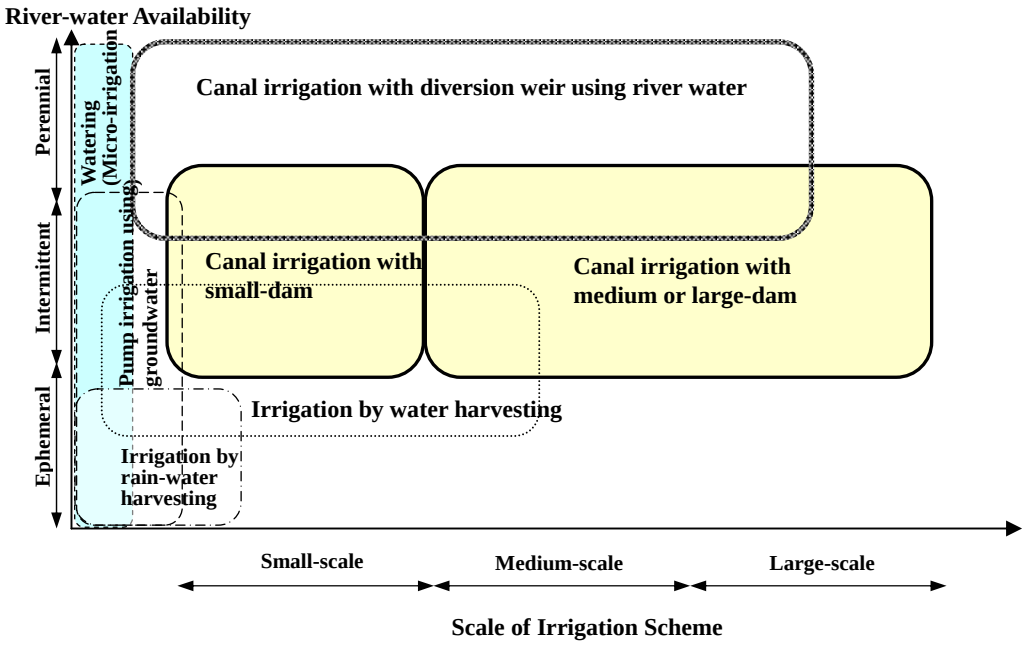
Recently, there have been strenuous claims that water abstraction for irrigation causes an environmental hazard by drying up the river during the dry season as happened at Usangu Basin. However there is no scientific justification of the opinion. The river basin approach should focus not on exclusion of irrigation within the river basin, but development of sustainable irrigation by means of

improving methods and modality of irrigation water use.

4.3.2 Type of Irrigation Development in Mainland

Irrigation practices in the Mainland are categorized into several patterns by scheme size, availability of water sources etc, as shown in the following figure:

Classification of Irrigation Practices in Mainland



A system of canal irrigation with a diversion weir and a water source of perennial river is the most prominent irrigation system in the Mainland. Traditional water harvesting practice of diverting flood water into fields is widely performed in the marginal areas in Central Tanzania. Watering by hand or by simple manual pump from a spring source, called "*kisima*", is practiced by individual farmers or small groups throughout the country. These systems are referred to as micro-irrigation.

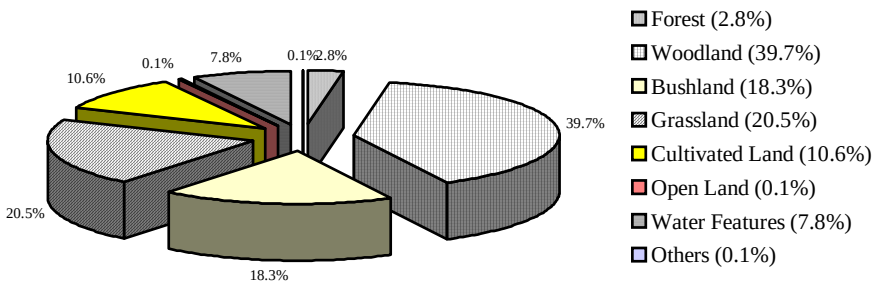
4.3.3 Land Use

(1) Present Land Use

(a) General Land Use

According to the land use data, the present land use is categorized into eight major land types, namely; forests, woodland, bushland, grassland, cultivated land, open land, water features and others. As shown below, the total of forest and woodland occupies more than 40% of the total land area of the Mainland. The cultivated land occupies about 10% of the land area, equivalent to 10 million ha. Bushland and grassland occupies around 20% of the total land area.

Distribution of Land Cover in Mainland



Source: National Reconnaissance Level Land Use and Natural Resources Mapping Project, Final Report 1997

(b) Crop Production

The main food crops grown in the country are maize, sorghum, millet, paddy, wheat, sweet potato, cassava, pulses and bananas. Of the food crops grown, maize is the dominant crop with the planted area of over 1.5 million ha during recent years. Sorghum is the second largest food crop with the planted area of 0.6 to 0.7 million ha. The planted area of paddy has increasing from less than 0.4 to more than 0.5 million ha within the past few years. Wheat is grown mainly on large farms in several regions. Roots and tubers such as cassava and sweet potato and also pulses such as beans, pigeon pea and cowpea are important food crops as a part of major staples and considerable areas are utilized for these crops. The yields of these food crops are generally low due mainly to the dependence on rainfed agriculture and also fluctuate because of unstable rainfall.

The cropping pattern regional-wise varies considerably. Maize is a dominant crop in the most of the regions, accounting for more than 50% of the food crop area in Iringa. Sorghum, with its drought resistant characteristics, dominates in dry regions such as Dodoma and Singida. A considerable part of the land area is allocated for paddy in Morogoro, Tabora, Mwanza and Mbeya. Similarly, cassava is important in Mtwara, Coast and Lindi and pulses are important in Kagera.

(c) Livestock and Rangeland

Livestock sector plays a significant role in the Mainland. Cattle, goats and sheep are the major types of livestock raised by agricultural holders. It is obvious that livestock activities are important in regions such as Arusha, Shinyanga and Mwanza.

About half the total land area is considered as suitable land for grazing, but it is estimated that 25% of the grazing areas are affected by tsetse fly. The population increase has, to some extent, resulted in an expansion of agriculture into marginal lands, many of them being drier or seasonally flooded areas that are important grazing areas for pastoralists. Particularly in drier regions, such encroachments have resulted in a reduction of land available for pastoralists, who have responded by moving into new areas with previously low livestock population, thus creating land use conflicts in the receiving areas.

(d) Household Characteristics

The total number of households increased over the period of 1993/94-1998/99 with an annual average increase of 4.5%. Out of the total agricultural households in 1998/99, 64% were involved in growing crops only, 36% were involved in growing crops and raising livestock, while only 0.4% raised livestock only. The average planted area per holding is 1.76 ha ranging from 0.94 ha in Kigoma to 3.00 ha in Shinyanga. This average area per holding is fragmented into 2.5 plots on average and the average area per plot is 0.7 ha.

(2) Land Tenure

Uncertainty and insecurity of land tenure for many rural households results in a reluctance to invest in land improvements. Most farming systems in the Mainland still do not use adequate external inputs, and fertility is mainly restored through fallows. However, such fertility is steadily reduced by population pressure and also by the aforementioned insecurity of land tenure. Soil erosion is consequently spreading throughout all parts of the country. A reform of the land tenure system and land use legislation is therefore needed in order to minimize the land use conflict and the degradation of land resources.

(3) Land Resources for Irrigation Development

According to "Basic Data Agriculture and Livestock Sector 1992/93-1998/99", about 33% of cultivated land is actually utilized for crop production as planted land. Only 6% of the planted land (approximately 200,000 ha) is being irrigated. This figure was confirmed by the results of the inventory survey carried out under the Study. The substantial areas were managed by smallholder farmers through traditional irrigation systems of flood recession or water harvesting. The total irrigation potential is so far estimated as 1 million[1] ha. This estimation was also

[1] *The National Irrigation Development Plan, October 1994*

confirmed by the results of the inventory survey of the current study and the preliminary estimate on potential area for large-scale irrigation schemes.

4.3.4 Farming System

(1) Crop Based Farming Systems

The National Coordination Unit for Farming Systems Research of the Department of Research and Training of the Ministry of Agriculture and Cooperatives (MAC) carried out the zoning of crop based farming systems based on the agro-ecological zones. In this zoning, the major crops grown and the suitable agro-ecological zone are shown for each farming system.

Variety preference survey was carried out through on-farm testing and evaluation with farmers. The result of this survey can provide the researchers and farmers with valuable information on suitable varieties for respective zones. This result is also useful to understand the diversity of farming systems and interaction with farmer's variety choice. Furthermore, farmer strategies on variety selection according to land use type, purpose of production either home consumption or sale, and implications to labor force were also clarified.

(2) Farm Management

Small-scale subsistence farming is dominant in the Mainland. The majority of farmers rely on hand hoes as main cultivating tools, though a small percentage use tractors and draft animals. The present cropping also depends on rainfed agriculture. Such a conventional low-input together with population increase and low-output production systems have resulted in high rates of soil degradation mainly due to the reduced fallow period. The government should therefore formulate strategic plans so that farmers are encouraged to be involved in sustainable agricultural production practices including proper land management. In this context, the irrigation development can contribute to an appropriate soil and land management not only through stable supply of irrigation water to the field but also through flood control, erosion control, augmentation of underground water resources and so on.

Due to heavy reliance on rainfed agriculture, there are two production systems according to the seasonal types. Major production depends on Masika (the long rains) for most of the cereals but Vuli (the short rains) production is important in some regions. When irrigation is introduced, dry season cropping can be achieved. In addition to that crop, the cropping pattern should carefully be designed as part of the development plan for each irrigation scheme.

It is said that the major constraints related to farm management are low use of

improved varieties, late transplanting, low plant density, poor weeding control and low inputs. These constraints should be improved through strengthening of farmers supporting systems such as research, extension, input supply, marketing and access to available loans. In case of irrigation development, even more careful support might be needed for proper operation of irrigation system and maintenance practices for sustainable utilization of the facilities. The comprehensive strategy on farmers supporting system should thus be organized.

The traditional irrigation crops are rice, maize, beans, onions, horticulture, bananas, sugarcane, coffee, tea and cotton. Out of these irrigated crops, rice is by far the most important crop. Purely rainfed rice is not common and rice is produced twice or three times per year in some regions mainly by using water harvesting method or simple river diversions. In the NIDP, the typical rainfed and irrigated paddy yields were compared and the result is shown below.

Typical Rainfed and Irrigated Paddy Yields in Mainland

Irrigation System	Yield (ton/ha.)	Remarks
Rainfed	1.0-1.8	Hand cultivation
Traditionally Irrigated	1.0-2.0	Water harvesting/River diversions
Improved Traditional	4.0	River diversion/Improved land development
New Small Holder Scheme	2.0-6.0	Mechanization/High Inputs/Modern varieties
State Farms	2.8	Mechanization/High Inputs/Modern varieties

Source: National Irrigation Development Plan

It is clear that irrigation can contribute to the increase of yield per unit area. The effect will be upheld when accompanied with mechanization, high inputs and modern varieties.

4.3.5 Marketing

(1) Marketing Channel of Staple Foods

The staple foods of the Mainland are classified into the cereals: maize, sorghum, millet, rice and wheat, and the non-cereals: pulses, cassava, bananas, and potatoes. The marketing channel of cereals is mainly described in this chapter. The distribution of these cereals from producers to consumers follows a multi-channel structure ranging from direct marketing to intensive distribution involving several intermediaries. The distribution structures also vary with location.

Producing Center

Due to differing climatic conditions in the mainland, different areas support the growth of different major crops. There are 63 agro-ecological zones based on variations in altitude, soil type and rainfall pattern (FAO/WFP 1999). In case of rice, it is mainly smallholder farmers some of who are assisted by the agricultural

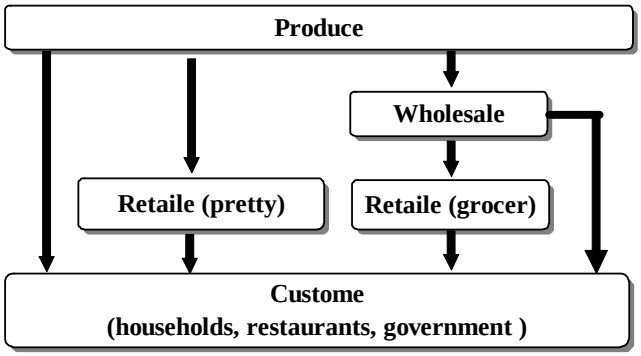
department in certain areas (Mbarali-Mbeya and Kilombero). Wheat is cultivated at a larger scale in Arusha region in the North. Peasants and small-scale farmers almost exclusively produce Millet and Sorghum.

The main surplus regions for maize are Iringa, Mbeya, Rukwa and Ruvuma, which collectively supply most of the country. Rukwa mainly supplies the North-Western Region, which also receives maize from Moshi and Arusha. Most of the maize from Iringa and Mbeya is destined for Morogoro and Dar-es-salaam. Dodoma receives most of its maize from Iringa, Singida and Arusha, whilst the main source of supply for Lindi and Mtwara in the south, is Ruvuma.

Marketing Channel

The surplus production of cereals is exported to other regionsin the country that face shortages of food and/or are big consumer centers, such as Dar es Salaam. Domestic trade is mostly undertaken directly between traders and producers with a limited role played by middlemen. In the main surplus areas retailers take on the functions of intermediaries (inter-regional traders and wholesalers) and in normal years there is easy access to plentiful supplies. The presence of bigger specialized wholesalers is largely confined to Dar-es-Salaam. Maize, Millet and Sorghum marketing is almost exclusively characterized by a large number of small traders operating from main producing areas and urban centers. Rice marketing has characteristics of both the presence of many petty traders as well as wholesalers who mainly supply retailers in urban centers. The structure of the marketing channels is presented in the right figure.

Structure of Markeing



In case of Wheat, the marketing channel is different from the other cereals. Wheat is first sold almost entirely to large grain millers who process grain and package flour for selling to urban retailers or wholesalers.

(2) Marketing Facilities

Marketing Place

The physical exchange process in the marketing of the major cereals in rural areas takes place mainly through periodic food market fares, which usually take place once to three times a week. It is commonly called ‘gulio’, and where producers

from neighboring villages meet to sell their surplus produce. Exchanges can be in cash or in barter form.

In urban centers physical exchange of cereal and non-cereal produce occurs mainly at the open food stalls “masoko”, or at grocery retailers. The local authorities own and maintain the premises housing these “masokos” including taking care of sanitation although the efficiency with which they carry out these activities is very poor.

Transportation

Transportation of the major cereals and non-cereals in the country is done by various means. This ranges from the use of human couriers and bicycles to pickup trucks, buses, and heavy-duty lorries for inter-district/regional transportation. The former are mainly practiced where distances are short and it is common for producers themselves to perform the carrying (women usually carry produce.).

The main impediments to transportation of cereals from surplus to deficit regions are the extremely large distances and the agro-diversity (uneven distribution of products) of the Mainland. The flow of food from surplus to deficit regions is heavily constrained by grossly inadequate transport systems and insufficient haulage capacity, vehicles and rail wagons (FAO/WFP 1999).

Storage Facilities

The storage facilities for most cereals are far from perfect. At the smallholder level, producers store grain in traditional silos whose sizes are roughly equal to the one-room huts that peasants occupy. A silo might have the capacity to store the equivalent of between 10 and 40 one hundred kg sacks of grain. This method of storage is vulnerable to some degree of pests

(3) Price Fluctuation of Staple Foods

In contrast to cash crops such as coffee, tea, and cashew nuts, there is currently no institution that is mandated to control the marketing of food crops. The pricing of all food crops in the Mainland is completely market determined, since the time the government liberalized the marketing of most agricultural products. Prices therefore depend on the supply-demand situation and for many of the foodstuffs they fluctuate considerably according to seasons of the year. High and sometimes exorbitant prices are common during seasons of high demand for food crops and low prices during the high supply season. The pricing problem is compounded by the unavailability of facilities such as packaging and temporary storage, which leads to an unstable pricing system. Some indication of the fluctuation of food crop prices in a major urban center in the Mainland is illustrated in table below for

three different periods of the recent year.

Price Fluctuation for Products

Product	Unit	Price at Dec 2001	Price at Mar. 2002	Price at May 2002	Maximum Deviation
Sorghum	TSh.100 kg bag	8,000*	13,000	16,000	5,000
Finger Millet	TSh.100 kg bag	22,000*	30,000	N/A	8,000
Rice	TSh.100 kg bag	35,000*	N/A	38,000	3,000
Wheat	TSh.100 kg bag	38,000	26,000	28,000	12,000
Maize	TSh.100 kg bag	25,000**	27,000**	N/A	2,000
Cow Peas	TSh.100 kg bag	15,000*	30,000	17,000	15,000
Cassava	TSh.100 kg bag	20,000*	9,000	12,000	8,000
Irish Potatoes	TSh.100 kg bag	18,000	19,000	17,000	2,000
Cooking Bananas	TSh.10 kg bunch	7,000	5,000	5,500	2,000

*Key: * prices are for October 2001, ** prices are at retail, N/A – not available*
Source: Business Times: Markets and Economy, October, December 2001: March, May 2002, Financial Times October 2001; March 2002

(4) Problems and Constraints

The marketing sector for foodstuffs in the Mainland has a number of problems. Among the major problems facing the efficient functioning of food crop marketing in the major cereals and non-cereals area is the unregulated market which mainly disadvantages the small producers, most of whom are semi-literate. Other major constraints are the underdeveloped transportation infrastructure, poor storage facilities, and absence of market information and promotion.

Small and medium sized producers are also facing a lot of problems in terms of financing and insurance. This is especially so when it comes to obtaining vital inputs or when they face adverse conditions. There are also natural physical constraints such as the diverse and vast geographical terrain, as well as the erratic weather patterns that often occur in non-periodic cycles. From the motivational point of view, these factors and the country's historical past serve as disincentives to small holders to produce food crops in greater surplus. Finally, from the consumer point of view, the problems they face mainly center on their vulnerability to exploitation in the form of hiked prices and sometimes limited product choices as a result of the periodic fluctuations in the supply-demand conditions.

4.3.6 Institution

(1) Background

During the four decades since independence, the agricultural policy in the Mainland has experienced a drastic fluctuation. The early stage was influenced by socialist ideology and experienced extensive governmental intervention. Later, in the mid 1980s, the policy reform and market liberalization began to be

implemented.

Along these policy changes the role of government has been also changing from being an active participant to being a facilitator playing a regulatory role as providing support services and technical backstopping. Instead of the governments' strong intervention, the participatory approach of all stakeholders in the agricultural development has been emphasized. Consequently, farmers and other private sectors are now expected and encouraged to play a much greater part in all stages of agricultural development including irrigation development. However, as the transformation of institutional framework is still under way, a further effort of strengthening the institutional framework should be made to attain efficient and sustainable agricultural development.

(2) Constraints identified in NIDP

A number of constraints facing irrigation development in the Mainland were identified in the NIDP as described in Sub-clause 4.2.3. They essentially stemmed from various factors and their complex interactions. However, the overall institutional setting for irrigation development has been unfortunately considered as one of major causes for the poor performance of irrigation in the past. Therefore, the institutional setting has to be carefully reviewed and effectively reformed to alleviate the constraints, although some of them have been improved to some extent since the mid '90s through the implementation of various externally supported projects. However, most of them are still directly applicable to the present problem situation.

In addition, as described in Sub-clause 4.3.3, the importance of adequate security of land tenure for irrigation farmers is also mentioned as a crucial factor for success. The government should provide an institutional guarantee of tradable tenure, long leases for example, in order to encourage farmers to invest in irrigation development. In the same way, the development of smallholder irrigation must be accompanied by government support for savings and credit development so that farmers can purchase the initial inputs that will enable productivity increases to be achieved.

Furthermore, it is important that the government holds strictly to its policy of addressing environmental issues for any irrigation development. Similarly, the possibility of conflict over water use between competing stakeholders should be carefully handled. Conflicts can arise not only between villages along rivers, cultivators and pastoralists, but also between the agricultural sector and other sectors like hydropower generation. The government, especially at the district level, will need to establish an institutional mechanism to mediate such conflicts

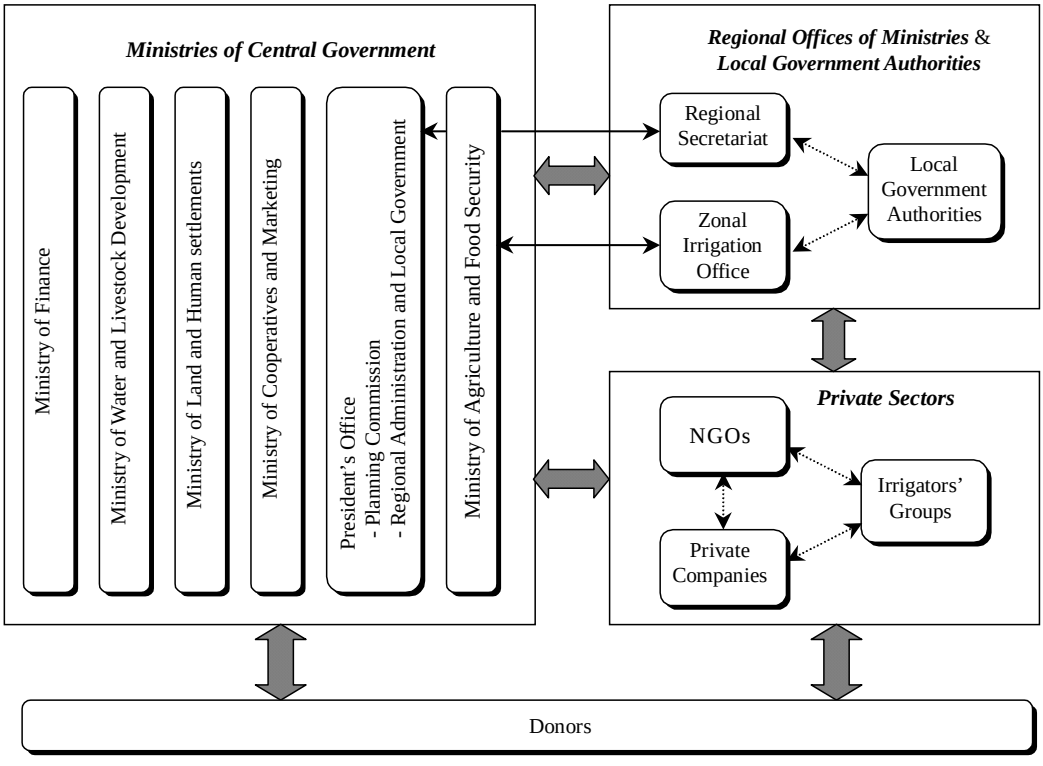
so that irrigation development is implemented smoothly without delay.

4.3.7 Organization

(1) Present Situation

Presently various organizations are involved in the field of irrigation development in the Mainland. They generally include; (1) Ministries of the Central Government, (2) Regional Offices of the Ministries and the Local Government Authorities (LGAs) and (3) the Private sectors (Irrigators' groups, Non-governmental organizations (NGOs), and private companies). In the Central Governmental body, there is no organization holding all necessary mandates of irrigation in the block. The major participants at the central level include PO-PC, PO-RALG, MOF, MAFS, MWLD, MLHS, and MCM. Coordination mechanism of the relevant organizations is, needless to say, necessary. However, no comprehensive mechanism among them has been established yet. The detailed organizational and functional relations among the above organizations are described in Appendix H.

Organizations Pertaining to Irrigation Development in Tanzania



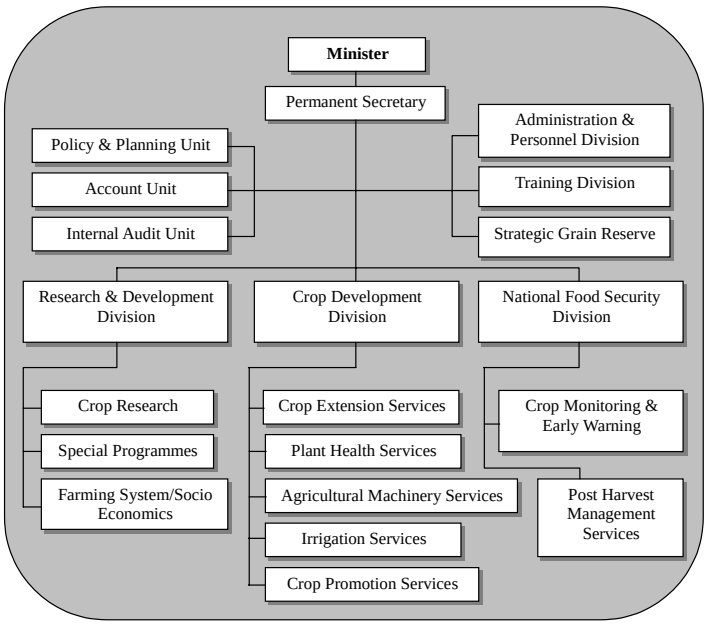
Remarks: (⟷) *Organizational Linkage,*
(⇢) & (⟺) *Functional Linkage*

Source: JICA Study Team

(2) Present Organization of Irrigation Section

The Irrigation Section is at present one of five sections belonging to the Crop Development Division in the MAFS. In 1988 the section was downgraded from the division. Taking an importance of irrigation development for economic development and poverty alleviation in the rural areas into account, the present institutional position of irrigation development unfortunately seems inappropriate to coordinate and harmonize the different organizations involved in irrigation development and, furthermore, to make prompt decisions. The section may also need strong mandates of the personnel administration and budget allocation.

Present Institutional Position of Irrigation Services in MAFS



Source: MAFS

(3) Regional Secretariat

The Regional Secretariat is a local agency of the Central Government whose functions are to encourage and coordinate Local Governments to execute and to implement policies. The quota of the staff is at present 83 which has decreased from more than 400 because of the decentralization policy, i.e. the LGRP. A proportion of the staff has been transferred to the Local Governments. At the Regional Secretariat the agricultural officer is currently responsible for the irrigation development. However, no staff is provided and his function is generally confined to an advisory role.

(4) Local Government Authorities

The LGRP will bring about the dramatic change of the roles and functions of the Local Governments through decentralization of those of the Central Government. These reforms will be particularly critical to the delivery of support services to

smallholders, rural infrastructure development, and farmer's access to financial services. However, Local Governments presently face a lot of constraints that limit their capacity building. The LGRP is still under way. Its efficient and smooth implementation may be very crucial to reform the institutional and organizational setting of irrigation development. The progress of LGRP should be carefully monitored and its attained results will be documented in the NIMP.

In the District Council the District Agriculture and Livestock Development Officer (DALDO) is in charge of irrigation development. However, not all DALDOs have irrigation officers and some are seriously understaffed.

Although their expected roles and functions have expanded, the LGAs presently face a number of constraints that limit their capacity including:

- Lack of a legal mandate, technical skills and facilities to enforce some roles.
- Lack of expertise for strategic and financial planning and management.
- Very limited resources for local level institutional building for community participation in the development process.
- A shortage of competent personnel and, in some cases, technical equipment to manage and control the development process. For example, all local governments lack the technical capacity for effective and timely land use planning.

(5) Present Performance of Governmental Organizations

The demarcation of roles and functions of irrigation farming among the relating governmental organizations was clearly defined conforming to the LGRP in June 2001. They are presently not necessarily well performed by each organization, however. Details are mentioned in Clause 2.5 of Appendix H.

For the MAFS, the high priority of institutional and/or organizational strengthening is to formulate and review policy, laws, procedures, regulations and guidelines on irrigation farming. It indicates that the formation of an effective institutional framework including securing the stronger institutional and organizational position of the Irrigation Section is urgent for efficient irrigation development.

The LGAs and Regional Secretariats are presently being transforming under the decentralization policy, i.e. the LGRP. Therefore, it is too early to judge their present performance of the demarcated roles and functions. However, it is quite obvious that they need strong support from the Central Government for a certain period after completion of the LGRP to secure their self-reliance.

(6) Private Sector Organizations

The private sector, in particular farmers themselves, is expected to become a main actor in irrigation development. However, at present farmers face a lot of constraints to perform their roles to a large extent. ASDS pointed out the followings:

- Institutional and governmental constraints, including an uncertain regulatory environment, inappropriate policies, inadequate extension, research, marketing and regulatory services.
- Financial constraints, including lack of access to capital assets and credit, exacerbated by low prices of output, high cost of inputs, multiple taxes and limited incomes.
- Natural environmental constraints, which include limited access to land and water, frequent outbreaks of pests and diseases and a deteriorating natural resource base.
- Human constraints that include limited knowledge and skills, poor health and low productivity.
- Infrastructure constraints, including poor roads, inadequate marketing infrastructure, lack of electricity, water and communication facilities.

This complexity is hampering farmer's efforts. However, the constraints should be carefully studied further to identify some key factors for practical and efficient countermeasures, and a gradual stage-wise support programme should be formulated to overcome the persistent constraints one by one.

The water users groups, i.e. the irrigators' groups (IGs), are generally classified into three categories, (i) registered irrigators cooperative society (ICS), (ii) registered irrigators association (IA), and (iii) non-registered group. Neither cooperative nor association is necessarily an optimum organizational form for the irrigators' group. Sustainable operation and maintenance of the scheme is one of major tasks for the irrigators' group. However, the cooperative is primarily a business-oriented organization (buying, selling and marketing) whereas the association is more involved with 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.

The investment by the private companies in irrigated farming will be one of important alternatives in the future and will play an important role for the irrigation development. The relevant governmental agencies need to prepare favorable and attractive legal and institutional framework for the private investors.

4.4 Problems on Selected Existing Irrigation Schemes

(1) Objectives and Methods of Problem Analysis

The NIDP should be improved due to the changes of current circumstances related to irrigation development in Tanzania, and additional issues which were overlooked when the NIDP was being prepared. In order to identify these changes and additional issues, a problem analysis was carried out for the selected existing irrigation schemes.

In the Study, an original form for project analysis was adopted to examine the existing irrigation projects in conjunction with project procedures from planning stage to O&M stage of the project. The form was devised so as to pursue problems in each stage of project implementation, with grading and appraisal according to five ranks that can be obtained in each stage of the project. The problem analysis has been undertaken in the following procedure:

- Finalize analysis form and schedule of the work
- Select projects to be examined
- Deliver the forms (analysis form and project sheet) to personnel concerned in the project through the counterpart giving adequate guidance
- Collect entered forms through the counterpart
- Review the reply on the form
- Inquire the personnel concerned with the project to give details, if necessary
- Analyze the results in consideration with other information for the projects available, and findings obtained through project site inspection

(2) Scheme Selection for Problem Analysis

It is judged that projects implemented some time ago were not appropriate for this analysis because circumstances surrounding irrigation implementation at those times have changed. Furthermore, some projects are also inappropriate for the study due to lack of generality of problems found on the projects. Based upon these understandings, projects which have been implemented under the NIDP, were selected.

A total of ten projects were nominated for this problem analysis. However, four projects were excluded because of no significant reply.

(3) Problem Analysis

Problem analysis was carried out for six projects for which replies to the questions had been received. Consequences of the problem analysis and salient features of the selected projects are given in Appendix D.

General viewing of the entered analysis forms of the answered projects showed

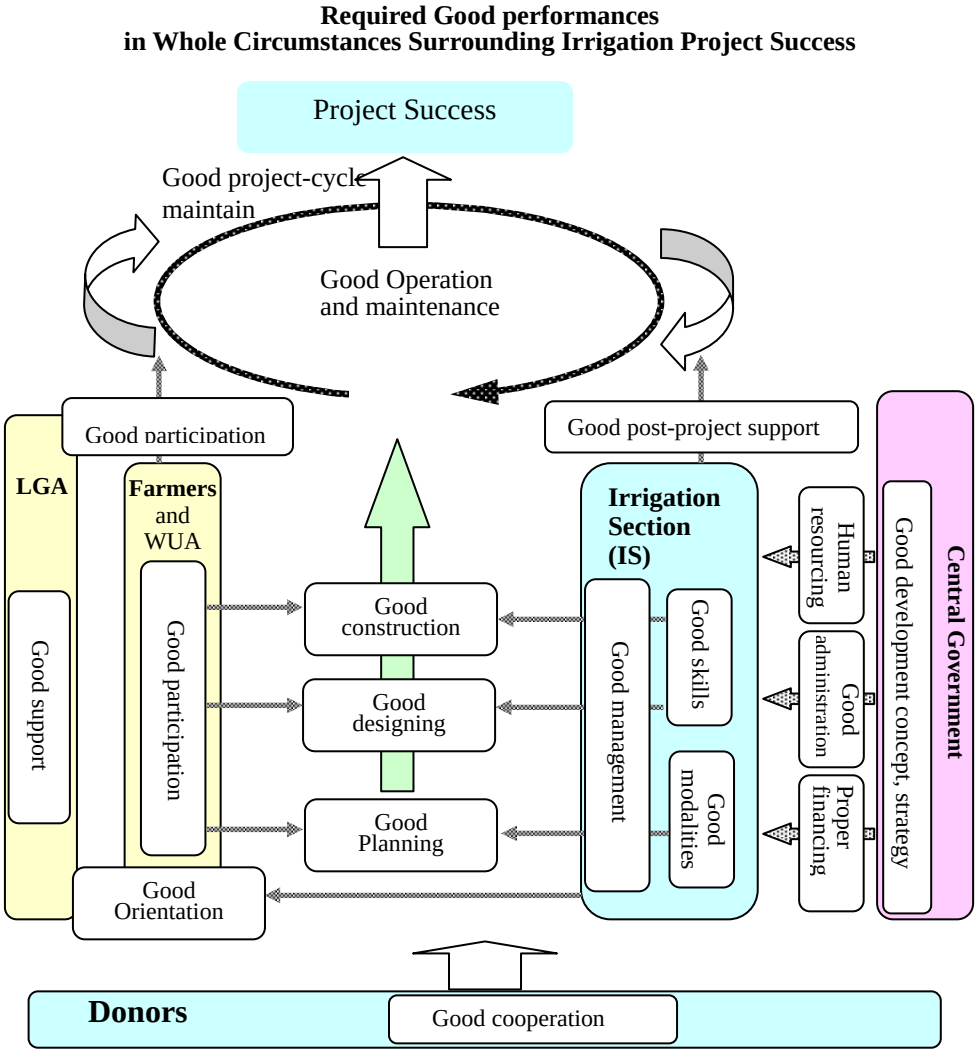
that each stage of the project plays an important part on overall success of the project. Important points concluded from the problem analysis in irrigation development are summarized and enumerated as follows:

Conclusions from the Problem Analysis

No.	Conclusion	Related Field
P.1	Adopting manner of farmers' participation is not always adequate, though participatory approach is an important direction for the success of project. There are some projects which had not succeeded because of misleading participation of farmers.	Farmers' participation
P.2	Logical structure of irrigation projects are generally not always sound. Sometimes important assumptions of the projects are not appropriately considered. These factors left off from previous consideration influenced project's success or failure. Also, linkage between the project purpose and projects outputs is generally weak.	Planning
P.3	A concept of "in affordable scale, for smallholder, by simple and low-cost technology" is a main stream in irrigation development. However, definition of "simple and low-cost" is sometimes an apt to be misunderstood as "easy and no concern of technical knowledge and aspect"	Technology
P.4	Presently IS works in general planning and project management much exclusively. Basic technology in irrigation which must be a foundation of such planning and management techniques, are apt to be looked down on. These movements seem to be a hotbed building unrealistic project formulation.	Management
P.5	Overlooking the selected projects in chronological order, it is notable not to reflect previous failures into the next projects. Feedback system to accumulate lessons learnt and reflect the experiences to others does not exist in IS. Accumulation of technical experiences is made light of, too much thinking about management.	Technology
P.6	Technical references such as guidelines and manuals are not adequately prepared or missing. Although some technical references were prepared under previous programmes/projects, those were not systematic or general enough. This has not only caused a misinterpretation of the contents of the prepared references, but also brought about by inadequacy of information management system.	Technology
P.7	Besides the inadequate preparations in contract system and supervising, capability and experiences of contractors are definitely below expectation. Substantial measures for improvement of contractors' capacity should be taken immediately. Provisional alternatives to successful construction work in irrigation schemes should be considered.	Private sector
P.8	WUA must play an important role in operation and maintenance of irrigation scheme. Besides encouraging WUA's effort on their duties, supporting system for the WUA's activities is essential during post implementation of irrigation scheme.	O&M
P.9	LGA is in charge of a significant part for the success of irrigation development. At present, function of office and personnel concerned in irrigated agriculture is still powerless in every district. Consideration should be given to adequate participation to meet their present status.	LGA

Source: JICA Study Team

The above points identified through the problem analysis seem to be related with only to implementation methodologies or plans, but also other circuitous sub-sectors. The project can succeed and have good performances in all circumstances surrounding irrigation development if implemented according to the following schematic figure.



4.5 Study on Irrigation Development Level

4.5.1 Needs for Benchmarking of Irrigation Development Level

As identified in Clause 4.4, irrigation development in the Mainland has been executed without certain authorized guidelines prescribing for irrigation development level. From the outset, it is difficult to contain great variation in natural condition and social situation in the Mainland to produce a unified criterion. It also seems out of place for the Mainland to set unified criteria in irrigation development level and to integrate all projects into a single criteria.

The differences in technical aspects among implemented projects are too significant even considering the variation of characteristics in regional conditions. The big differences in irrigation development level may be due to; (i) ineffective utilization of limited resources to be appropriated for irrigation development, (ii) complaints from farmers concerned about the irrigation schemes being in depleted level, (iii) confusion in expansion of model effects to other areas, and (iv) complexity in supervising and monitoring irrigation schemes under a wide range of development levels. It is therefore required to prepare an original criterion on irrigation development level that is elastic or widely accommodating for the variation of conditions of relevant projects.

4.5.2 Previous Guidelines and Criteria

Irrigation development level is a basic assumption or a fundamental condition of the technical standards in irrigation planning, designing and construction. So far, several technical guidelines have been prepared in relation to the specified projects. The following table shows general views of the technical guidelines already prepared:

Existing Technical Guidelines in Irrigation Development

Name of Project	Prepared Term	Title	Comments
ISID	1991 - 1994	Project Planning manual	The manual consisting of several volumes covers all technical fields related to irrigation. Unfortunately, the manual has been hardly utilized by all concerned personnel.
ASMP	1996 -	Technical Manual for Planning and Design of Irrigation Systems, Construction Manual for Irrigation Works, Technical Manual for Operation & Maintenance of Irrigation Systems	The manual provides technical and procedural guidance to all personnel involved in planning, designing, implementation and O & M of irrigation system. But, it is still a draft, and has not been finalized.
RBMSIIP	1999 - 2000	Irrigation Design Manual	A design manual for irrigation system consists of Guidelines and Drawings. It is a well-organized outcome. It is expected to give some improvements in the contents.
PIDP	2000 - 2001	Rainwater Harvesting Design Manual for Irrigated Agriculture in Marginal Areas	A design manual consists of eleven chapters. Many parts of the manual present design methods for conventional irrigation system, and few special modalities for water harvesting scheme design.
ASPS-IC	2001 -	Irrigation Water Management Field Handbook for Extension Staff	The handbook is not yet finalized. The handbook will provide information on water management to extension workers as a quick reference manual.

Source: Information from Irrigation Section of MAFS

Existing technical guidelines and manuals are not utilized in irrigation development widely and effectively. Although this is caused by inadequacy of knowledge management system or failure of information delivering and circulating arrangement in the IS, contents of the existing references also have

room for improvement. The existing technical guidelines and manuals comprise an introduction and explanation for technical subjects on an item-by-item basis, diverting from the approach of international technical guidelines, such as "Irrigation and Drainage Paper, FAO". These existing technical references scarcely mention issues such as the irrigation development level.

In the Mainland, irrigation development should be promoted in various manners corresponding to the characteristics of each project area. Pursuing optimum irrigation development for each target area, which has its own constraints and locality, requires enthusiastic debate.

As a basic irrigation development concept, "low-cost technology" was advocated in the preparation of the NIDP. Later, lower investment cost became an object of argument. However, the argument has been seen from a viewpoint of affordability, rather than suitability or optimality of the project. Irrigation development level should be based on the suitability or optimality of the project.

4.5.3 Objectives of Study on Irrigation Development Level

The appropriate approach should correspond to the natural and social conditions in the concerned project area. In general, many options can be conceived for irrigation improvements. In many cases, the same agricultural productivity could be ensured by different ways of irrigation practice; for example one may be realized by means of systematic irrigation operation with substantial initial investment in hardware, another could achieve the same result by simple facilities with close attention to human behavior and technology transfer post-implementation. Concept of the combination between hardware (initial investment) and software (post-project implementation) components by several typical irrigation systems are illustrated in Figure 4.5.1.

From these understandings, objectives of the study on irrigation development level are to provide conceivable options for irrigation development with appropriate combinations of hardware and software components to meet any unusual characteristics of the concerned project area.

4.6 Privatization of NAFCO

After the Arusha Declaration of 1967, the government proposed to construct a number of large-scale mechanized irrigated rice projects, to be run by a parastatal, the National Agriculture and Food Corporation (NAFCO), in order to substitute growing imports of rice. The government at that time placed great emphasis on Tanzania's self-reliance and chose large-scale state farms and agricultural collectives to achieve the national and local food self-sufficiency. Presently

NAFCO has 22 farms including 4 rice farms, Mbarali rice farm, Ruvu rice farm, Dakawa rice farm, and Kapunga rice farm. However, the farms, in particular the rice farms, are today facing severe financial and managerial difficulties because of policy change conforming to market oriented economy since the mid ’80s and poor management.

In order to revive the farms through privatization, the government established the Ministerial Committee for agricultural sector privatization. The expert committee, was also established as a working group and presented the report on March 2001, to the Ministerial committee meeting held on July 28, 2001 in Dodoma. The expert committee proposed the following:

- The Tanzanians should be given higher priority to foreigners in privatization.
- The large farms should be divided into economically feasible size plots (small plots) and redistributed to the Tanzanians.
- Each economic activity of the farms should be sold separately to the Tanzanians.

Based on the proposed suggestions of the experts committee the Ministerial Committee instructed the relevant Ministries to visit each farm and obtain suggestions and advise from the stakeholders.

Then, at the Ministerial committee on March 31, 2001 the MAFS established the sub-committee of the experts to prepare the privatization strategy of the agricultural farms, particularly the NAFCO. The experts of the committee were appointed from the MAFS, MLHS (Ministry of Land and Human Settlements) and the NAFCO. The strategy has not yet been completed, however.

4.7 Existing Construction and O & M Equipment of MAFS

The MAFS possesses construction and O & M equipment comprising 347 items as of end of July 2002, as shown in Table 4.7.1. Most of them are out of order and would require repairing, for which the necessary cost has been estimated at Tsh.976 million in total by the MAFS. This amount would give heavy financial load to the MAFS. Prior to repairing, it is necessary to urgently make a study on effective use of each item. To obtain the necessary data and information for the study, a detailed inventory survey should be carried out for them. The results will be classified into four categories; no repair required, minor repairing, major repairing and scrapped. The appropriate measures shall be considered category by category, for example, to sell the scrapped ones at auction is an effective way for ensuring the budget for repairing of remaining equipment.

4.8 Past Existing Irrigation Development Plans

The irrigation schemes listed through the inventory survey executed in this Study and also in the RBMSIIP in 1997 are estimated at 1,428 in total. In addition to these schemes, there are many existing irrigation development plansthat have been conducted under bi-lateral assistance. Table 4.8.1 shows the list of existing irrigation development plans. These plans are classified into three different study levels: the preliminary study level, master plan study level, and the feasibility study level. These plans often overlap with the irrigation schemes listed up through the inventory survey. The following irrigation development plans in Moshi Districts that do not overlap with the scheme list of the inventory survey are as follows:

- Miwareni Pump Lift Scheme
- North Groundwater Scheme
- East Groundwater Scheme

These schemes were studied in 1980, and those requiring further study will be identified.

4.9 International Relationship in Irrigation Development

4.9.1 International Cooperation and Assistance

Enhanced donor coordination and improved partnership between the government and foreign donors is increasingly critical to the sustainable development of the country, especially to the challenge of poverty reduction. This principle for the improved coordination is set out in the TAS. There are currently 20 major development assistance organizations in total, consisting of 6 multilateral donors and 14 bilateral donors. Their aid policy and assistance fields are as follows:

(1) Donor’s Aid Policy

A different JICA study implemented in 2000 provides a comprehensive view on aid policy of each donor. This survey results show that the World Bank (study only), Denmark, Finland (forestry sub-sector), Germany and Japan regard the agricultural sector as the priority and/or target sector for assistance.

(2) Effectiveness of Basket-funding

There are some comments on the effectiveness of the basket-funding from the donors. Some embassy officers considered that the basket-funding scheme had worked effectively when monitored and consulted about the performance properly. Others did not support it and one commented that it had taken a long process and time to advance the money to the end beneficiaries because of cumbersome handling decided by Tanzanian side or insufficient fund and project management

capacity.

(3) Assistant Fields by Respective Donors

At present, respective donors/agency provides their assistance for 222 projects in 16 sectors. Out of 222 projects, 71 projects relate to the agricultural sector. Irrigation sub-sector in the agricultural sector is supported with 27 projects by UNDP, World Bank, Japan, Denmark, USAID, etc.

4.9.2 Activities of NGO in Irrigation Development

It is said that there are roughly 3,000 NGOs working in Tanzania including foreign NGOs; some of them are dormant. Active local NGOs established an umbrella organization called Tanzania Association of Non-governmental Organizations (TANGO) in 1988 to promote the growth and improved performance of the NGO sector through capacity building, coordination of its members, and by acting as a resource hub for information and skills exchange. Currently TANGO has about 500 members (all of them are local). According to TANGO, major constraints to the work of NGOs are limited availability of human and financial resources.

Traditional Irrigation and Environmental Development Organization (TIP), based in Moshi and not a member of TANGO, has been active in the irrigation sector, and at the time of the interview survey had five on-going irrigation projects. TIP finances its operations from consultancy and donor funding.

4.10 Environment

There have been environmental issues identified in reports on different schemes, which are summarized as follows:

Negative Impact

- Overuse of water by upstream beneficiary to the detriment of downstream beneficiary, leading to loss of income and quality of life for downstream beneficial and finally accelerating over grazing and wide spread land degradation.
- Overuse of water leading to falling replenishment of groundwater reserves.
- Local flooding due to poor water control/management.
- Soil erosion leading to loss of soil cover.
- Water logging and salinity in vulnerable soils leading to poor agricultural production.
- Water-born diseases such as bilharzia and malaria.
- Increased use of fertilizer and pesticides resulting in negative impact to environment.

- Deforestation for reclamation of new farming land.

Positive Impact

- Creation of cattle grazing during periods when there are not many alternatives using end points of drains.
- Creation of an incentive for highly beneficial soil and water conservation practices through irrigation.
- Reduction of i) damage to downstream and upstream cultivation areas, ii) health risks associated with flooding and iii) soil erosion through flood alleviation.

Inevitably, it is likely that any intervention that increases or changes the utilization of water in a system would bring about an impact on the environment. It is therefore important that the government adheres strictly to its policy of addressing environmental issues for any irrigation development. Similarly, the potential for conflict on water use especially for upstream and downstream beneficiaries, requires careful management. Water conflicts are increasingly observed between cultivators and pastoralists, and also between the agricultural sector and other sectors like hydropower generation. The government needs to provide proper approach to cope with such water conflicts on time from the viewpoint of appropriate river basin management.

CHAPTER 5 INVENTORY SURVEY AND PCM WORKSHOPS

5.1 Existing Irrigation Facilities

Many irrigation facilities are provided for the existing irrigation schemes in the Mainland. These include dams, intake structures, canal linings and related structures such as diversion structures, turnouts, checks, culverts, cross-drains, spillways, aqueducts, bridges, field outlets and washing steps and appear in the various projects at different levels of quality. Findings through site inspection are outlined as follows:

(1) Dams

In the 1970s, 21 small-scale dams were constructed mainly on seasonal rivers for irrigation and domestic use purposes, centered on the Tabora region. These are of the earthfill type and currently, all except seven small-scale dams suffer from serious sedimentation, the removal of which is essential for recovery of reservoir function. Dam construction is largely restricted by hydrological and topographic conditions, and suitable site can only be selected based after in-depth study. In addition to these dams, many smaller dams exist over the whole land, called Charco dam for use for irrigation, domestic and livestock purpose.

(2) Diversion Structures

There are several types of diversion structures comprising gunny bags piling type, wooden piling type, bamboo piling type, gabion type, stone masonry type, and concrete type. The former three types are seen in the traditional irrigation scheme and the remaining types in improved traditional scheme and modern irrigation scheme. The former types are simple and easily constructed by farmers themselves but need frequent repairs as they are often washed out by floods. The gabion type weir has recently been developed as a low-cost option, but even careful construction supervision does not provide protection against floods. Many gabion weirs have been damaged by flood mainly due to poor construction and frequent repairs impose big loads on farmers. The stone masonry and concrete type weirs are the most stable and firm of all designs, but except in some cases, poor exterior condition has been caused by unsuitable plan, design and construction. The stone masonry and concrete type weirs require higher construction cost, therefore appropriate technical approach is essential.

(3) Canals

Canal lining is observed in both improved traditional and modern irrigation schemes. The applied linings are of stone masonry, concrete panel and cast-in-situ concrete types. Canal linings bring about benefits such as less maintenance, low

conveyance loss, less land acquisition area, and protection against water-borne disease. Many farmers prefer the canal lining but since canal lining is generally expensive, its application should be carefully determined from not only technical and economic viewpoints, but also socio-economic and environmental viewpoints.

(4) Canal Related Structures

Traditional irrigation schemes are generally provided with no or few simple structures such as concrete pipe for crossing purpose. On the other hand, improved traditional and modern irrigation schemes are provided with many structures for system operation. Those structures are mostly made of concrete or stone masonry. Generally, those structures, except in some exceptional cases, are not properly designed or constructed from a hydraulic or structure viewpoints. In some cases, the structure interferes with smooth canal flow or proper water distribution. Over-design is also found. Poor gates with extremely short spindles are seen from place to place. Farmers are faced with difficulty in management activity if these incorrectly constructed facilities are handed over. Practical design and construction supervision manuals, and training of how to use them effectively are urgently required.

5.2 Inventory Survey for Irrigation Schemes

5.2.1 Objective and Scope

The objective of inventory survey of irrigation schemes is to describe the present situation including any proposed irrigation schemes. Features to be described include location, history, irrigation and drainage, agriculture and land use, farmers' supporting system, farmers' organization, operation and maintenance, and environment.

An inventory survey was conducted for the Arusha, Kilimanjaro, Tanga, and Iringa Regions by the RBMSIIP in 1995, covering 739 irrigation schemes. In the NIMP, a similar inventory survey has been conducted for the existing and newly proposed irrigation schemes, focusing on the remaining regions of the Mainland although additional irrigation schemes in the above four regions have also been included, a total of 689 schemes. Thus, the total irrigation schemes to be analyzed have come to 1,428 covering an area of 854,300 ha as follows:

Inventorized Schemes

Data Source	Nos. of Schemes	Estimated Irrigation Area (ha)
Inventory survey by the NIMP	689	616,700
Inventory survey by the RBMSIIP	739	237,600
Total	1,428	854,300

Source: Inventory survey conducted by the NIMP and the RBMSIIP

The general features of those inventorized schemes are summarized hereinafter

and the relevant details are compiled in Appendix A.

5.2.2 Definition of Irrigation Schemes

In the NIMP, four types of irrigation schemes are identified for grouping, following the study results on Regional Irrigation Development Strategy in 1992. These are traditional irrigation schemes, water harvesting schemes, modern irrigation schemes and improved traditional irrigation schemes. Those irrigation schemes are defined as follows:

Traditional Irrigation Schemes: schemes which have been initiated and operated by farmers themselves, with no intervention from external agencies. Those would include schemes based on traditional furrows for the production of fruit and vegetables in the highland areas, and simple water diversion schemes on the lowlands for paddies.

Water Harvesting Schemes: water harvesting schemes and flood recession schemes, on which sub-subsistence farmers have themselves introduced simple techniques to artificially control the availability of water to crops.

Modern Irrigation Schemes: the formally planned and designed fully developed smallholder schemes, on which full irrigation facilities have been provided by external agencies with or without some contribution from the beneficiaries, and on which there is usually a strong element of management provided by the government or other external agency.

Improved Traditional Irrigation Scheme: schemes which have been initiated and operated by semi-subsistence farmers themselves and on which there has subsequently been some intervention by an external agency in the form of construction of a new diversion structure.

5.2.3 Classification of Inventorized Irrigation Schemes

The inventorized irrigation schemes classified by the irrigation scheme types are as follows.

Inventorized Schemes by Type of Irrigation

Type of Irrigation	Nos. of Schemes	Existing Area (ha)	Estimated Irri. Area (ha)
Existing Schemes	1,189	191,900	670,400
Traditional Irrigation	982	122,600	518,700
Water Harvesting	42	7,900	27,600
Modern Irrigation	52	35,900	73,800
Improved Traditional Irrigation	113	25,500	50,300
Newly Proposed Schemes	239	-	183,900
Water Harvesting	163	-	123,100
Modern Irrigation	76	-	60,800
Total	**1,428**	**191,900**	**854,300**

Source: Inventory survey conducted by NIMP and RBMSIIP

Existing traditional irrigation schemes, in Arusha and Kilimanjaro, account for

over 60% of the total area. Water harvesting schemes are mainly located in such regions as Dodoma, Mara, Mwanza, Shinyanga, Singida, and Tabora. Modern irrigation schemes are developed in Kilimanjaro, Morogoro and Mbeya.

Out of 1,428 schemes, 1,111 schemes have a potential area of less than 500 ha. The irrigation schemes are categorized by size of irrigation area as shown below.

Inventorized Schemes by Size of Potential Area Unit : Nos.

Type of Irrigation	Less than 500 ha	500 – 2,000 ha	More than 2,000 ha	Total
Traditional Irrigation	810	136	36	982
Water Harvesting	133	54	18	205
Modern Irrigation	86	25	17	128
Improved Traditional Irrigation	82	30	1	113
Total	1,111	245	72	1,428

Source: Inventory survey conducted by the NIMP and the RBMSIIP

Of the total schemes, 1,328 are smallholder irrigation schemes while 85 private schemes and 15 government-managed schemes, such as NAFCO, and SUDECO, have been identified. Some private scheme cultivates cash crops, namely, tea, coffee, cashew, sugarcane.

Inventorized Schemes by Management Type Unit : Nos.

Type of Irrigation	Smallholder	Private	Others	Total
Traditional Irrigation	924	52	6	982
Water Harvesting	204	1	0	205
Modern Irrigation	95	25	8	128
Improved Traditional Irrigation	105	7	1	113
Total	1,328	85	15	1,428

Source: Inventory survey conducted by the NIMP and the RBMSIIP

River water is the main water resource of irrigation schemes in the Mainland. Some 1,300 schemes depend on water source from rivers and streams. Pump irrigation schemes, which are mainly located in such regions as Kagera, Mara, and Mwanza, depend on water sources from groundwater and lakes such as Lake Victoria.

Inventorized Schemes by Type of Water Abstraction Unit : Nos.

Type of Irrigation	Gravity	Pump	Total
Traditional Irrigation	962	20	982
Water Harvesting	204	1	205
Modern Irrigation	74	54	128
Improved Traditional Irrigation	106	7	113
Total	1,346	82	1,428

Source: Inventory survey conducted by the NIMP and the RBMSIIP

The result of classification is presented in Tables 5.2.1 and 5.2.2.

5.2.4 Need of Rehabilitation and Improvement

The irrigation schemes required for construction/improvement and rehabilitation

are as follows:

Required Work Type Unit : Nos.

Type of Irrigation	Construction/Improvement	Rehabilitation	Total Scheme
Dam	5	3	1,346
Diversion weir	478	395	
Pump	78	2	82
Irrigation Canals	340	895	1,428

Source: Inventory survey conducted by the NIMP and the RBMSIIP

Over 60% of gravity type irrigation scheme require construction, improvement, and rehabilitation of diversion weirs. Most of the diversion weirs made by local materials in traditional irrigation schemes will be replaced by permanent structures made of masonry or concrete. Irrigation canal shall be rehabilitated or improved by providing partial lining of the diversion structure. Most of the pump irrigation schemes are constrained by shortage of funding for the scheme operation and/or the breakdown of the pump equipment.

5.3 Problems Analysis on Specific Fields

5.3.1 Agriculture

Through the site inspection and review on the existing data and information, the problems and constraints facing agriculture are found and discussed in Sub-clauses 4.3.3 and 4.3.4, and are summarized as follows:

- Low crop yield and unstable production due to over-dependence of rainfed agriculture
- Insufficient investment in land improvement due to uncertainly and insecurity of land tenure
- Rudimentary farming system mostly depending on hand hoes
- High rates of soil degradation due to the reduced fallow period

5.3.2 Irrigation Schemes

The problem analysis has been conducted for the six selected irrigation schemes that had been constructed after the preparation of NIDP as explained in Clause 4.4. The results of problem analysis are summarized below:

- Inadequate farmers' participation
- Poor logical structure for project planning
- Insufficient capability of Irrigation Section on appropriate project planning
- No feedback system
- No practical guidelines and manuals on project implementation
- Poor capability of private sectors such as local consultant and contractors
- Poor supporting system to WUAs
- Low capability of local government staff in irrigation development

5.3.3 Institution and Organization

The major institutional and organizational problems and constraints to irrigation development, which are discussed in Sub-clauses 4.3.6 and 4.3.7, are as follows:

- Low autonomy of Irrigation Section
- Inadequate coordination capability of Irrigation Section
- Unclear demarcation of responsibilities for extension services between Irrigation Section and local governments
- Lack of institutional guarantee tenure
- Lack of institutional mechanism to mediate water conflicts
- No comprehensive mechanism among major participants at central level
- Lack of a legal mandate, technical skills and facilitate to enforce some roles
- Lack of expertise for strategic and financial planning and management
- Very limited resources for local level institutional building for community participation in development process
- A shortage of competent personnel and technical equipment to manage and control development process.

5.3.4 PCM Workshops

(1) Core Problems and Objectives Identified

Five PCM (Project Cycle Management) workshops inviting different participant groups were held in June 2002. The invited groups were (i) the Irrigation Section, MAFS, (ii) Zonal Irrigation Officers, (iii) LGAs (DALDO), and (iv) Irrigators' Groups.

At each workshop the core problem for irrigation development, which each participant group was facing, and its direct causes were discussed and identified. The core problems identified are as follows:

- Ineffective Performance of the Irrigation Section
- Poor Support to Irrigation Development by LGAs
- Water Scarcity on Farm Plots
- Poor Development of Irrigation Facilities

At least two hidden core problems were further identified from these separately identified problems. They are *insufficient ownership* and *insufficient capability in institution, technology and finance*.

The core problems and direct causes may have a causal relationship among them. The results are summarized into the two charts, the integrated problem tree and the integrated objective tree as shown in Figures 5.3.1 and 5.3.2. These charts are utilized to identify program and project approach of the NIMP.

(2) Classification of Problems and Constraints

In the PCM workshops, a number of problems and constraints to irrigation development and/or management were raised by the attendant stakeholders such as Irrigation Section, LGAs, and WUAs. These problems and constraints have been analyzed and direct and secondary causes have been clarified. In addition, these secondary causes have been classified into five categories: financial, technical, social, organizational/institutional, and environmental issues, as shown in Figures 5.3.3 to 5.3.6. The direct causes for each stakeholder with related issues are summarized below.

Summary of Problem Analysis on PCM Workshop

Stakeholders/ Core Problem	Direct Causes	Issues				
		Financial	Technical	Social	Organization/ Institution	Environment
MAFS Ineffective Performance of the Irrigation Section	Lack of reliable database	○	○			
	Poor coordination amongst programmes and projects within the section		○		○	
	Inappropriate institutional set up for irrigation development central-local				○	
	Inadequate policy guidelines in irrigation development				○	
	Inadequate irrigation development capacity		○			
	Low moral of staff		○		○	
LGAs Poor Support to Irrigation Farming by the Local Government	Inadequate adoption of irrigation development policies				○	
	Mismanagement of extension staff		○		○	
	Lack of knowledge on the importance of irrigation to local government leader		○		○	
	Inadequate resources and capacity in the Districts				○	
WUAs Water scarcity on farm plots	Vandalism and inadequate maintenance of irrigation infrastructure	○	○	○	○	
	Inadequate water utilization		○			
	Poor irrigation canals		○	○		
	Inadequate irrigation scheme development		○	○	○	
	Inadequate water distribution		○			

	Inadequate protection of water resources					○
Farmers Poor development of irrigation farming	Intakes constructions not durable	○	○			
	Poor irrigation infrastructure		○			
	Inadequate water utilization in farm		○			
	Low participation of farmers in self-help activities			○	○	
	Intakes are dilapidated	○	○			
	Unreliable availability of water at source					○

Source: PCM Workshop conducted by JICA Study Team

The analysis results on the PCM workshops, present agriculture and irrigation schemes mentioned above, are used for preparation of Subject-wise Improvement Programme which is discussed in Clause 8.3.

CHAPTER 6 POTENTIAL AREA FOR IRRIGATION DEVELOPMENT

6.1 General

In this chapter, the potential area for irrigation development is examined and clarified since it is a key factor for planning irrigation schemes. Generally, irrigation development potential is assessed from the water resources potential and land resources potential only. In this Study, socio-economic potential is also taken into consideration, because marketing conditions are very important for irrigation development and largely influence the selection of irrigation schemes. The possible extent of irrigation development is determined by preparing and overlaying the assessment maps for the respective potentials mentioned above. The estimated area using this assessment method is significantly larger than using potential area for irrigation development only, by as much as 1 million ha.

6.2 Water Resources Potential

6.2.1 Hydrological Environment

The country is hydrologically divided into nine drainage river basins. These are (i) Pangani River Basin, (ii) Ruvu/Wami River Basin, (iii) Rufiji River Basin, (iv) Ruvuma River and the Southern Coast Basin, (v) Lake Nyasa Basin, (vi) Internal Drainage Basin, (vii) Lake Rukwa Basin, (viii) Lake Tanganyika Basin, and (ix) Lake Victoria Basin. The river regime in the Mainland follows the general rainfall pattern. River discharge and water level of lakes start rising in November and December and generally reach their maximum in March and April with a recession period from May to October or November. Considering these hydrological circumstances, the hydrological year starts in October or November and ends in September or October.

6.2.2 Previous Studies on Assessment of Water Resources Potential

The MWLD has conducted the following three water resources potential assessments through different examinations in the Mainland:

Previously Conducted Assessments in Water Resources Potential

Name of Project	Completed Period	Remarks
Water Master Plan by Region	From 1970' to 1980'	This is the first comprehensive achievement in water resources potential assessment compiled for most of the regions. It keenly requires to be updated, considering recent accurate information and data.
Rapid Water Resources Assessment	In 1995	The assessment significantly gave an outline of water resources potential in the country as an entire country basis, and indicated new direction to deal with water resources every river basin. As titled "Rapid" in the project name, it was rapidly

		assessed.
River Basin Management Project *	From 1996 to 2002	RBM has two development objectives: (i) to strengthen the Government's capacity to manage water resources in the Pangani and Rufiji river basins and (ii) to improve irrigation efficiency of selected smallholder traditional irrigation schemes in those river basins. Water resources potential for the river basins have been studied under the former objective.

** : Related to this Project, "Project for Sustainable Management of the Usangu Wetland and its Catchment" was conducted during from September 1998 to March 2002, in which irrigation was focused and condemned from an environmental views in Usangu.*

6.2.3 Macroscopic Water Balance in the Country

Prior to assessment of water resources potential, it is necessary to identify a general feature of water balance in the entire Mainland.

Mean annual rainfall and mean annual run-off, which are major factors in the hydrologic cycle, were estimated utilizing existing hydro-metrological data observed at 143 stations. The amount of groundwater recharge and basin evapo-transpiration from river basin were also calculated on the basis of hydrological information as described in Appendix E. Hydrological water balance by river basin made up of hydrological factors obtained in such manner is tabulated below:

Hydrological Balance by River Basin

No.	Drainage River Baisins	Catchment Area (sq.km2)	Inflow	Outflow			Remarks
			Annual Mean Rainfall* (mm)	Annual Mean Runoff* (mm)	Evapo-transpiration from the Basin** (mm)	Groundwater Recharge*** (mm)	
I	Pangani River basin	56,300	1,001.9	31.5	966	4.0	into the Indian Ocean drainage system
II	Ruvu/Wami River Basin	72,930	765.1	51.7	710	3.0	into the Indian Ocean drainage system
III	Rufiji River Basin	177,420	988.3	185.9	799	3.0	into the Indian Ocean drainage system
IV	Ruvuma River and Southern Coast Basin	103,720	1,050.0	20.5	1,028	2.0	into the Indian Ocean drainage system
V	Lake Nyasa Basin	39,520	1,672.5	344.6	1,324	4.0	into the Lake Rukwa drainage system
VI	Internal Drainage Basin	153,800	619.0	36.6	577	5.0	into the Internal drainage system
VII	Lake Rukwa Basin	88,180	1,095.0	104.5	985	6.0	into the Lake Rukwa drainage system
VIII	Lake Tanganyika Basin	151,900	1,173.6	124.7	1,045	4.0	into the Atlantic Ocean drainage system
IX	Lake Victoria Basin	79,570	1,111.1	18.6	1,087	6.0	into the Mediterranean Sea drainage system
	Total	923,340	997.5	97.0	896	4.0	

** : These were analyzed under this Study using data of 143 gauging stations.*
*** : These were estimated deducting (Runoff) and (Groundwater recharge) from (Rainfall).*
**** : These were tentatively estimated consulting the groundwater potential map in "RAPID WATER RESOURCES ASSESSMENT, 1995".*

In the Mainland, various water uses have intervened into the hydrological cycle. Major water uses are drinking and domestic water supply, irrigation water supply, livestock water supply, and hydro-power generation. The amount of each water use could be approximately calculated by making reference to the report of Rapid

Water Resources Assessment. The result is shown in following table:

Estimated Present Water Uses

No.	Drainage River Baisins	Annual Mean Runoff (Million m^3)	Groundwater Recharge (Million m^3)	Present Water Use			
				Domestic water supply * Upper: (population:1000) Lower: (Million m^3)	Irrigation supply ** Upper: (Area: ha) Lower: (Million m^3)	Livestock supply *** Upper: (heads: 1,000) Lower: (Million m^3)	Hydropower Upper: (MW) Lower: (Million c.m)
I	Pangani River basin	1,773.5	225.2	*3,507.7*	*46,347*	*2,675.9*	*75.0*
				57.6	1,205.1	14.8	(422.7)
II	Ruvu/Wami River Basin	3,770.5	218.8	*4,172.8*	*10,326*	*561.8*	*0.0*
				68.5	268.8	6.1	-
III	Rufiji River Basin	32,975.3	532.3	*4,551.1*	*35,027*	*1,534.5*	*280.0*
				74.8	1,183.9	22.8	-
IV	Ruvuma River and Southern Coast Basin	2,126.3	207.4	*2,208.1*	*6,263*	*595.8*	-
				36.3	187.9	1.8	-
V	Lake Nyasa Basin	13,618.6	158.1	*856.1*	*2,838*	*328.7*	-
				14.1	78.6	3.1	-
VI	Internal Drainage Basin	5,629.1	769.0	*4,455.4*	*29,239*	*4,776.8*	-
				73.2	876.1	63.3	-
VII	Lake Rukwa Basin	9,214.8	529.1	*1,674.3*	*12,417*	*498.0*	-
				27.5	319.3	9.6	-
VIII	Lake Tanganyika Basin	18,941.9	607.6	*4,692.7*	*7,416*	*3,011.3*	-
				77.1	185.4	46.1	-
IX	Lake Victoria Basin	1,480.0	477.4	*3,901.3*	*7,122*	*2,239.1*	-
				64.1	111.5	39.5	-
	Total			*30,019.5*	*156,995*	*16,221.9*	-
		89,529.9	3,724.9	493.1	4,416.6	207.2	-

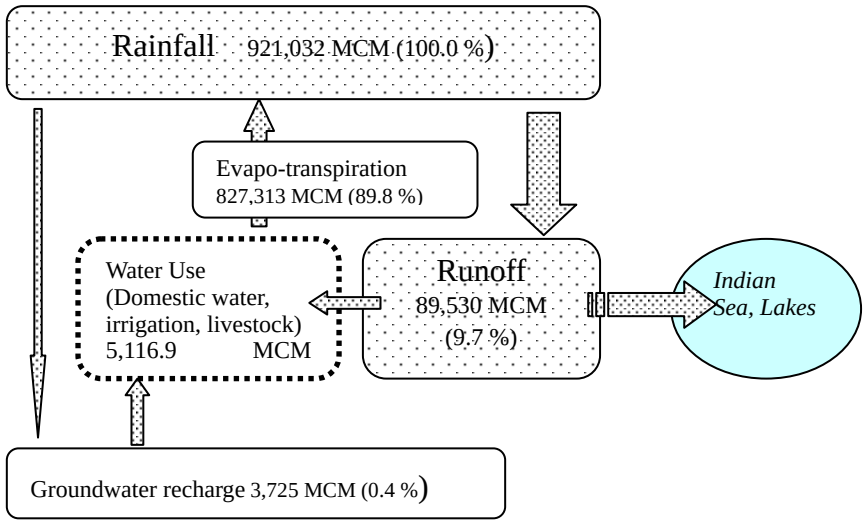
* : *Population of each basin was estimated recombining region-wise population in 1998 on the basis of geophisical factors.*

** : *These data in irrigation supply were estimated on the basis of the present irrigated areas which were referred in several sources.*

***: *Heads of livestock (cattle, goats and sheep) in each basin were estimated recombining the data in the District Integrated Agricultural Survey 1998/99 on the basis of geophysical factors. 30 lit/day and 5 lit/day of water requirement are applied for a cattle and a goat, respectively.*

The result of water balance analysis, indicated that and abundant amount of water source for present water use would be available. Water balance with present water use in the Mainland is schematically shown below:

General Water Balance in Entire Mainland



This figure indicates that the amount of water currently used requires only 0.6% of rainfall, although this does not include water used for rainfed cultivation.

However, fluctuation of water availability is a crucial factor since seasonal rivers are predominant in the Mainland. Most rivers have no flow in the dry season.

6.2.4 Method of Assessment of Water Resources Potential

(1) Specific Run-off

Specific run-off of every concerned hydro-meteorological station was calculated at annual mean level. Distribution of the obtained figures of specific run-off in the whole Mainland is shown in Figure 6.2.1**.** It is known that specific run-off becomes smaller as catchment area becomes larger. In this respect, the specific run-off was calculated using adjusted run-off data by deleting the effect of differences in magnitude of catchment area. The adjustment method is described in detail in Appendix E.

(2) Flow Regime

A flow duration curve shows a relationship between discharge of any given magnitude and the percentage of time that discharge is exceeded. In the Study, one-day flow duration curve was applied. It can be derived by assigning daily flows for the whole period of record to class intervals and counting the number of occurrences within each interval. The total number of occurrences above the lower limit of each class interval is then expressed as a percentage of the total number of days in the record.

Rivers classified into the Group A ($Q_1(95)>0$) are perennial and constant water abstraction from them would be achievable. Rivers into Group C($Q_1(65)=0$) are ephemeral rivers for which water use is short-lived within a year. Rivers into Group B($Q_1(65)>0$, $Q_1(95)=0$) are intermittent with an intermediate characteristic between the former two. The breakdown of river classification is that 68.5 %, 17.5 % and 14.0 % of rivers fall into Group A, B and C, respectively.

Regional distribution of flow regime was examined utilizing obtained flow duration curves in every concerned station. The flow duration curve for one-day discharge is expressed by $Q_1(n)$, where n is the percentage time exceeded in a year. Paying attention to the value of $Q_1(75)$ in the flow duration curves, the regional distribution was formed as shown in Figure 6.2.2, where the figure of 75 % means water flow available at the duration of at least three quarters of a year. The figure of regional distribution in the Mainland on flow regime, indicates that range of $Q_1(75)=0$ extends in marginal areas in Central Tanzania and southern parts. It confirms the fact that water harvesting is prominent in those areas.

(3) Groundwater Potential

Groundwater potential is closely related to hydro-geological characteristics, and

correlates closely area by area. The amount of groundwater potential could be determined from the general hydro-geological structure in the Mainland. The general outline of groundwater potential for the Mainland was summarized as showing in Figure 6.2.3, utilizing previous result of investigation such as Rapid Water Resources Assessment Vol. I.

6.2.5 Identification of Water Resources Potential

In analyzing the results of assessment of water resources potential, three viewpoints, namely, "Quantitative potential of water in natural condition", "Allowable water quantity under the artificial control" and "Seasonal steadiness of water availability" were considered. Most significant viewpoint of water potential is the quantitative potential of water in natural condition. Besides availability of surface water, groundwater is also exploitable in the Mainland depending on the suitability of hydro-geological condition. However, quantitative share of groundwater within the whole hydrological cycle in the Mainland was identified at 0.4 % only. Therefore, for the purpose of understanding the general situation of water potential, a focus should be put on potentiality of surface water only.

Natural stream flow is not always abstracted freely. Attention should be paid for water right. "Allowable water quantity under the artificial control" means this water right. However, registration of water right has not been completed for all existing irrigation schemes so far. It should be therefore considered scheme by scheme, by means of confirming the individual water right.

Seasonal stability of water availability is another important factor of water potential for the convenience of perennial irrigation. This could be identified from the information of river regime characteristics obtained through the analysis of flow duration curves. The results for water potential analysis from the three viewpoints are summarized as follows.

Summary of Water Potential in Major Viewpoints

Viewpoints	Available Data	Identification of Water Potential	Status
Quantitative potential of water in natural	"Map of Specific Run-off" (see Figure 6.2.1)	Areas more than or equal 1.0 m^3/sec./500km^2 * could be identified as higher potential area.	To be considered largely
Allowable water quantity under artificial control	No information is available at the moment at the whole country basis.	It should be considered separately for scheme by scheme, by means of confirming individual water right.	To be referred if possible
Seasonal steadiness of water availability	"Map of Distribution of $Q_1(75)$ in Flow Duration Curves" (see Figure 6.2.2)	Areas having the value of $Q_1(75)$ more than or equal 10 % could be identified as higher potential area for perennial irrigation, otherwise identified as the area for water harvesting.	To be considered supplementary

**: The"m^3/sec. per 500 km^2" is used as a unit for the data analysis as described in Appendix E.*

Generalizing the above examination, the "Specific Run-off" showing a

quantitative potential of water in natural conditions could be regarded as providing wide-ranging water potential in the Mainland for the common purposes.

6.3 Land Resources Potential

6.3.1 Land Unit Classification

One hundred twenty eight land units were distinguished according to the position in the terrain and the proportions of the occurring soils. Each land unit was briefly described based on various viewpoints including slope and salinity. According to this description, land units were classified into three major classes, namely highly suitable, moderately suitable and marginal as land resources potential for irrigation development. Major criteria for the classification were based on slope, physical condition of the land, susceptibility to soil erosion and flood conditions.

Based on the above-mentioned classification, the land suitability map was processed from digitized land unit maps. This land suitability map was then utilized to produce the final land resources potential map to be explained in Sub-clause 6.3.4.

6.3.2 Soil Type Classification

Thirty major soil types were distinguished based on the dominant and associated soils distributed in the above-mentioned land units with different proportions. Characteristic of each major soil type is described in Soil Map of the World, FAO/UNESCO. According to this description, the major soil types were classified into three major classes, namely highly suitable, moderately suitable and marginal as land resources potential for irrigation development. Major criteria used were natural soil fertility levels, soil profile characteristics (such as hardpan), salinity levels, and drainage characteristics (well drained or poorly drained).

Based on the above-mentioned classification, the soil suitability map was processed from the digitized SADCC soil map. This soil suitability map was then utilized to produce the final land resources potential map to be explained in Sub-clause 6.3.4.

6.3.3 Land Cover Classification

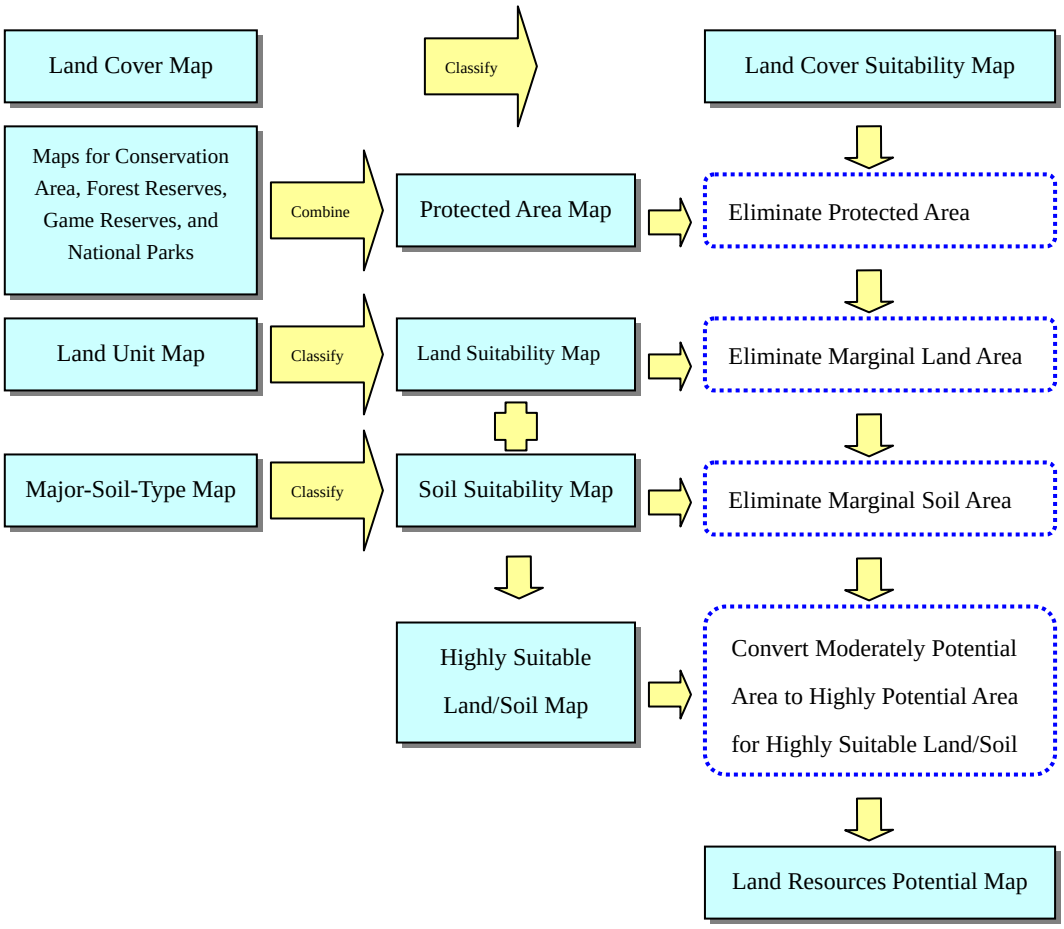
Similar to land units and major soil types, the land cover suitability map was processed from the digitized national level land cover map. Since cultivated land has higher priority for irrigation development, cultivated land was classified as highly suitable area. The areas belonging to bushland and grassland were classified as moderately suitable area. Various forest types including natural forest, mangrove, plantation and woodland should be conserved. Other

categories such as bare soil, salt crusts, rock outcrops, water surface and urban areas are marginal for irrigation development. This land cover suitability map was then utilized to produce the final land resources potential map for irrigation development to be explained in Sub-clause 6.3.4.

6.3.4 Identification of Land Resources Potential

Land resources potential map was prepared based on the above-mentioned maps such as land suitability, soil suitability, land cover suitability and protected area according to the data processing system as shown below.

Preparation Process of Land Resource Potential Map



The land cover suitability map was used as a base potential map for the current analysis. Since the protected areas including Forest Reserves, National Parks, Game Reserves and Conservation Areas are not permitted to be developed, all the protected areas were eliminated from the potential area. Marginal land such as mountainous ranges, steeply sloping land and saline areas were then eliminated from the potential area. Marginal soils such as saline soils were further eliminated from the potential area. Finally, the moderately potential areas were converted to highly potential areas provided that the land unit and soil type were

both classified as highly suitable. The land resource potential map thus created is shown in Figure. 6.3.1.

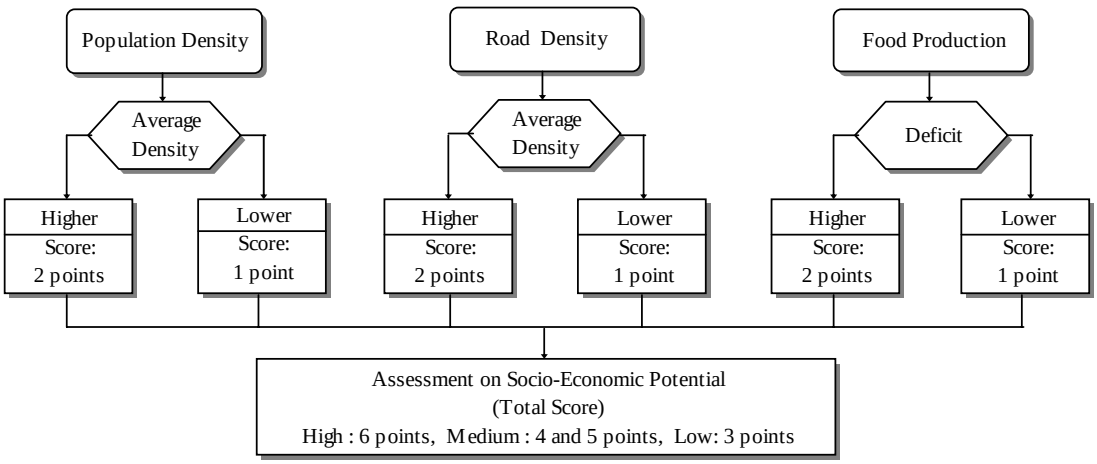
6.4 Socio-economic Potential

6.4.1 Assessment Methodology for Socio-economic Potential

Factors to be considered for assessment of socio-economic potential are (i) size of market, (ii) distance to market and its accessibility, and (iii) availability of agricultural labor. In this assessment, population density, road density and food deficit are employed as indicators expressing the said factors. Inventory survey results show that many irrigation schemes are located surrounding areas of paved roads (bitumen main roads: Dar es Salaam - Morogoro - Iringa – Mbeya, Dar es Salaam – Kilimanjaro – Arusha, Mwanza – Musoma, and Mwanza – Runere) so from the viewpoint of accessibility to markets, both sides 50 km from these roads are considered as an additional indicator.

As for population and road densities, all districts are classified into two areas, namely higher and lower density districts as compared with the average density in population and road of the Mainland. Food deficit was evaluated from the results of questionnaire survey and inspection by the Food Security Department, MAFS. The deficit scores 2 points and surplus one point. Finally, the socio-economic potential is expressed by total scores; high potential for 6 points, medium potential for 4 to 5 points, and low potential for 3 points as shown in the following figure:

Assessment Flow of Socio-Economic Potential



6.4.2 Population Density

Population density is estimated using the district area[1] and the estimated

[1] *Socio-Economic Profiles for respective regions jointly prepared by the Planning Commission and Regional Commissioner's Office in 1998*

population for 2002[2]. In this Study, the districts newly established are used, and the population for them is calculated on the pro rata basis of area if data is not available. Table 6.4.1 presents the district area, population and road density. The average population density except Dar es Salaam Region is estimated at 36 persons/km^2, and then socio-economic potential by population density is assessed accordingly.

- Higher Potential (more than or equal to 36 persons/km^2) : 69 districts
- Lower Potential (less than 36 persons/km^2) : 30 districts

6.4.3 Road Density

The Socio-Economic Profiles also present the length of roads in the respective districts, such as trunk, regional, district and other small roads. The socio-economic potential by road density is assessed using the estimated average road length of 93 m/ km^2.

- Higher Potential (more than or equal to 93 m/km^2) : 70 districts
- Lower Potential (less than 93 m/km^2) : 29 districts

The results are shown in Table 6.4.1.

6.4.4 Food Deficit

The Food Security Department of MAFS executed the questionnaire survey on food situation for the statistically selected 35 households for respective districts in 2001. The survey results first determined the percentage of households in the sample who replied as "Deficit", and then more than or equal to 50% defined a food deficit area, which is compiled in A Statistical Analysis of 2000/01. In case of no reply, the food situation is judged by inspection by staff of the Food Security Department of MAFS.

- Higher Potential (more than or equal to 50%) : 31 districts
- Lower Potential (less than 50%) : 68 districts

The breakdown of deficit for respective regions is given in Table 6.4.1.

6.4.5 Identification of Socio-economic Potential

Based on the results of the study on population density, road density and cereal deficit, the socio-economic potential is assessed as shown in Table 6.4.1.

Out of 99 districts, 25 districts are categorized as a high potential area from socio-economic viewpoints, 58 districts as a medium potential area and 16

[2] *Tanzania Population Projections (2000 – 2025) prepared by the President's Office*

districts as a low potential area.

As mentioned above, the paved road gives positive effects to the socio-economic potential. The potential for the area within 50 km from the paved road were thus lastly upgraded. The final socio-economic potential thus determined is shown in Figure 6.4.1.

6.5 Identification of Irrigation Development Potential Area

Irrigation development potential area is demarcated based on the results of study on water resources, land resources and socio-economic potentials mentioned above. The demarcation is made by overlaying these three assessment maps, and then high, moderate and severe areas are roughly identified. The locations of high, medium and low potential areas in potential are shown in Figures 6.5.1.

According to this figure, the High Potential Area is largely split between four places. The first place is extended at Mara, Mwanza and Kagera regions. The second place is located at Arusha and Kilimanjaro regions. The third place is in Morogoro region. The fourth place lies at Mbeya and Iringa regions. The Medium Potential Area is mostly located around the high potential areas. The Low Potential Area is scattered over the whole country.

The study results show the total area of 94.8 million ha, consisting of 2.1 million ha for “High Potential Area”, 4.8 million ha for “Medium Potential Area”, 22.3 million ha of “Low Potential Area”, 31.1 million ha for “Forest/Marginal Area”, 7.3 million ha for “Water Body”, and 27.1 million ha for “Protected Area”. Table 6.5.1 presents the more detailed information on the above.

The irrigation development potential areas on the district basis are given in Appendix E.

6.6 Confirmation of Irrigation Schemes Inventorized by Identified Irrigation Development Potential Area

Irrigation schemes obtained through the inventory survey, for which accurate coordinates are available, are plotted on the irrigation development potential map shown in Figure 6.6.1. This figure confirms the general trend that most of the irrigation schemes plotted are located around the irrigation potential areas.

According to the irrigation potential map prepared, high potential area is estimated at 2.1 million ha in gross. The estimated existing irrigation area by inventory survey is 854,300 ha, which indicates that there would still be plenty of room for further irrigation development. It is therefore proposed that further irrigation development be undertaken, and that selection of irrigation schemes be made by referring to this irrigation potential map.

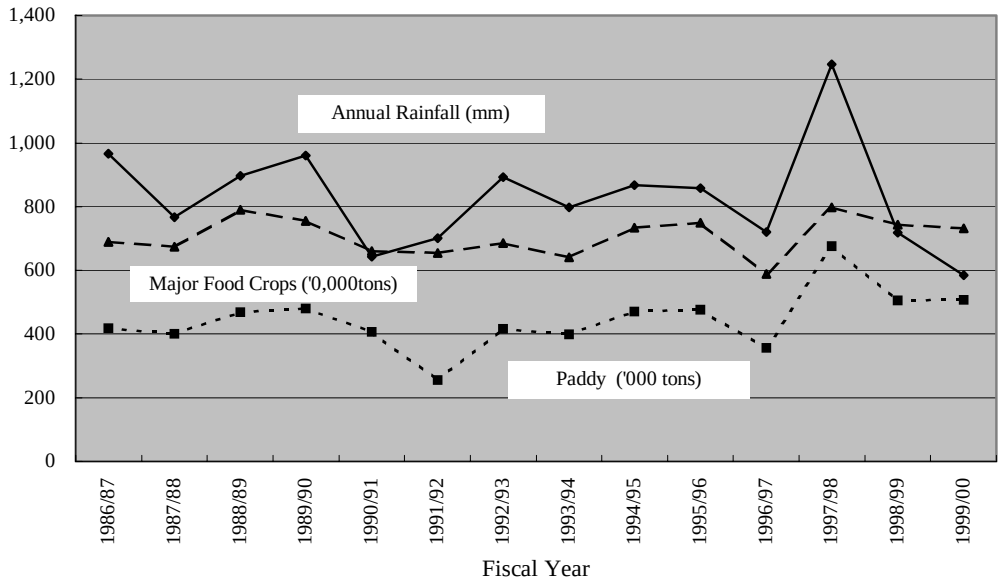
CHAPTER 7 FRAMEWORK FOR IRRIGATION DEVELOPMENT

7.1 Need of Irrigation Development

(1) Stabilization of Food Crops Production

At present, the cultivated area is estimated at approximately 10 million ha, and rainfed cultivation is dominant. As a result, food crops production has largely fluctuated year by year due to erratic and unreliable rainfall. This is easily identified from the past data on annual rainfall and food production as shown below:

Relation between 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)

When rainfall decreases, food production also decreases. This figure would also indicate that timely water supply to crops, namely 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 of the Mainland.

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

In addition to unstable food production, the Mainland has another crucial issue that is a poverty problem. It is reported that more than 80 % of inhabitants in rural areas, who are almost all smallholders, are categorized as living in poverty.

Poverty levels may have increased to over 50% in 2000, and poverty is more widespread in rural area where rainfed agriculture by smallholders is prevailing. An improvement in farm income for them is urgently required . Irrigation development is able to produce the stable and higher production as mentioned above and in this sense, irrigation development could be regarded as one of effective approaches to poverty alleviation in rural area.

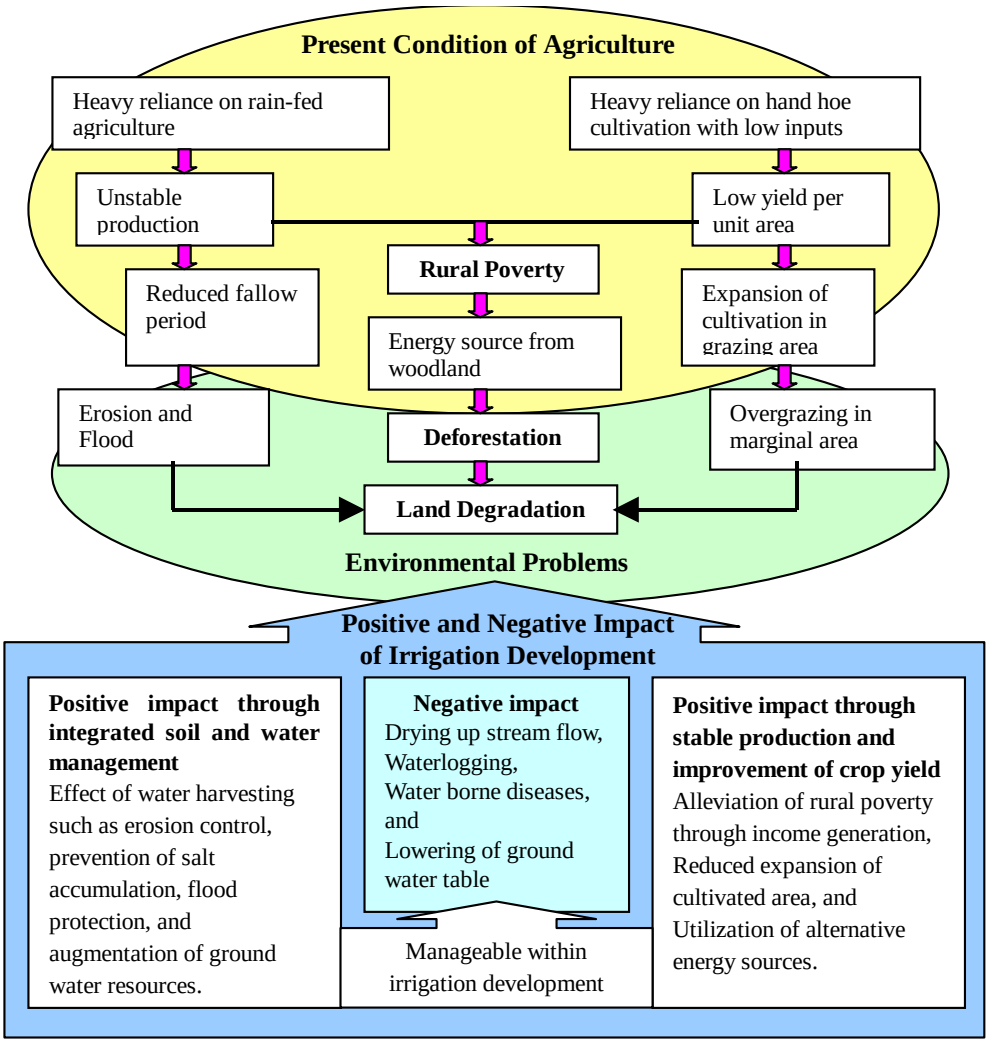
(3) Environmental Conservation Effects of Irrigation Development

Agriculture in Tanzania is heavily depending on hand hoes as the main cultivating tools with minimum inputs and rainfed conditions. These are the major causes of unstable production and low yield per unit area. Inappropriate land husbandry practices also accelerate the soil erosion and the consequent flood hazard. Expansion of cultivation into grazing area results in the overgrazing shifting into marginal areas. This can be a possible reason for land degradation along with the deforestation through fuelwood collection from woodland.

Under these circumstances, it can be expected that irrigation development can greatly contribute to the environmental conservation. Stable production and improvement of yield per unit area that will be attained through irrigation development can 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, the integrated soil and water management can be undertaken under a properly designed irrigation scheme. The effect of water harvesting technologies such as erosion control, prevention of salt accumulation, flood protection and the augmentation of underground water resources will be of great importance specially in semi-arid regions.

Although the negative impacts of irrigation development on the environment such as drying-up of stream flow, 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 scheme. 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 the past increasing trend of cropped area and production of paddy, the future production can be estimated at most 950,000 ton in the year 2017 even under maximum efforts in input supply and extension services for yield increase. On the other hand, the production under the irrigation development could be estimated at around 1,250,000 ton in the year 2017, which would attain the self-sufficiency of rice as mentioned in Sub-clause 7.10. It is thus obvious that the self-sufficiency of rice will not be attained without irrigation development even with maximum effort for yield increase such as extension services and input supply improvement. Irrigation development can therefore be regarded as one of the effective approaches to the self-sufficiency of rice in the Mainland.

7.2 Objective and Strategies of National Irrigation Master Plan

7.2.1 Primary Objective of ASDS

The Tanzania Development Vision 2025 predicts that Tanzania will graduate from a least developed country to the middle-income country by the year 2025. This means that the GDP per capita shall reach US$ 755 at 2002 current cost by the year 2025 with the high average annual growth rate of 8 %. The Vision 2025 also envisages an agricultural sector that by the year 2025 is modernized, commercial, highly productive and profitable, utilizes natural resources in an overall sustainable manner and acts as an effective basis for inter-sectoral linkages. Taking into consideration these long-term goals, the ASDS, although taking a short-term view of the next five years (2002/07), defines that *its primary objective is to create an enabling and conducive environment for improving the productivity and profitability of the agricultural sector* as the basis for improved farm incomes and rural poverty reduction in the medium and long term.

The ASDS identifies agriculture's weakness and threats such as (i) low productivity, (ii) poor coordination and limited capacity, (iii) underdeveloped supporting facilities, (iv) other weakness and threats such as erosion of natural resource base, inappropriate technology, and dependency on rainfed agriculture. To settle these weakness' and threats, the ASDS proposes five strategic areas of action and thirty-seven broad activities/interventions. In these activities/interventions, the major issues related to irrigation development are to apply the principles of integrated soil and water management emphasizing the use of low-cost approaches by smallholder and to promote and support small-scale irrigation. The NIMP shall include these issues. Figure 7.2.1 shows the linkage of the NIMP with the ASDS.

7.2.2 Purpose of NIMP

In consideration of the strategic activities/interventions stipulated in the ASDS, the philosophy employed in the NIDP and also the study results, the "*Sustainable Irrigation Development*" was selected as a purpose of the NIMP with emphasis on comprehensive measures through "*Effective Use of National Resources*", to largely contribute to attainment of the primary objective of ASDS.

The "*Sustainable Irrigation Development*" means the establishment of technically and financially self-reliant irrigation schemes through institutional and organizational strengthening/reform, which will undertaken in line with the following conditions and targets:

Targets of Sustainable Irrigation Development

Required Conditions	Targets
Technical Self-reliance	- Capacity building of Irrigation Section staff, Local Government Authority Staff 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	- 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	- Definition on roles and responsibility of Irrigation Section, Local Government Authority, and WUAs under decentralization - Strengthening/reform of Irrigation Section, Zonal Irrigation Offices and Local Government Authority - 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)

7.2.3 Strategy of NIMP

(1) Lessons Learnt from NIDP Implementation

There are three major constraints which caused the unsatisfactory implementation of the NIDP. These are lack of appropriate technical approach to scheme implementation, inadequate institutional building and lack of financial resource as discussed in Sub-clause 4.2.3. There still remain the same and similar constraints in the current Irrigation Section of MAFS and other irrigation development activities, which were identified through the PCM workshops and problem analysis mentioned in Chapter 5. The NIMP shall be therefore formulated taking into due consideration these constraints.

(2) Irrigation Development with close association between Subject-wise Improvement and Scheme-wise Development

The NIMP proposes the two ideologies of Subject-wise Improvement and Scheme-wise Development, and a close linkage between them as a strategic approach to the sustainable irrigation development. The Subject-wise Improvement aims at creation of appropriate environment for sustainable irrigation development, mainly from a viewpoint of enhancing quality. The Scheme-wise Development aims at expansion of irrigation area and variation using effective use of national resources including financial resource. The

Subject-wise Improvement Programme and Scheme-wise Development Programme shall be prepared in consideration of five elements; “Economically Sound”, “Technically Appropriate”, “Socio-logically Sustainable”, “Institutionally Reliable” and “Environmentally Friendly”.

(a) Economically Sound

The NIMP is concerned with the economic soundness on use of limited capital. The government and farmers face difficult situations in terms of capital holding. It should thus seek the most appropriate use of limited capital in irrigation development so as to provide the most effective economic solution.

(b) Technically Appropriate

The NIMP emphasizes the importance of appropriate technologies for irrigation development. In the selection of appropriate technologies, consideration shall be given to simple and low-cost technology solutions, focusing on technical soundness for easy O & M by farmers. Dissemination of information shall be through the enhancement of extension services as a key to sustainable irrigation development.

(c) Socio-logically Sustainable

The NIMP puts farmers first. The NIMP is worked out considering farmers as not only the beneficiaries, but also the major driving force for irrigation development. Active participation and empowerment of farmers are indispensable for the sustainable irrigation development as farmers can help themselves in a bottom-up manner.

(d) Institutionally Reliable

The NIMP emphasizes the importance of institutional reliability for irrigation development. The government/farmers partnership is essential for sustainable irrigation development, which would require the capacity to fulfill the respective duties. The NIMP will be formulated paying attention to institutional reliability to heighten the capacity of the partnership and also the ownership.

(e) Environmentally Friendly

The NIMP actualizes environmentally sustainable management of water and land use. A well-managed water and land use philosophy guarantees good circumstance for agricultural production, and a sustainable ecological system. It brings about environmentally appropriate conditions for farmers’ living.

The concept of the NIMP which is discussed in the above, is delineated in the following figure.

Concept of NIMP

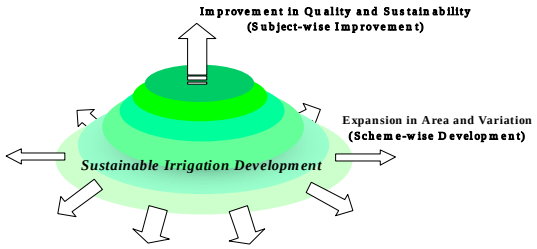
ASDS

Development Policy :	To stimulate and facilitate agricultural sector growth, and to reduce rural poverty
Primary Objective :	To create an enabling and favorable environment for improving productivity and profitability of the agricultural sector.

National Irrigation Master Plan

Purpose : To make sustainable irrigation development through effective use of national resources for supporting ASDS' Objectives

Strategy :
Well Harmonization of Scheme-wise/Subject-wise Development supported by :
Economically sound,
Technically appropriate,
Sociologically sustainable,
Environmentally friendly, and
Insitutionally reliable elements



Basic Structure of NIMP

Scheme-wise Development Program

Covering whole areas and irrigation development categories
- **Long-term Schemes**
- **Medium-term Schemes**
- **Short-term Schemes**

→ *Project Success*

Subject-wise Improvement Components

- Improvement Programme for Implementation Systems
  - To achieve reliable planning
  - To achieve reliable designing
  - To achieve reliable construction
  - To maintain project performance
- Training Programme for Farmers
  - **Farmers/WUAs** — To participate and orient in development
- Capacity Building for LGAs in Irrigation
  - **LGA** — To support and enlighten farmers/WUAs
- Strengthening and Capacity Building Programme for IS
  - **Irrigation Section (IS)**
    - To participate and orient in development
    - To hold and perform approproate skills
    - Tointroduce and keep proper modalities
- Improvement Programme for Institutional Circumstances
  - Toprovide proper human resource
  - To facilitate proper administration
  - To provide proper finance
- Building up Programme for Donor Coordination

Ministry of Agriculture and Food Security
To hold sound and realistic development policy for irrigation sector

NGO

Donors — To accelerate effective cooperation

7.3 Framework for National Irrigation Master Plan

7.3.1 Policy Framework

The government has made some effort towards changing the government-oriented irrigation development into the farmers-oriented irrigation development, aiming at the final target of the self-reliant irrigation development. Some progress has been achieved, but should be further accelerated. The policy framework requires strengthening or modification to create the enabling environment toward the self-reliant irrigation development by the private sector.

(1) Legal Access to Land

The land tenure system plays an important role of establishment of self-reliant irrigation development. Presently, most of cultivated area is used for small-scale farming under customary tenure, not officially registered tenure. The majority of land holding falls within a land class referred to as “Village Land”. This situation generally leads to security of tenure, which is critical for investment, but also hinders entry of medium and large-scale farmers into irrigation development and agriculture. The legal and physical access to land should be established.

(2) Dissemination of Water Right Registration

Water right is indispensable for irrigation development. Customary water use for traditional irrigation schemes is currently easily granted if proper application is made. However, most of farmers do not understand the water right, therefore do not submit a water right application. An education campaign is required to make them to understand the water rights issue, which would improve sustainable development and management of water resources.

(3) Act for Farmers Organization

In many irrigation projects, beneficial farmers register their organizations in conformity with the Cooperative Societies Act No.51 of 1991, which applies to associations of persons that have voluntarily joined together for the purpose of achieving common needs. The Water Users Association which carries out the operation and maintenance of the project facilities requires the membership of all beneficial farmers and compulsory payment of water charge from them. There is often conflict between the member farmers and non-member farmers in the same project because of lack of consistency in registration of membership under the Cooperative Societies Act. This issue also closely related to the ownership of transferred irrigation facilities. Improvements to the legislation of the Water Users Association are thus required for good management of irrigation projects.

(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 agriculture sector including irrigation sub-sector. These are critical issues for the private investment to the agriculture sector including the irrigation sub-sector. The relevant agencies should review them and set rates which will result in profitable and increasing agriculture, which lead to promotion of irrigation development.

(5) Policy on Food Security

At present, the Government does not issue a clear policy on food security. In particular, a policy on staple food such as rice and maize is urgently required. Population in the Mainland is expected to increase with a high growth rate of about 3 %, which would result in serious food shortage in the near future. A policy to focus on effective use of national resources is required.

(6) Donor Coordination

Many donors have provided their assistance for irrigation sub-sector in their own policies. In order to enhance the effect of assistance, it is desirable to coordinate the donor-assisted projects/programme based on the development direction for irrigation.

7.3.2 Macro-economic Framework

(1) Macroeconomic Framework for the Projection of the Financial Resources Envelope

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

Pillars	Specific Measures/Targets
Stable and sustainable overall economic development	Assumed GDP growth rates for the implementation of the NIMP have been decided by referring to the rates provided in the PRSP and the Completion Point Document of IMF/IDA November 8, 2001. 2003/04 – 2007/08: 5.8%p.a.; 2008/09 – 2012/13: 5.9%p.a.; 2013/14 – 2017/18: 6.0%p.a.
Accelerated and sustainable irrigation development	Allocation of Development Budget (Local and Foreign Funds) to Irrigation Development
Stable and increased donor assistance	Financial assistance of foreign donors, both multi-lateral and bi-lateral, distributed through on-budget and out-of-budget system to irrigation development

(2) Indices Used for Financial Resources Envelope for NIMP

The past development expenditures, and operation and maintenance costs for irrigation development were analyzed using data from 1997/98 to 2002/03 since further past data could not be employed due to lack of figures and their reliability.

The obtained indices to be used for financial resources envelope for base case are summarized below:

Summary of Assumptions in Base Case

Items of Budget	Results of Analysis	Indices Obtained
(Development Budget)		
Local Fund of GOT Development Expenditure	Average share of local fund portion to GOT Development Expenditure for 5 years (1998/99 - 2002/03) is 12.48%.	12.5%
Local Fund of the MAFS Development Budget	Average MAFS's share to GOT Development Budget (local fund) for 5 years (1998/99 - 2002/03) is 5.48%.	5.5%
Local Fund of Development Budget for Irrigation Development	Average share of irrigation development for 5 years (1997/98 - 2001/02) is 1.46% of GOT Development Budget.	1.5%
Foreign Fund of Development Budget for Irrigation Development	Average multiple of foreign fund to local fund of irrigation development is during 1998/99 – 2002/03 is 9.4.	9.4 times
Out-of-Budget Foreign Fund for Irrigation Development	UNDP Tanzania Development Co-operation Report 1999 indicates that approximately half of donor money is reflected in the government budget, and the remaining will go directly to projects/programs as out-of-budget funds.	100% of Foreign Fund of Develop. Expenditure allocated to Irrigation Develop.
(Operation and Maintenance Budget)		
Personnel	37% of personnel of Crop Development Department are engaged in irrigation development. 50% of personnel expenditure of those personnel is the responsibility of NIMP.	Tsh.317,922 thousand/ year, and increase in proportion with annual GDP growth rate.
Maintenance of Irrigation Facilities	15% of Maintenance of Physical Infrastructure within Recurrent Expenditure.	Tsh.4,500 thousand/ year, and increase in proportion with annual GDP growth rate.

(3) Financial Resources Envelope

(a) Development Budget

Using indices mentioned above, the analysis is carried out and the result is Tsh 342,179 million in Base Case, which is US$ 360.2 million converted at Tsh. 950/US$, over 15 years of the NIMP implementing period.

(b) Operation and Maintenance Budget

The analysis is carried out and the result is Tsh 7,863 million, which is US$ 8.3 million equivalent, for over 15 years of the NIMP implementing period.

(4) Sensitivity Analysis

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

Conditions of Sensitivity Analysis

Variable	Base Case	High Case	Low Case
GDP Growth Rate	5.8% p.a. for 2003/04 – 2007/08; 5.9% p.a. for 2008/09 – 2012/12; 6.0% p.a. for 2013/14 – 2017/18	1.0%p.a. above Base Case	5.1% p.a. for the entire NIMP period (Ave. of 1999 – 2001)
Budget allocation to Irrigation Development	1.5% (of local fund portion of GOT Development Budget)	1.7%	1.5% (No increase)
Out-of-Budget Donors Assistance	100% (Same amount of foreign fund portion of Development Budget)	110%	100% (No increase)

The results of the sensitivity analysis are given below:

Results of Sensitivity Analysis on Total Budget for 15Years

Scenario	Financial Resources Envelope (million Tsh)*	In million US$
Base Case	350,042	369
High Case	451,251	475
Low Case	327,967	345

** : Initial/Development Budget + Operation and Maintenance Budget*

From the results of sensitivity analysis, the annual development budget, and operation and maintenance budget are projected as follows:

Annual Projected Development Budget

Case	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
High[1]	17.8	19.0	20.3	21.7	23.1	24.7	26.4	28.3	30.2	32.3	34.6	37.0	39.6	42.3	45.3
US$[2]	18.7	20.0	21.4	22.8	24.4	26.0	27.8	29.8	31.8	34.0	36.4	38.9	41.7	44.6	47.7
Base[1]	14.8	15.7	16.6	17.6	18.6	19.7	20.9	22.1	23.4	24.8	26.3	27.8	29.5	31.3	33.2
US$[2]	15.6	16.5	17.5	18.5	19.6	20.7	22.0	23.3	24.6	26.1	27.6	29.3	31.1	32.9	34.9
Low[1]	14.7	15.5	16.3	17.1	18.0	18.9	19.9	20.9	22.0	23.1	24.2	25.5	26.8	28.2	29.6
US$[2]	15.5	16.3	17.1	18.0	18.9	19.9	20.9	22.0	23.1	24.3	25.5	26.8	28.2	29.6	31.1

1 : Billion Tsh, 2 : Million US$

Annual Operation and Maintenance Budget

Case	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
High[1]	0.34	0.37	0.39	0.42	0.45	0.48	0.51	0.55	0.59	0.63	0.67	0.72	0.77	0.82	0.88
US$[2]	0.36	0.39	0.41	0.44	0.47	0.50	0.54	0.58	0.62	0.66	0.70	0.75	0.81	0.86	0.92
Base[1]	0.34	0.36	0.38	0.40	0.43	0.45	0.48	0.51	0.54	0.57	0.60	0.64	0.68	0.72	0.76
US$[2]	0.36	0.38	0.40	0.43	0.45	0.48	0.50	0.53	0.57	0.60	0.63	0.67	0.71	0.76	0.80
Low[1]	0.34	0.36	0.37	0.39	0.41	0.43	0.46	0.48	0.50	0.53	0.56	0.59	0.62	0.65	0.68
US$[2]	0.36	0.37	0.39	0.41	0.44	0.46	0.48	0.51	0.53	0.56	0.59	0.62	0.65	0.68	0.72

1 : Billion Tsh., 2 : Million US$

7.3.3 Demand Projection of Staple Foods

(1) Food Policy for Irrigation Sector

It is obvious that alleviation of poverty and agricultural activities are closely related where the agriculture creates employment and it is the main activity to secure not only food but also income. In rural areas where it is difficult to find major industries other than agriculture, the majority of the poor is engaged in agriculture, which suggests that the promotion of agriculture through the

agricultural development that is capable of providing 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 the Mainland the only way of achieving the improvement of food conditions (the achievement of self-sufficiency) and the securing of income (sales of surplus agricultural products and promotion of the sales of cash crop), which are the two main challenges of the country, is the vitalization and continuous improvement of agriculture by making effective use of existing resources. The development of irrigation, in particular, is expected to be effective as a measure for stable food supply as well as stable source of income, capable of realizing much-desired alleviation of poverty.

It is necessary in the Mainland to attempt to secure a stable supply of staple food with the improvement of nutritional state of the people in mind. It is not sufficient to try and secure the stable supply only through the enhancement of domestic production. Food import should naturally be taken into consideration from the point of adequacy of food variation as well as from the point of economy. Increase in production of food, however, should be the objective target because domestic production is found to be more economical than import, as shown in the table below which indicates that domestic agricultural products are competitive internationally.

Tanzanian Agricultural Sector Comparative Advantage Indicators
(Domestic Resource Coefficients)

Crops	Average	Improved	Potential
Maize (Iringa)	0.93	0.72	0.61
Maize (Dodoma)	0.66	0.71	0.96
Rice (rainfed, upland)	0.82	-	-
Rice (rainfed, lowland)	0.60	0.78	-
Rice (irrigated, Morogoro)	0.63	0.72	0.66

Note: The DRC measures the opportunity cost of the domestic resources required to save (or earn) US$ foreign exchange. A coefficient of 0.61 indicates that there is a potential for only spending US 61 cents to US$ 1.0 in maize imports. Any coefficient less than 1 implies that it is competitive at world prices.

Source Table 7.28, Tanzania, Agriculture: Performance and Strategies for Sustainable Growth, February 2000

As the buying ability of food of the poor people living in rural areas is exceptionally low, security of self-sufficiency through the increased production of staple food in rural areas and the enhancement of buying ability through the expansion of the cultivation of cash crop are both essential objectives and should be promoted as much as possible.

(2) Basic Assumption for Staple Food Demand Forecast

The Crop Monitoring and Early Warning Unit, Food Security Department, Ministry of Agriculture and Food Security in the Mainland, with the collaboration of FAO and others, has determined the annual per capita intake of staple food product, the outline of which is shown right.

Per Capita Consumption for Mailand

Commodity	Kg/Year/Person*
Maize	74.5
Rice	14.1
Wheat	4.3
Sorgum	15.5
Millet	15.5
Puses	11.4
Cassaba	38.2
Bananas	15.3
Potatoes	16.3

** Dry, edible*

An estimate of expected demand for staple food products was made in order to clarify the positioning of the irrigation sector in the overall agricultural development, and also to examine the relevance of the reinforcement and promotion of irrigation sector from the point of view of food supply.

The following conditions have been set up in making the demand forecast:

The calculation has been made based on the assumption that the current pattern of food intake will not change in the future. Accordingly, the current calorie intake of 2,300 kcal stays the same with demand increasing in proportion to the increase in population.

(3) Staple Foods Demand Forecast

In accordance with the scenario set in the above, the future demand of staple food products has been assessed for the population of 53,464,000 estimated by the President's Office with the average annual increase rate of 3.08 %. The result is shown in Table 7.3.1**,** the summary of which is shown right:

Future Demand of Staple Food Products

Crop	Year 2017
Maize	5,151
Rice	1,239
Wheat	322
Sorghum	1,118
Millets	917
Pulses	655
Cassava	6,007
Bananas	4,070
Potatoes	3,418

Unit : 1,000 tons

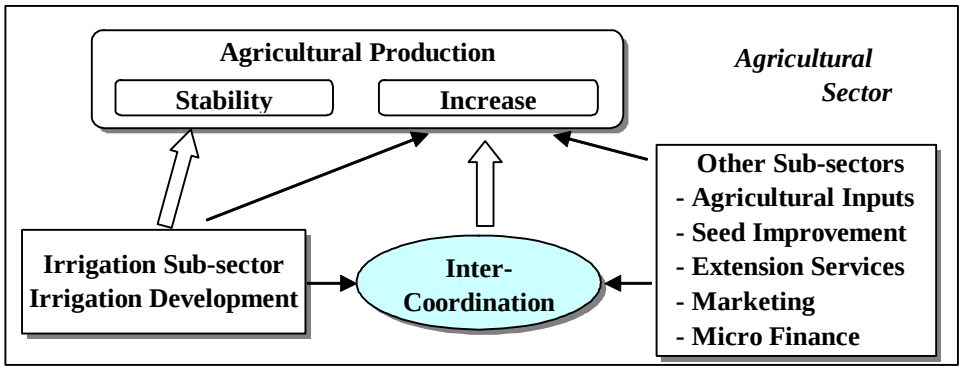
Even in a rather pessimistic assumption in which the Mainland is supposed to enjoy little economical development with calorie intake kept at the current level, the pressure from the increased population will require a demand for rice 1.6 times bigger than the current amount as well as that for maize 2.6 times more in the year 2017.

7.3.4 Need of Inter-coordination in Agricultural Sector

Irrigation is an essential tool for stabilization and increase of agricultural production. As discussed in Clause 7.1, there is no doubt that irrigation itself contributes to the stabilization of agricultural production. However, in relation to improvement of agricultural production, irrigation can function as a catalyst to

bring out the physiologically suitable environment for enhancing the agricultural production. Irrigation itself could not realize the remarkable increase of agricultural production without interventions from other sub-sectors such as agricultural inputs, extension services, marketing and micro finance. The other sub-sectors therefore require to be developed under close inter-coordination with the irrigation sub-sector, to achieve a significant increase of agricultural production.

Need of Inter-coordination in Agricultural Sector



7.4 Basic Plan for Irrigation Development Level

7.4.1 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 absolutely. Often, it will indicate areas of flexibility, which may be applied to a particular scheme. 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 every area may develop irrigation to an extent which suits their own requirements. Farmers will develop their irrigation practice within allowable range of irrigation development corresponding to the development potential of their own areas. The guideline for irrigation development level should show the possible and most suitable modalities of irrigation development by irrigation development pattern recognizing the potential and limitation of irrigation development of the relevant area.

7.4.2 Classification of Irrigation Development Patterns

In the NIDP, all of potential irrigation schemes were divided into the following three kinds of intervention, having a sense of prioritization for scheme implementation.

- Rehabilitation or Upgrading of Traditional Irrigation Schemes
- Schemes based on Water Harvesting Technology
- New Smallholder Schemes

Within the new schemes mentioned above, traditional irrigation schemes are also included if a significant improvement results in classification in a completely different class. These classifications of irrigation development pattern, however, do not cover all possibilities, and are not sufficient for the purpose of defining the irrigation development level.

Through reviewing other classification of irrigation type in the Mainland proposed previously, in this Study irrigation development patterns is classified into the following types from three different angles, namely, scheme style, type of water source, and scale of scheme.

Classification of Irrigation Development Pattern

Scheme Type	Rehabilitation of ex.scheme *			New irrigation scheme **			Water harvesting scheme		
Water sources	Surface water	Ground water	Others (lake etc.)	Surface water	Ground water	Others (lake etc.)	Stream flood	Catchment water	Rain water
Village scheme	R-V-S	R-V-G	R-V-O	N-V-S	N-V-G	N-V-O		W-V-C	W-V-R
Small-scale	R-S-S	R-S-G	R-S-O	N-S-S	N-S-G	N-S-O	W-S-F	W-S-C	
Medium-scale	R-M-S	R-M-G	R-M-O	N-M-S	N-M-G	N-M-O	W-M-F		
Large-scale	R-L-S			N-L-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, W: Water harvesting scheme
(Scale of scheme), V: Village scheme, S: Small-scale. M: Medium-scale, L: Large-scale
(Water source), S: Surface water, G: Groundwater, O: Others
**: Irrigation schemes grouped into "Traditional" and "Improved Traditional" are classified in this pattern.*
***: Irrigation schemes grouped into "Modern" are classified in this pattern, and irrigation schemes newly developing without existing irrigation systems are also included.*

Within the above classification, the village scheme has a special characteristic. Its size is generally less than 30 ha and is smaller than the so-called small-scale scheme. It would be implemented on the basis of farmers' initiative without public intervention. Moreover, this classification may be further subdivided by water abstraction. For the irrigation patterns categorized into "for surface water", those could be subdivided into "by intake weir", "by dam reservoir" and "by under-drain" etc. These schemes may be the subject of specialized study but might not be considered as general examples.

7.4.3 Guideline of Irrigation Development Level

The guideline of irrigation development level shall consider a number of

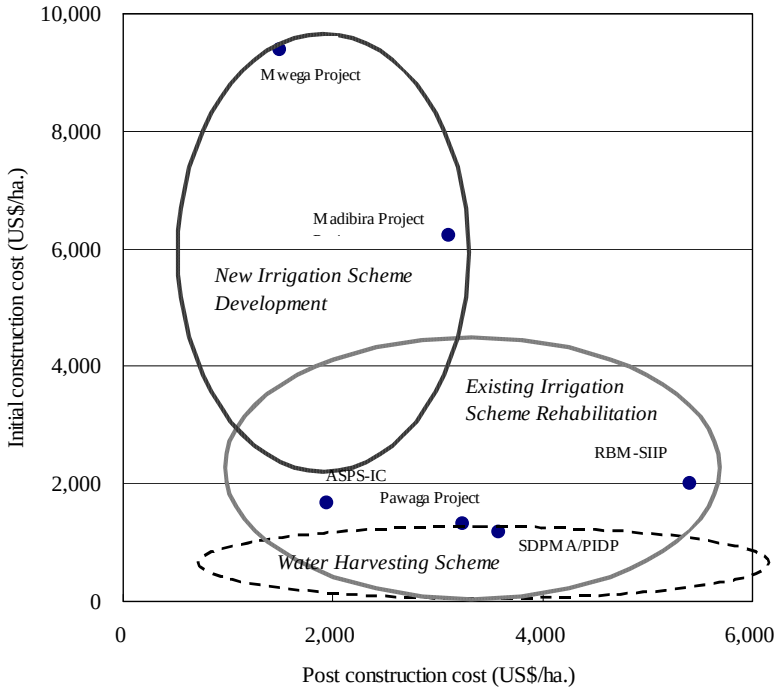
indicators for each irrigation development pattern. The indicators on irrigation development level are extracted from many prospective ones, taking views in Sustainability, Adaptability and Feasibility into consideration, namely, (i) Position of a balance in hardware and software, (ii) Project Scale, (iii) Applicable Crop for Irrigation, (iv) Target Yield of Irrigation Crop, (v) Irrigation Method, and Modality of Irrigation System, (vi) Expectable Project Life, (vii) Reliability of Project, (viii) Affordable Range of Project Cost, and (iv) Allowable Limit in Economic Indicator. Applicable indications in these indicators are summarized in Table 7.4.1. Outlines for the indications are given below:

(1) Position of a balance in hardware and software

A balance in hardware and software is the most important aspect for irrigation development. Hardware in irrigation development might indicate physical facilities for irrigation practice whereas software in irrigation development might specify those activities during post-project implementation including project O & M and additional care efforts of all those associated with the Project.

The ranges of project costs for the selected on-going projects show a close relationship between “hardware (like an initial construction cost) “and “software (like a post construction cost)” which are described in more detail in Appendix D. The positions of irrigation schemes on the two-axis graph of the initial construction cost and the post-project cost are distributed with a certain tendency and can be grouped into several classifications of irrigation development as shown in the following figure:

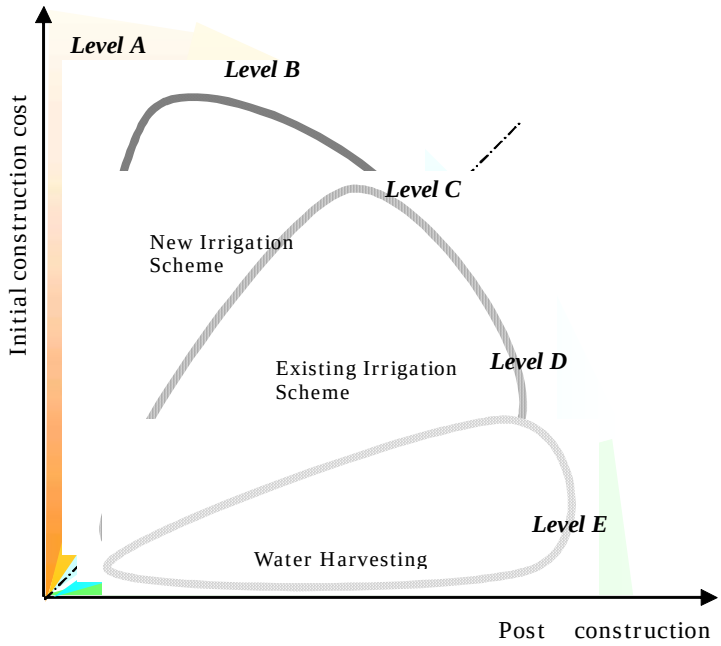
Provisional Classification of Irrigation Development



For new irrigation development schemes, rather higher-cost facilities are required to compensate for the farmers' shortcoming of experiences and knowledge in water management, which have arisen from poor irrigation practices. This viewpoint was also recognized in previous studies. Conversely, for the rehabilitation scheme, the post construction cost exceeds the initial construction owing to the advantages of farmers' experiences in irrigation practice. For water harvesting adopted in marginal areas, low-cost technology is essentially recommended for constructing simple facilities with shorter project life, due not only to economic feasibility, but also the characteristic of natural condition. For example, ephemeral rivers for water harvesting generally change watercourse regularly resulting in investments of long life solid facilities being inappropriate.

Relationships between hardware and software aspects could be grouped into five levels from A to E as shown in the figure to the right:

Groups of Balancing Position of Hardware and Software



When planning irrigation schemes, the method and modality of the irrigation system should be outlined taking these guidelines regarding balancing position of hardware and software into consideration.

(2) Project Scale

"Project scale" is the covering area of irrigation service provided by the relevant irrigation project. Although it is difficult to develop strict rules for categorizing the irrigation into classes, the following three classes of irrigation scheme will be adopted:

Indications in Project Scale

Irrigation class	Covered area (ha.)	Remarks
Small-scale	～500	Generally lower limit (about 20ha) exists.
Medium-scale	500～2,000	
Large-scale	2,000～	

Designated values of irrigation area in the above table are generally assumed to be

applied primarily for the rice cultivation. Therefore, it may give a broad interpretation of application of the designated values of irrigation area.

(3) Applicable Crop for Irrigation

Applicable crop for irrigation is selected as that which features highest, in terms of economical and practical analysis, on the basis of beneficiaries' requirement.

(4) Target Yield of Irrigated Crop

The target yields of irrigated crops were proposed in various figures in all previous irrigation development schemes. In the case of rice production, it ranges from 1.5 ton/ha to 5.0 ton/ha. Various target yields of irrigated crops are being proposed under the previous irrigation schemes.

Target Yield of Irrigated Crop

Crop	Scheme Style	Target Yield	Remarks
Paddy	New scheme	3.0～6.0ton/ha	
	Rehabilitation	3.0～5.0ton/ha	
	Water harvesting	1.0～1.5ton/ha	Considering yearly fluctuation
Maize	New scheme	3.0～5.0ton/ha	
	Rehabilitation	3.0～5.0ton/ha	
	Water harvesting	1.0～1.5ton/ha	Considering yearly fluctuation
Beans	New scheme	1.0～2.0ton/ha	
	Rehabilitation	1.0～2.0ton/ha	

(5) Irrigation Method and Modality of Irrigation System

In consideration of the Distribution of Flow Duration Curves ($Q_1(75)$), Figure 6.2.2, the river regimes in the Mainland can be identified.

Broadly Applicable Irrigation Methods

River Regime Type	Indicator	With Reservoir		Without Reservoir	
		Higher Altitude	Lower Altitude	Higher Altitude	Lower Altitude
Perennial rivers	$20<Q_1(75)$	C	A	C	A
Intermittent rivers	$0<Q_1(75)\leq 20$	C	A	B	B
Ephemeral rivers	$Q_1(75)=0$	-	B	B, C	B, C

"Higher altitude" means higher elevation position of irrigation area in compare with the height of water source, "Lower altitude" is in opposite condition.
A: Perennial Irrigation, B: Flood Irrigation, C: Lift Irrigation, -: Not applicable

(6) Expected Project Life

Generally, the project life is selected to be the optimized point of the relation between inputs and outputs of the project, in viewpoint of economy. However, in some cases, optimality hides other factors, including capability of implementation, possibility of acquisition of required inputs, stability of project conditions etc. It should be at least 50 years. If some conditions surrounded projects are variable and remodeling of the project is envisaged when the conditions alter, project life should be restrained reduced to the predictable duration.

(7) Reliability of Project

Reliability of irrigation project means a dependability of project against certain targeted drought occurrences to secure and maintain irrigation needs by means of construction of irrigation system. Adopting lower reliability of irrigation with simpler and cheaper facilities lowers security of irrigation water supply against drought occurrence. Conversely, accepting irrigation development with higher reliability against harder drought occurrence becomes much more expensive. For the investment level of project implementation, affordable limits and manageable scale of project are very crucial. Therefore, the final project formulation is not to be an optimum choice in economy, but to be an optimum selection in good balance of the input and output. The indication of drought occurrences for irrigation water supply is proposed from 20 to 50 %. In the case of water harvesting, no significant improvement against drought occurrences is expected.

(8) Affordable Range of Project Cost

Approximate unit project cost of US$ 2,000/ha is used as as initial figure and had gradually become a standard. However, adequate project cost varies corresponding to the own circumstances of the project. Some projects may be optimal at a lower standard than the unit project cost, alternatively, some can be constructed taking a much higher cost than the unit cost.

Affordable range of irrigation project cost is subject to affordability and admissibility of a party of project concerned, and project economy. It would be decided at the minimum among the values. It is surveyed as follows:

Affordable Limit of Project Cost by Expected Production Yield **(unit: US$/ha)**

Project life / Profit/ha	～10 years			10～20years			20～30years			～50years		
	N	E	W	N	E	W	N	E	W	N	E	W
～$100/ha	500	400	300	650	500	400	750	600	500	800	650	-
$100～$200/ha	1,000	800	600	1,250	1,000	800	1,500	1,200	1,000	1,650	1,300	-
$200～$400/ha	2,000	1,600	1,200	2,500	2,000	1,600	3,000	2,400	2,000	3,300	2,600	-
$400～$600/ha	3,000	2,400	-	3,750	3,000	-	4,500	3,600	-	5,000	3,900	-
$600～$800/ha	4,000	3,200	-	5,000	4,000	-	6,000	4,800	-	6,600	5,200	-
$800～$1000/ha	5,000	4,000	-	6,250	5,000	-	7,500	6,000	-	8,250	6,500	-
$1000～	6,000	4,800	-	8,000	6,000	-	9,000	7,200	-	10,000	7,800	-

N.: New irrigation scheme, E.: Existing irrigation scheme, W: Water harvesting scheme
Above indicated unit irrigation project cost is major part of initial investment cost. New irrigation scheme cost much initial cost with small O&M cost. Instead of the situation of new irrigation scheme, existing and water harvesting scheme require much O&M cost in spite of lower initial cost.

(9) Allowable Limit in Economic Indicator

Economic indicator of EIRR or B/C etc. can be adopted for irrigation projects as well as other sectoral development projects in order to specify a relative position

in economic worth. A figure around 10-12 % or more is usually required as the project allowable limit along with a reasonable rate of interest when loan is adopted. The economic indicator is not only useful to identify absolute status of the project in economic feasibility but also to enable a comparison with other similar candidate projects. A basin-wise approach has been recently highlighted in the sector of water-resources development and management in the Mainland, in which good consent and objective prioritization corresponding to the economic superiority among concerned water users are highly attached importance.

7.5 Basic Plan for Institutional Development

The basic concept of the institutional development for the NIMP 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 and 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 encounter the persistent constraints discussed previously. Whether the institutional development is achieved smoothly and harmoniously among the various players or not will definitely become a crucial prerequisite for the sustainable and self-reliant irrigation development, i.e. the NIMP.

7.5.1 Roles of Central Government, Local Government Authorities and Farmers' Organizations

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

The Central Government, including the MAFS, will be basically responsible for determining the national minimum standards (NMS) of service, safeguarding professionalism, and determining the qualifications and numbers of staff required to meet the NMS. In that sense, among the demarcated roles, a top priority for the Irrigation Section is given to the role of formulating and reviewing policy, laws, procedures, regulations and guidelines on irrigation farming. This role is quite essential and requires the Irrigation Section to provide firm policy and technical guidance to the Local Government Authorities (LGAs).

The Zonal Irrigation Office and the Regional Secretariat have basically inter- and

intra-regional coordination and supervision functions through different channels. The main task of the Zonal Irrigation Office is technical supervision while the Regional Secretariat is to coordinate irrigation development with other development activities.

The LGAs' role is quite critical under the decentralization policy. A number of constraints discussed in Sub-clause 4.3.7 must be resolved one by one for them to perform their roles satisfactorily. One of their main roles is based on the guidance from the Central Government to provide technically and financially appropriate and feasible replicable models and/or methods of irrigation development to the irrigators' organizations (farmers) and, in addition, to assist and encourage them to operate and maintain the irrigation scheme by themselves.

The role of irrigators' organizations will become very important for the farmers-oriented irrigation development. They will play a main role in operating and maintaining the irrigation scheme and achieving self-reliance. However, they surely need back-up support from the LGAs and the Zonal Irrigation Offices during the short and medium terms.

7.5.2 Institutional Development Components

The following three groups of the institutional development components are identified for the NIMP and they will support the participants of irrigation development to achieve good performances of their demarcated roles and functions. The details were discussed in Clause 8.2.

(1) Institutional Strengthening of the Irrigation Section

- Promotion of the Irrigation Section to the Department
- Strengthening of Monitoring Function
- Reform of Zonal Irrigation Office conforming to the LGRP

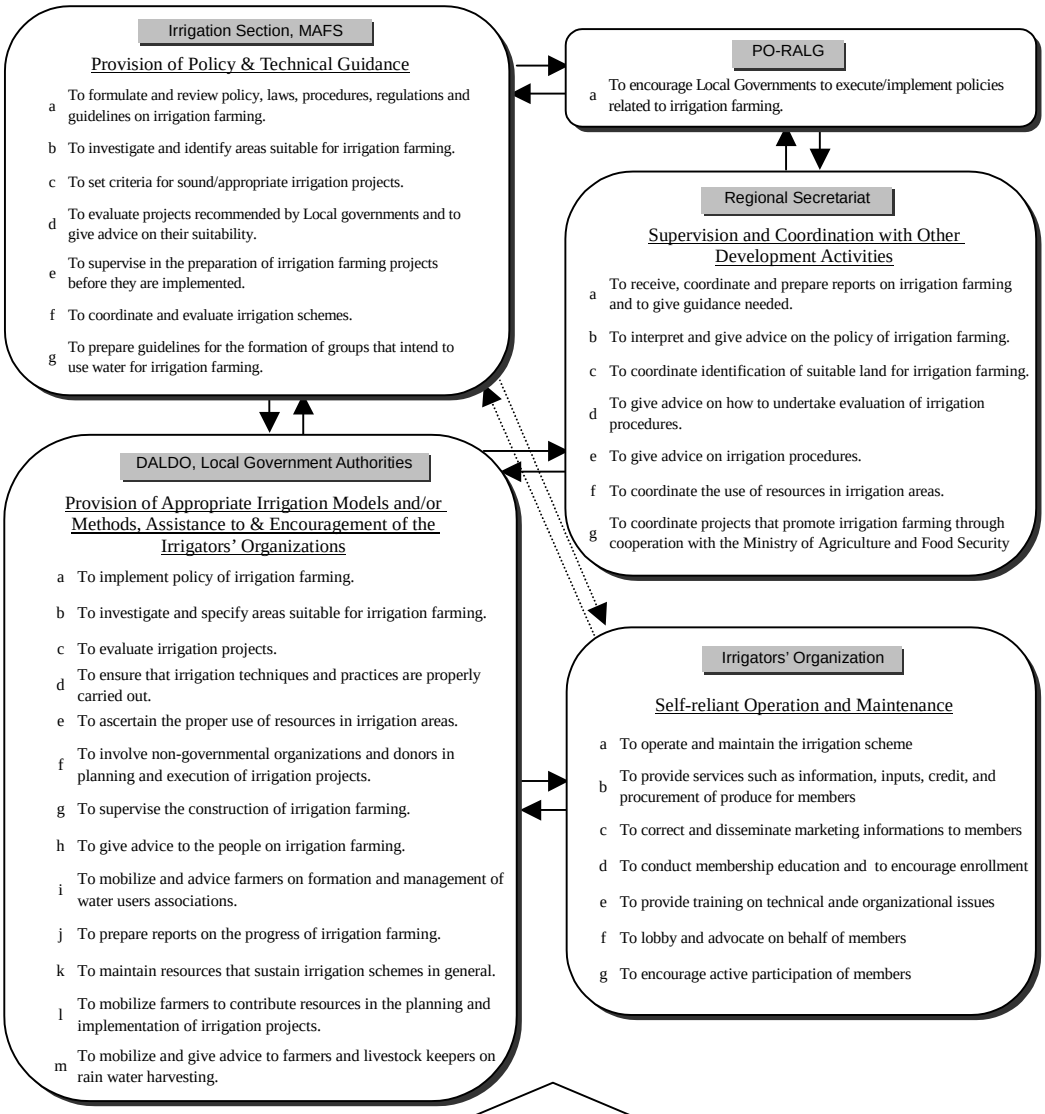
(2) Legal Framework Strengthening for Irrigation Development Program

- Establishment of Legal Framework for the Irrigators' Organization
- PPP (Public Private Partnership): Privatization Promotion

(3) Smallholder Supporting Program for Self-reliance

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

Institutional Development Components and Demarcated Roles of the Central Government, Regional Secretariat, the Local Government Authorities, and Irrigators' Groups



Source: JICA Study Team

7.6 Basic Plan for Agricultural Development

7.6.1 Target Crops for Irrigation

The most important food crop in the Mainland is maize and accounts for about 40% of per capita calorific consumption. The country became self sufficient in maize production in 1985/86 but since then the production has fallen as it depends on the rainfall availability. There is therefore a need to invest in irrigation as a mean of increasing the nation's self-sufficiency or security in maize again, especially in areas where there is erratic rainfall or maize is cultivated as a second crop after paddy. In addition, the importance of rice in the national diet in urban areas is increasing with per capita consumption rising during the past decade. The yield of rice has increased at a greater rate due mainly to an improvement in the irrigation systems. It was concluded in the NIDP that irrigation had a role in contributing towards food security and self-sufficiency in rice production at national level and this principle is maintained under the NIMP.

The importance of rice production was further reinforced through the forecasted demand for rice production mentioned in Clause 7.1. Currently, the total production and demand for paddy are both slightly less than 800,000 ton per year at national level. But the estimated demand at the year 2017 will exceed 1,200,000 ton due mainly to the population increase. In order to satisfy such an increasing demand, the future production of paddy should be increased. One big advantage of paddy production for farmers is that paddy can be used as subsistence food crop to supplement maize at the same time as cash crop.

The demand for maize will similarly increase based on the future population increase. The demand projection discussed in Sub-clause 7.3.3 shows that the total demand of maize will reach above 5 million ton per year by the year 2017. The major development on the future maize production should be carried out through full utilization of the remaining potentials under rainfed conditions. This can be achieved in the regions having a strong expectation of adequate rainfall such as Iringa, Mbeya, Rukwa and Ruvuma by expanding the cultivation area and also by increasing the yield per unit area through improvement in management for the supply of hybrid seed and necessary farm input. Even in the drier part of the country, there is potential for increased maize production under rainfed conditions through the introduction of drought resistant varieties and the improved rainfed farming practices.

The importance of sugarcane and perishable commodities such as vegetables and other high valued crops was also emphasized as target crops for irrigation development in the NIDP. The production of industrial crops including sugarcane should be considered in the course of privatization of the large-scale

irrigation schemes. According to the results of the inventory survey, major irrigated crops under smallholdings other than paddy and maize are beans and vegetables including onion, tomato and leaf vegetables. Such crops can be produced in the areas with good access to the markets or with strong and durable local demand. Special attention should be paid for leguminous crops such as beans and chick peas not only from the production viewpoint but also from the soil management viewpoint.

7.6.2 Land Use Plan

(1) Agro-ecological Zone

In order to select the most suitable crops for different areas, the information obtained through the agro-ecological zone map can effectively be utilized. Agro-ecological zones map provides data on climate, physiography, soils and vegetation/land use and tsetse occurrence. These are the main physical factors that influence potential and constraints for crop and livestock production.

According to the data on major farming systems for each agro-ecological zone, a map of the area suitable for paddy and maize was produced as shown in Figures 7.6.1 and 7.6.2. Furthermore, the data on temperature regime and moisture zones were also expressed on maps as shown in Figures 7.6.3 and 7.6.4**.** This information is useful for the selection of suitable crops and also for the decision of cropping intensity. Agro-ecological zone maps thus provides valuable information for the selection of suitable crops under rainfed condition, for the evaluation of the area to be proposed for irrigation scheme and also for the investigation of the suitable crop and cropping intensity in each scheme.

(2) Present Cropping Pattern

Since the major irrigated crops cultivated in the smallholders' field are paddy and maize and to a lesser extent, beans and vegetables, the analysis of the present cropping pattern was carried out by focusing on paddy, maize and others. The present cropping pattern is estimated based on the crop production data of the year 1999/2000 with the existing irrigated area obtained from the current inventory survey by allocating the planted area, production and yield into rainfed and irrigated, for paddy and maize. The result is shown in Table 7.6.1. It is clear from the result that the irrigated area for paddy occupies less than 20% of rainfed area but the production under irrigated area reaches more than 50% of rainfed production. On the other hand, irrigated maize is negligible both in area and production.

(3) Future Cropping Pattern

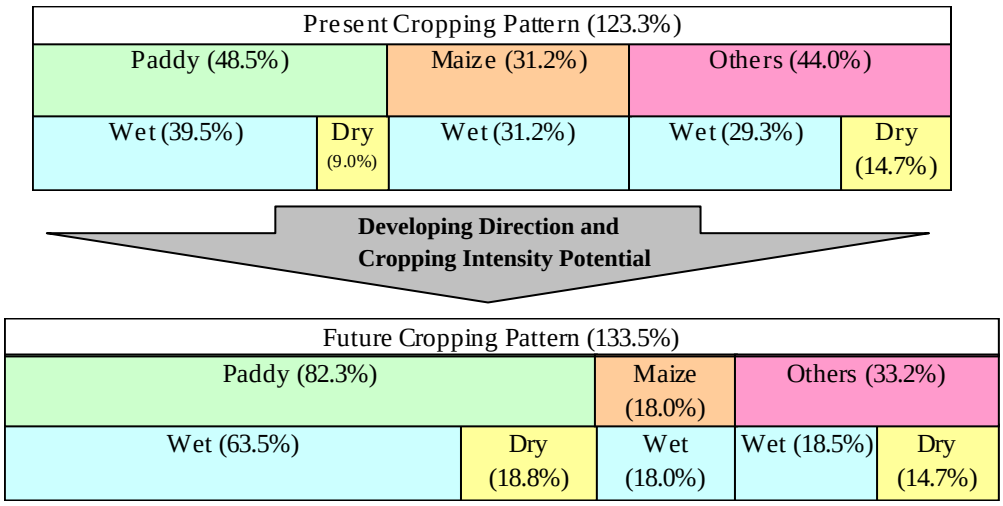
Based on the present cropping pattern as shown in Table 7.6.2, the future cropping

pattern was planned according to the following criteria including the development direction and cropping intensity potential estimated from the agro-ecological zone map as shown in Table 7.6.3.

- Emphasis is given to the promotion of rice production according to the principle of development concept,
- Emphasis is also given to the full utilization of remaining potential of maize production under rain-fed conditions,
- Production of other crops such as beans and vegetables will be adjusted by the climate and market conditions of each year,
- Information on crop suitability obtained from agro-ecological zone map is taken into account for the decision of development direction in each region, and
- Information on temperature regime and moisture zones obtained from agro-ecological zone map is taken into account for the decision of cropping intensity potential in each region.

The future cropping pattern thus planned is shown in Table 7.6.4 and the overall alteration of cropping pattern at national level is shown below. These results on cropping pattern were used for the estimation of economic feasibility of each scheme.

Present and Future Cropping Patterns under Irrigation



Source: JICA Study Team

7.6.3 Farming System Improvement Plan

(1) Farming System

Present farming practices prevailing in the majority of rainfed area are likely to be of extensive cultivation, namely no application of fertilizer and agro-chemicals as well as low input of labour force. 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. This would include the use of 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.

(2) Input Supply

(a) Fertilizer and Agro-chemicals

Since the main reason restricting fertilizer use appears to be the absence of access to credit for its purchase, the government has tried to alleviate this problem through the establishment of Agricultural Input Trust Fund (AGITF). The AGITF provides soft loans to traders with low repayment rates for the local distribution of inputs. So far, the AGITF deals with only about 10% of all inputs supplied in the country and this should be strengthened. The government's strategy on input supply should continue with support for private channels focusing more on the creation of an enabling environment for the efficient operation of the private sector in input supply.

As for agro-chemicals, the government policy is to improve and strengthen the services in plant protection especially for the control of migratory pests and epidemic diseases. The supply of agro-chemicals has, however, suffered from the shortage in credit and distribution system. Furthermore, the enforcement of regulations of agro-chemicals under the Plant Protection Act of 1997 is inadequate. The establishment of proper distribution systems, the provision of extension messages on the safe handling and use of agro-chemicals together with the promotion of integrated pest management measures are the key issues for the future improvement and for irrigation development.

(b) Improved Seeds

Breeder seeds are mainly produced by the Department of Research and Development, more specifically in research stations such as Dakawa Research Center and the KATRIN (Kilombero Agricultural Training and Research Institute at Ifakara) where breeders are stationed. Foundation seeds were formerly produced in Kilosa Farm and certified seeds were supplied through the TANSEED. Since Kilosa Farm is not functioning and the TANSEED was privatized, there is no clear system of improved seed production and distribution. Tanzania Official Seed Certification Agency (TOSCA) is responsible for quality control from the foundation seed farm stage up to the sale of certified seed to the farmer. The TOSCA is also supervising the selection of farmer inspectors to produce certified seeds by

distributing breeder or foundation seeds obtained from Research Centers.

Improved seed production and distribution in the Mainland is thus in a vulnerable position. The most promising approach to improve seed production now is to develop community based seed production. This approach builds upon pilot projects funded by bilateral donors and NGOs. These projects are all based upon continued government responsibility for the production of breeder and foundation seed and for inspection. Under such projects, selected farmers who have received specific training in seed production are supplied with foundation seed for multiplication. If this approach proves to be viable, it can be scaled up as a major seed production system.

(3) Farmers Supporting Systems

(a) Agricultural Research

The current research programmes are classified into crop research, livestock research, special programmes and socio-economics. There is no specialized research on irrigation. The crop research on developing appropriate agronomic recommendations along with the development of high yielding varieties, and special programmes on soil fertility and water conservation are comparatively relevant to the development of irrigated agriculture and such research should be promoted. Special emphasis should be given to the research on new varieties of irrigated rice including Nerica Rice.

A system for allocating funds to the district for contracting research activities has been pioneered in the lake zone. Under this approach, the district is empowered to award contracts for research and it is free to award such contracts to government research stations, universities or NGOs. Reaction to the farmers' needs would be served by strengthening the links between the research agencies and the districts within their respective area, ensuring that research topics are demand-driven with priority to solve local problems. This approach should also be applied for the research activities on irrigation development.

The department of research and development made substantial progress in privatizing research activities connected with the main export and cash crops such as tea, coffee and tobacco. A joint venture arrangement is being negotiated for the research on cotton, cashew and sugarcane. This is another direction of research for the future. Research in the field of irrigation should be incorporated into crop research activities as crop productivity will be greatly increased through irrigation.

(b) Extension System

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 condition.

The most dramatic change to affect extension services has been the decision to decentralize all extension services to the district level. The district councils are responsible for the provision of extension services to farmers together with other services such as education, health etc. Priority should therefore be given to the empowerment of extensions staff in the field of irrigation development, and the supporting system for such staff should also be established.

There has been a long tradition of NGOs operating in the agricultural sector in the Mainland. These NGOs offer an excellent opportunity to assess alternative approaches to extension work. Privatization of extension and mechanisms for cost sharing with beneficiaries are being tried under National Agricultural Extension Project II (NAEP II) with the specific objective of bringing the private sector and NGOs into the provision of extension services. This is another direction of agricultural extension in future and the activities of such private sector and NGOs should be promoted.

7.6.4 Crop Budget

In order to preliminarily evaluate the economic feasibility of each proposed irrigation scheme, crop budgets of 'with' and 'without' project were prepared for rice, maize and beans. Beans were selected as typical irrigated crop other than rice and maize. "With-project" reflects the condition under which proper irrigation facilities with appropriate input supply and farmers' support services are provided. "Without-project", on the other hand, relates to the prevailing rainfed condition without any input supply and support services. Information collected in the field and from relevant agencies along with the data obtained from past similar studies was utilized for the preparation of the crop budget. The draft proposal was also carefully examined by the economist of the Department of Research and Development. The crop budget thus finalized is shown in Table 7.6.5 and the results were used for the evaluation of the economic feasibility of each proposed irrigation scheme.

7.7 Basic Plan for Spatial Development

From the viewpoint of agricultural development potential in the Mainland, the

"suitable product in suitable land" policy should be promoted, as a prerequisite for an effective and feasible development. It is advisable to consider the required demand of food at the national level as much as possible by putting priority on projects with higher investment efficiency, which enables increased production of agricultural products and the subsequent efficient distribution of surplus agricultural products in regions that lack sufficient food so as to optimize the overall effect within the confinement of limited budget.

In a social environment in which decentralization is promoted, it is not an intention to deny the efforts made by respective regions to draw up and implement individual development plans. However, strengthening of ties between regions in an effort to complement each is an essential part of decentralization. Concerning food security in particular, it is very important for adjacent regions plagued by food scarcity or over-production to cooperate with each other and to complement each other. The mechanism is important from the point of view of mutual development as well. The decentralization can be promoted only with the mutual complement as a prerequisite. The enhancement of cooperation among sectors as well as regions is essential to enable the agricultural (irrigation) development to proceed

The irrigation development potential map indicates the High, Medium and Low Potential areas. The High Potential areas are located at Mbeya, Iringa, Morogoro, Kilimanjaro, Arusha and Mwanza.. Further selection of irrigation schemes shall be made in these High Potential areas locations.

7.8 Basic Plan for Scheme Implementation

Most of irrigation schemes in the Mainland have been implemented by the central government initiative, using the so-called "Top-Down System". However, this system is recently changed. In the government, the initiatives in irrigation development are gradually being transferred to the local governments. In irrigation schemes, the farmers' role is become more crucial as a leading player, and finally will be involved in the private sector which is expected to participate in and activate irrigation development.

In this process, however, the Central Government is still required to take an initiative for implementation of model type schemes, which will effect the direction in development of all irrigation schemes. These correspond to the pilot model scheme and river basin management scheme supported under ASPS-IC and RBMSIIP respectively. Such an approach will continue considering the importance of its role.

Possible implementation options for irrigation schemes are as follows:

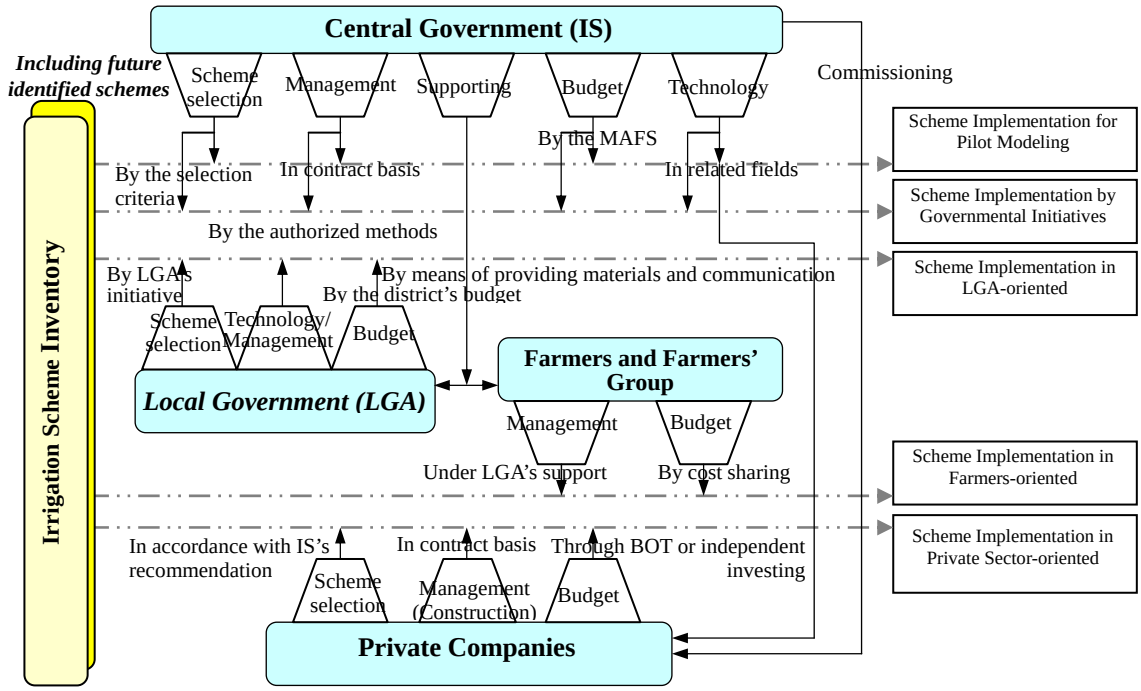
Implementation Options for Irrigation Scheme

Options	Characteristics	Examples
Scheme Implementation for Pilot Model Type	This option is to establish a replicable model of irrigation development scheme. In order to make the pilot model effective, extending efforts for the model effects is essentially required, after the establishment of the model. Prior to implementing the pilot model irrigation schemes within the NIMP, methodology on the pilot scheme establishment should be examined thoroughly	ASPS-IC, Mwega Irrigation Project etc.
Scheme Implementation by Central Governmental Initiatives Approach	This option is to implement the schemes which have a special objectives, or provide a significant benefit in magnitude and in quality.	Pawage Project, Madibila Project, RBMSIIP etc.
Scheme Implementation by LGA-oriented Approach	This option is to implement by LGAs' initiatives with few intervention of central government for the common schemes, which are controllable by the LGAs.	*No examples so far*
Scheme Implementation by Farmers-oriented Approach	This option is individual irrigation practice of farmers on a small scale. Required involvement from the public organizations is not direct intervention but technical assistance.	Widely seeable in local
Scheme Implementation by Private Sector-oriented Approach	This option is, for instance, to implement irrigation scheme by BOT basis. The schemes are required to gain certain profit for worth business.	Kilombero Irrigation Project (planning)

As mentioned above, there are five options in scheme implementation. These are (i) Scheme Implementation for Pilot Model Type, (ii) Scheme Implementation by Central Government Initiative Approach, (iii) Scheme Implementation by LGA-oriented Approach, (iv) Scheme Implementation by Farmers-oriented Approach, and (v) Scheme Implementation by Private Sector-oriented Approach. Scheme implementation should be prepared considering the timely application of these options.

To start with, "Scheme Implementation by Governmental Initiatives" will be carried on at the same pace as usual in view of the national development policy. "Scheme Implementation for Pilot Modeling" should precede the remaining sorts of scheme implementation so as to lead success of irrigation development by means of giving a replicable model. As the decentralization progresses, the "Scheme Implementation in LGA-oriented Approach" should spread in parallel with capacity building of LGAs and improvement of institutional circumstances. Concurrently, the "Scheme Implementation in Farmers-oriented Approach" should be executed. Finally, "Scheme Implementation in Private Sector-oriented" is expected to be gradually introduced in the possible sites and be established by the target year of the NIMP.

IS, LGAs, farmers and their groups, and private companies will participate in all irrigation scheme implementation as players. Relationships among them in irrigation development by implementation type are schematically shown as follows:



7.9 Priority Grouping of Inventorized Irrigation Schemes

7.9.1 Preparation of Criteria of Priority Ranking

(1) General

Several criteria/guidelines for scheme prioritization have been developed for such irrigation development programs as RBMSIIP, ASPS-IC, and PIDP so as to select suitable schemes to meet objective of the programme. Those criteria are facilitated so that the schemes can be evaluated by various aspects, such as technical factors, economical factors, environmental aspects, and social aspects. The criteria have been reviewed and two, criteria for screening schemes, and criteria for scheme prioritization, are proposed.

(2) Criteria for screening of inventorized schemes

Criteria for screening of the inventorized schemes are set up to examine the minimum qualification of the proposed irrigation schemes for implementation. The proposed schemes should have the following conditions:

Screening Criteria for Inventorized Schemes

Item		Description
(a)	Needs of rehabilitation	The schemes requiring rehabilitation shall be selected.
(b)	Type of scheme	The smallholder irrigation schemes shall be selected.
(c)	History of rehabilitation	No rehabilitation/improvement works has been conducted for last 5 years shall be selected.
(d)	Availability of basic data	Basic data for scheme prioritization shall be available for prioritization.

(3) Criteria for prioritization of inventorized schemes

(a) Factors for Prioritization

In due consideration of five elements for sustainability of the irrigation development as mentioned in Sub-clause 7.2.3, prioritization of the inventorized irrigation schemes are carried out from the following viewpoints:

- Technical Factors
- Economic Factors
- Environmental Factors
- Ease of Implementation
- Social Factors
- Regional Condition

(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 and 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 wet 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.

(g) Regional Conditions

The objective of NIMP in line with that of ASDS is to realize the

sustainability of irrigation development through effective use of national resources, and it consequently contributes to regional food security and poverty reduction. Regional condition of those factors, such as development potential, regional self-sufficiency ratio of food crop, and poverty index, shall be assessed for prioritization of schemes.

Considering the above, the criteria for prioritization are prepared, as shown in the following page:

Criteria for Scheme Prioritization

Factors for Evaluation			Points
A	Technical Factors (15 points)	1. Slope (4 points)	
		(a) Flat (less than 0.5%)	4
		(b) Mild (0.5 - 2.0%)	3
		(c) Moderate (2.0 - 4.0%)	2
		(d) Steep (more than 4.0%)	1
		2. Salinity / Alkalinity of Soil (7 points)	
		(a) Observed	0
		(b) Not observed	7
		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 (30 points)	1 Size of potential area (7 points)	
		(a) Less than 500 ha	2
		(b) 500 - 1000 ha	4
		(c) 1000 - 2000 ha	5
		(d) More than 2000 ha	7
		2. Water abstraction method (8 points)	
		(a) Gravity	8
		(b) Pump	2
		3. EIRR (10 points)	10
		(a) Less than 8.0%	1
		(b) 8.0 - 12.0 %	3
		(c) 12.0 - 16.0 %	5
		(d) 16.0 - 20.0 %	7
		(e) More than 20.0 %	10
		4. Financial Viability (5 points)	5
3	Possibility of Environmental Status Factor (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 (20 points)	1. Organization set-up (2 points)	
		(a) Established	2
		(b) Not yet established	1
		2. Establishment of O&M committee (2 points)	
		(a) Organization set-up	2
		(b) Not yet established	0
		3. Linkage with village (1 point)	
		(a) Good	1
		(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 (1 point)	
		(a) By Farmers' organization	1
		(b) By Other bodies	0
		7. Existence of water right (8 points)	
		(a) Existence	8
		(b) Non-existence	0
		8. Average farm size (1 point)	
		(a) 0 – 1.0 ha per household	1
		(b) Others	0
6	Regional condition (20 points)	1. Development ratio (3 points) (existing irrigated area / potential area)	
		(a) Less than 30%	3
		(b) 30 – 60%	2
		(c) More than 60%	1
		2. Self-sufficiency ratio of food crop (10 points)	
		(a) Less than 20 %	10
		(b) 20 – 40 %	8
		(c) 40 – 60 %	6
		(d) 60 – 80 %	4
		(e) More than 80 %	2
		3. Poverty index (BHN) (7 points)	
		(a) More than 40	7
		(b) 30 - 40	5
		(c) 20 - 30	3
		(d) Less than 20	1

7.9.2 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 Economic Internal Rate of Return (EIRR) were crosschecked and supplemented.

(2) Estimate of Rehabilitation / Construction Cost

Estimate of the project cost are assumed classifying the grades of rehabilitation or construction into four categories.

Classification of the Inventorized Scheme by Type of Construction / Improvement Works

Category	Diversion Weir	Irrigation Canal
Category 1	No need for rehabilitation	To be rehabilitated
Category 2	To be rehabilitated	To be rehabilitated or no need
Category 3	To be constructed / replaced	To be rehabilitated or no need
Category 4	To be constructed / replaced	To be constructed / extended

Source: JICA Study Team

The project costs for rehabilitation, improvement and construction for each category were assumed and supplemented based on the previous performance of irrigation development and the Guideline of Irrigation Development Level described in Clause 7.4.

Unit Project Costs by Type of Water Abstraction **Unit : US$/ha**

Type of Irrigation	Category 1	Category 2	Category 3	Category 4
Traditional Irrigation	1,500	2,000	2,500	3,000
Water Harvesting	500	1,000	1,200	1,500
Modern Irrigation	2,000	3,000	4,000	5,000
Improved Traditional Irrigation	2,000	3,000	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 between future with and without project conditions, and were calculated according to the flowing 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 7.6.

(4) Calculation of EIRR

EIRR for each scheme was 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.

7.9.3 Priority Grouping of Inventorized Schemes

(1) Objectives

Priority grouping of the inventorized schemes aims to facilitate the formulation of a 15-year scheme-wise development programme for the NIMP. In order to utilize the nation’s endowed 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, and only those schemes that will pass the screening criteria should be allowed to proceed for implementation.

The implementation schedule of NIMP should therefore be based on the priority groupings which will classify the inventorized schemes into 5 groups (“A” group to “E” group.)

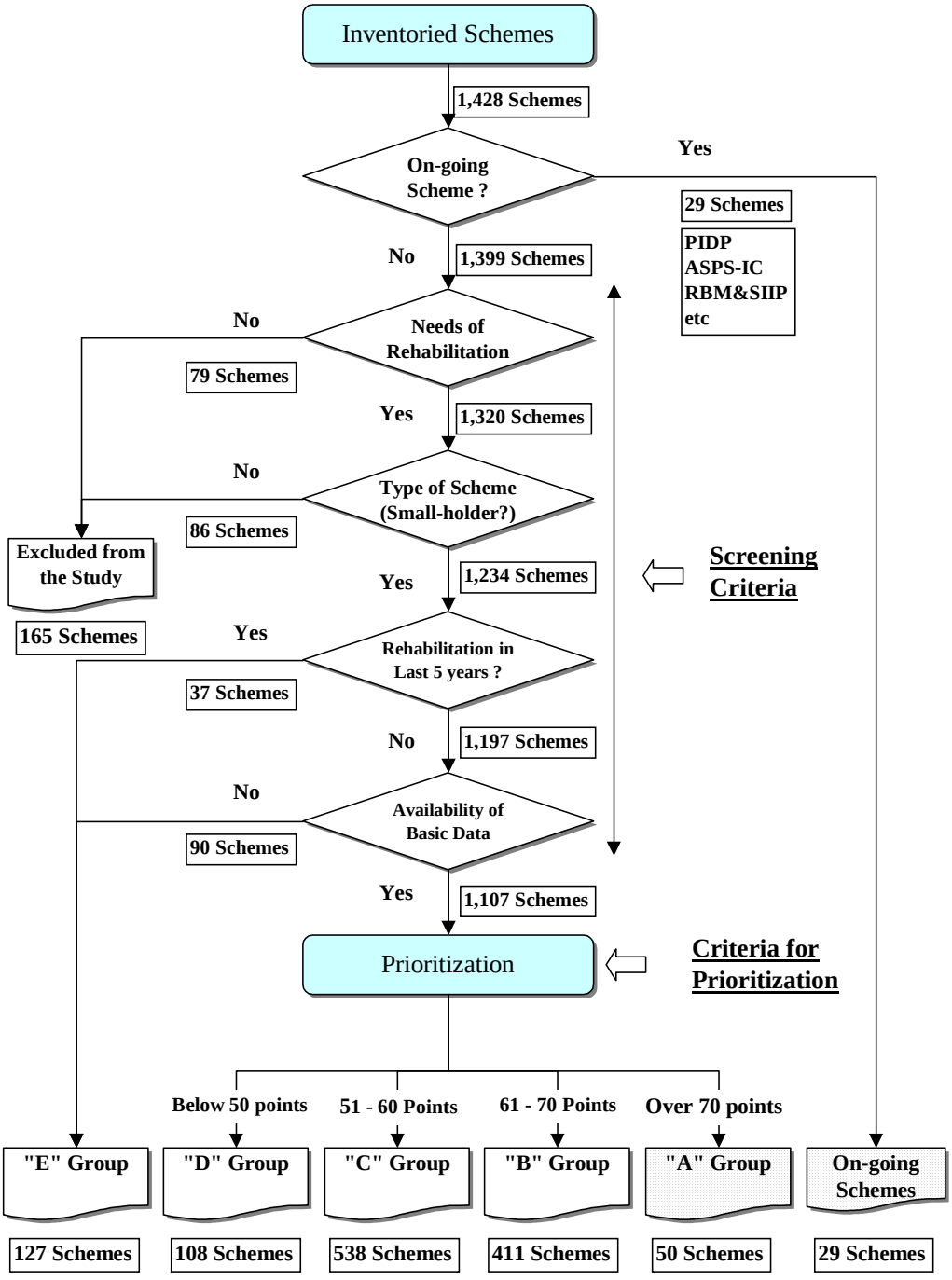
(2) Method and Process of Priority Grouping

The inventorized schemes are classified into three priority groups through the assessments of the following factors:

- Present status of schemes,
- Needs of rehabilitation,
- Management type of schemes,
- History of rehabilitation/improvement,
- Availability of basic data
- Prioritization of schemes

The workflow of the priority grouping is shown below.

Priority Grouping of Inventoried Schemes



Present status of schemes

Among the inventorized schemes, the schemes, which are under implementation or are committed to be implemented, are confirmed. The implementation schedule for those schemes shall be reflected in the NIMP.

- On-going or committed schemes : 29
- Other schemes : 1,399

Necessity of rehabilitation

Schemes which have been recently constructed or rehabilitated, or well functioning and do not require rehabilitation/improvement works, are to be excluded from the list of schemes for implementation under the NIMP. The schemes requiring rehabilitation works are further examined for the priority grouping.

- Schemes not requiring rehabilitation works : 79
- Schemes requiring rehabilitation works : 1,320

Management type of schemes

In line with the approach of the NIMP, aiming finally to improve productivity of smallholders through rehabilitation of irrigation infrastructure, the NAFCO and private schemes are to be excluded from the list of schemes for implementation under the NIMP. The 1,320 schemes requiring rehabilitation works are further examined for the priority grouping.

- NAFCO and private schemes : 86
- Smallholder irrigation schemes : 1.234

History of rehabilitation/improvement

The schemes, where rehabilitation/improvement works were carried out in last 5 years, are excluded:

- Rehabilitation in last 5 years : 37
- No rehabilitation in last 5 years : 1,197

Availability of basic data

Availability of the basic data should be checked before prioritization of the schemes is carried out in the light of the “criteria for prioritization”. A check of data availability is made for the above 1,197 schemes. The data required are as follows:

- Name and location of scheme
- Present irrigated area and potential area
- Description of rehabilitation/improvement

The number of schemes to meet the above condition is 1,107

Prioritization according to the criteria

1,107 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

7.9.4 Results of Priority Grouping

(1) "A" to "D" Groups

Among the inventorized schemes, 50 schemes are finally as the "A" Group (schemes to be implemented) through the following steps:

	Nos. of Schemes
- No rehabilitation work is in progress	: 1,320
- They are smallholder irrigation schemes	: 1,235
- No rehabilitation work has been conducted for 5 years	: 1,198
- Basic data for prioritization are available	: 1,107
- "A" Group	(50)
- "B" Group	(411)
- "C "Group	(538)
- "D" Group	(108)

(2) "E" Group:

The "E" group (schemes to be investigated) consists of 127 schemes. These schemes have one or more of the following characteristics:

- No rehabilitation work is in progress;
- They are NAFCO schemes or private irrigation schemes, or
- They are smallholder irrigation schemes, but rehabilitation works have been conducted for recent 5 years;

The results of the priority grouping are summarized as follows:

Summary of Priority Grouping

No.	Group	Nos.	Estimated Area (ha)
(1)	On-going Schemes Group	29	13,600
(2)	"A" Group	50	34,800
(3)	"B" Group	411	199,000
(4)	"C" Group	538	158,700
(5)	"D" Group	108	19,300
(6)	"E" Group	127	343,100
(7)	Excluded Group	165	85,800
Total		**1,428**	**854,300**

(3) General features of "A" Group schemes

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

Distribution of "A" Group Schemes by Region

Region	Nos.	Potential Area (ha)	Region	Nos.	Potential Area (ha)
Arusha	2	240	Mbeya	-	-
Coast	2	2,300	Morogoro	3	6,793
Dar es Salaam	-	-	Mtwara	-	-
Dodoma	-	-	Mwanza	14	8,610
Iringa	1	120	Rukwa	-	-

Kagera	-	-	Ruvuma	2	2,700
Kigoma	-	-	Shinyanga	6	3,700
Kilimanjaro	6	2,180	Singida	6	3,140
Lindi	4	3,200	Tabora	-	-
Mara	1	50	Tanga	34	1,750
Total	**50 nos. and 34,783 ha (34,800 ha)**				

7.10 Alternative Study for Development Target

(1) Available Budget for Development

In Sub-clause 7.3.2**,** the available budget for irrigation development is projected for 3 cases, namely High Case, Base Case and Low Case using the past actual expenditures and assuming the increase in GDP growth rate. The projected available budget for initial/development fund is tabulated below:

Projected Initial/Development Budget

Case	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
High[1]	17.8	19.0	20.3	21.7	23.1	24.7	26.4	28.3	30.2	32.3	34.6	37.0	39.6	42.3	45.3
US$[2]	18.7	20.0	21.4	22.8	24.4	26.0	27.8	29.8	31.8	34.0	36.4	38.9	41.7	44.6	47.7
Base[1]	14.8	15.7	16.6	17.6	18.6	19.7	20.9	22.1	23.4	24.8	26.3	27.8	29.5	31.3	33.2
US$[2]	15.6	16.5	17.5	18.5	19.6	20.7	22.0	23.3	24.6	26.1	27.6	29.3	31.1	32.9	34.9
Low[1]	14.7	15.5	16.3	17.1	18.0	18.9	19.9	20.9	22.0	23.1	24.2	25.5	26.8	28.2	29.6
US$[2]	15.5	16.3	17.1	18.0	18.9	19.9	20.9	22.0	23.1	24.3	25.5	26.8	28.2	29.6	31.1

1 : Billion Tsh., 2 : Million US$

(2) Possible Irrigation Development Areas by 2017

Taking into consideration the analysis results of inventory survey discussed in Clause 5.2, the possible irrigation development areas by 2017 are calculated for 3 cases as follows:

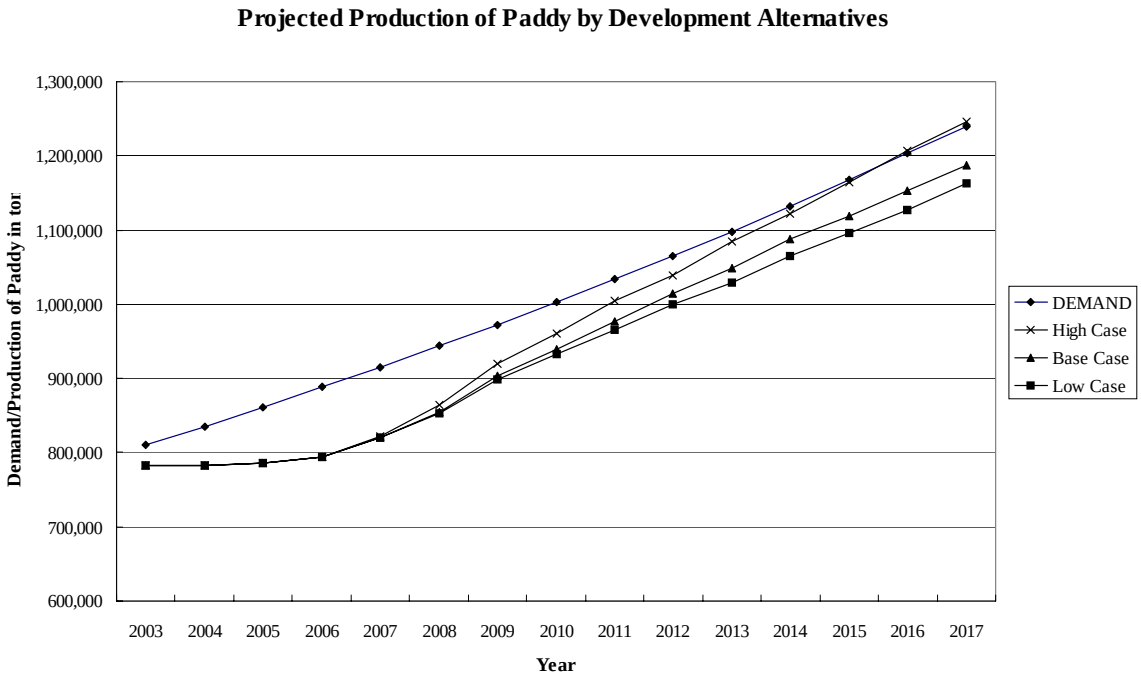
Irrigation Development Areas by 2017

Case	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
High[1]	218	229	239	250	265	276	281	294	312	325	337	352	372	387	405
Base[1]	218	228	236	243	254	264	271	278	290	304	316	325	335	351	362
Low[1]	218	222	234	240	248	261	268	274	287	296	306	321	328	337	350

1: Thousand ha

(3) Comparison with Future Demand of Rice

The possible production of paddy was calculated for the above 3 cases in view of the built-up period. The table below shows comparison future demand of paddy with each case:



As can be seen in this figure, the irrigation development areas under the High Case, say 405,400 ha will satisfy the paddy demand by 2017 subject to proper agricultural input supply. Those areas under Base Case will fall short as will those under the Low Case. Since it is deemed that the High Case would be within procurable extent, and also taking into consideration that the High Case had a high probability of meeting the projected demand of paddy by the target year 2017, it was regarded as an appropriate scenario for the study on development programme of the NIMP.

As shown in the table of conditions of sensitivity analysis in Sub-clause 7.3.2, Low Case means the application of current financial situation to the irrigation development. If such financial situation continues in the future, the GOT would face the severe deficit of paddy. It is therefore expected that the GOT will arrange the budget for High Case.

CHAPTER 8 IRRIGATION DEVELOPMENT PROGRAMME

8.1 Development Scenario for the Year 2017

The NIMP aims to achieve sustainable irrigation development through effective use of national resources resulting in an improvement of agricultural productivity and profitability. Thus, the development programme which implements the NIMP, target the establishment of sustainable irrigation development system by 2017.

The ASDS is a strategy report relating to the immediate short-term period of five years (2002 –2007). The ASDP which will implement the ASDS, is a five-year rolling programme (2002-2007). In view of the similarity of the ASDP with the NIMP, the development programme for the NIMP with the target year 2017 will utilize the following stage-wise development:

- Short Term : 2003 – 2007
- Medium Term : 2003 – 2012
- Long Term : 2003 – 2017

The ASDS mentions the need for three new critical interventions for innovative and practical actions toward the sustainable agricultural development including irrigation development. These are (i) focus on agricultural productivity and profitability, (ii) promotion of private sector/public sector partnership, and (iii) implementation of ASDS through DADPs. These interventions should be reflected in the development programme.

In Sub-clause 7.3.2 and Clause 7.10 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 of agricultural development discussed in Clause 7.6 of this Main Report as well as in the NIDP, proposes the irrigation development emphasizing increase of rice production from the economical and financial viewpoints, and also considering its beneficial double functions of staple food and cash crop production.

In due 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 2017)
Development Target	**To Establish Sustainable Irrigation Development System by 2017**		
Key Issue for each Term	**Reform**	**Decentralization**	**Self-reliance**
Subject-wise Improvement			
Strategic Approach	- Reform of environment for promotion of decentralization and involvement of private sector - Establishment of appropriate technologies on irrigation development in cost-effective concept - Dissemination of concept of river basin approach - Establishment of irrigation development system by participatory approach	- Actualization of irrigation development by LGA's initiatives under decetralization - Application of appropriate technologies on irrigation development in cost-effective concept - Establishment of environmental protection method on irrigation - Establishment of farmers-oriented irrigation development system	- Establishment of easy access system from farmers on technical support - Spred of environmental protection method established - Establishment of self-reliant irrigation development by private sector-oriented with public sector partnership
Activities	Prepare and apply tailor-made improvement programme for project sustainability		
Scheme-wise Development			
Strategic Approach	Expand the irrigated area through development of irrigation schemes in effective use of national resources		
Activities	Give priority to rehabilitation of small-scale irrigation and water harvesting schemes		
Expected Annual Growth Rate of GDP	**5.8 % to 6.0 %**		

The Short Term (2003 – 2007) is regarded as “Reform” time toward establishment of self-reliant irrigation development. The enabling environment for decentralization and involvement of the private sector will be created. The irrigation development will focus on further effort for the establishment of irrigation development by a 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, a tailor-made improvement programme will be prepared and simultaneously executed in this period. The environmental issue is also important for irrigation development. The concept of river basin management is included in this improvement programme. The scheme-wise development will commence with rehabilitation of traditional irrigation schemes and development of water harvesting schemes.

The Medium Term (by 2012) will be crucial period for irrigation development. The Public Service Reform Program (PSRP) shows that the decentralization will be completed by 2011. The irrigation development will therefore be conducted by initiatives of local government. In addition, the irrigation development system will require gradual transfer from the farmers’ participatory approach to the farmers-oriented approach, to move toward the self-reliant irrigation development,

which is a final target in this development programme. The scheme-wise development will progress focusing on rehabilitation of traditional irrigation schemes and development of water harvesting schemes.

The Long Term (by 2017) program will focus on the establishment of self-reliant irrigation development in the partnership of private sector and public sector. For this, it is essential to create the enabling circumstances for involvement of the private sector and execution of public support function by that time, including 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 be accelerated, so that the rice production would meet its target by 2017 although allocation of required expenditures and support from other sub-sectors to irrigation development are essential.

8.2 Institutional Supporting Programme

8.2.1 Stage-wise Development

For the institutional development stage-wise programs are basically appropriate. The conformity to the LGRP is also essential. The programs basically 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 development responding to the decentralization policy.
- Medium Term (by 2012): To support actualizing farmers-oriented irrigation development through the LGAs' initiatives and assistance to the farmers.
- Long Term (by 2017): To support realizing self-reliant irrigation development through the PPP (Public Private Partnership).

8.2.2 Strengthening of Irrigation Section

(1) General Approach and Basic Components

The Institutional Strengthening of the Irrigation Section has the following three subcomponents:

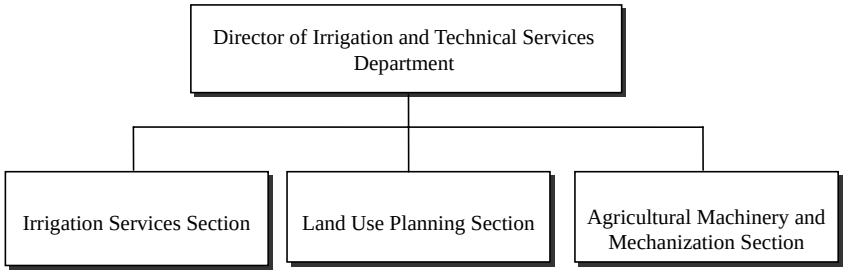
- Promotion of the Irrigation Section to a new Department
- Strengthening of Monitoring Function

- Reform of Zonal Irrigation Office conforming to the LGRP

Presently a possible reform plan is under consideration in the MAFS. It is to promote the Irrigation Section to a new department, i.e. the Department of Irrigation and Technical Services through combining the Irrigation Section, the Soil Conservation and Land Use Planning Unit and the Agricultural Mechanization Unit. In the reform plan, an assistant director should head each section under the supervision of director. Strengthening of the irrigation section by including this plan should be given serious consideration.

In addition, the Monitoring and Evaluation Unit and the Environmental Unit are presently seriously understaffed, even though their expected roles at the national level are quite crucial for the provision of effective feedback data and, moreover, to monitor socio-economic and environmental aspects of the effectiveness of irrigation development. The Section does not yet have an established firm monitoring mechanism and has not selected a list of necessary socio-economic, technical and environmental indicators to monitor and evaluate the irrigation development activities. Strengthening of those two units should be included in the strengthening of the Irrigation Section.

(2) Possible Institutional Strengthening Plan of Irrigation Section



Source: Irrigation Section, MAFS

The third subcomponent, Reform of Zonal Irrigation Office should be synchronized with the progress of LGRP. Presently the Zonal Irrigation Office still has a very influential role in irrigation development, in particular, in new development schemes, because the LGAs are presently not yet capable of performing their demarcated roles and functions. The constraints limiting the LGAs' capacity are already discussed at Sub-clause 4.3.7.

At least in the first stage of the NIMP up to 2007 the Zonal Office should maintain the present roles and functions. Gradually, however, their roles should focus on the inter-regional coordination in cooperation with the Regional Secretariat and provision of policy and technical guidance to the LGAs (DALDO) toward the end of third stage up to the year of 2017. Gradual withdrawal from direct supervision of irrigation schemes and transferring the function to the LGAs should be

undertaken from the first and second stages.

A task force of experts should be organized to make a reform plan for the Irrigation Section. The plan should be a stage-wise program responding to the short term (2003-2007), the medium term (by 2012) and the long term (by 2017). The promotion of the Section to the Department should be actualized 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.

8.2.3 Legal Framework Strengthening 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 right, as well as ownership of and responsibility for irrigation infrastructure should be clearly defined for irrigation development. Presently these items are defined in a fragmented fashion by a number of separate laws, such as the Land Acts, the Water Act, the Cooperatives Act, the Societies Ordinance and etc.

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

The rights and obligations of the irrigators' group members cannot always be clearly and uniformly defined under the present legal framework. Neither present cooperatives nor associations are necessarily the optimum organizational form for the irrigators' group. The cooperative is primarily a business-oriented organization registered with the MAFS on the one hand, and the association, which is registered with the Ministry of Home Affairs can be applicable to any type of social activities on the other hand. A new legal framework exclusively for the irrigators' groups seems to be very important and necessary for securing their ownership and self-reliable irrigation development. The framework should cover and define the at least the following issues; ownership of the irrigation facilities, security of land tenure and water right, collection of water right charge, compulsory enrollment of all water users to the irrigators' group, establishment and dissolution of the irrigators' group.

A consultancy work for establishment of the legal framework, possibly a new Act, Ordinance or Regulations, should be undertaken through the initiative of the Irrigation Section in cooperation with the relevant governmental agencies, lawyers and technical specialists. The MWLD, however, will review the present Water Act for amendment based on the revised National Water Policy, and will provide the

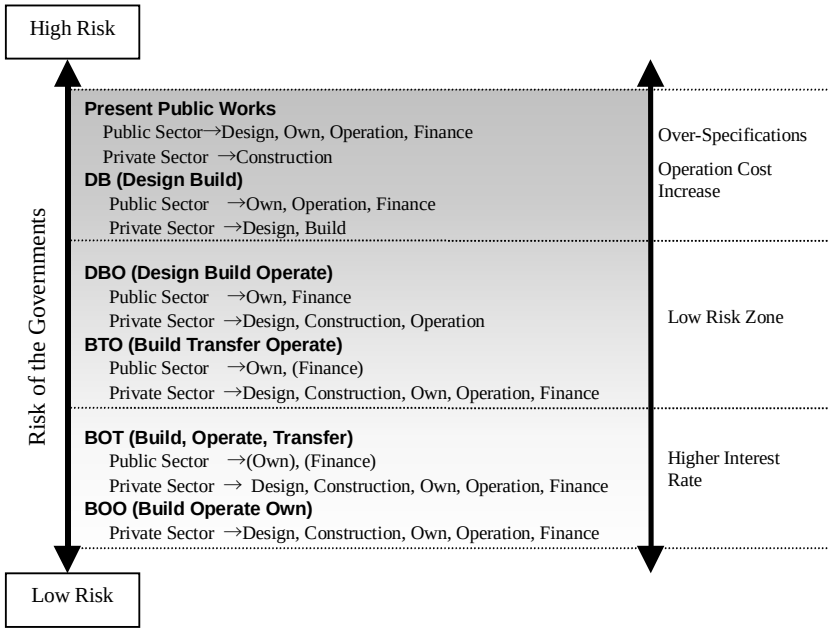
scope of activities and powers of water users' associations. The consultancy work should be undertaken in conjunction with the review of the Water Act.

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

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

The first step toward the PPP is to achieve a smooth privatization of NAFCO. The government has already established the Ministerial Committee for agricultural sector privatization. Under the supervision of this committee, a further in-depth study on privatization methods, strategy and implementation plan by the expert committee should be undertaken. For the PPP, there are several possible schemes. The applicability and feasibility of each privatization scheme such as DBO, BTO as well as BOT (see the next chart) should be carefully explored and compared based on the present situation of the parastatals. Furthermore, the investment guidelines for the private sector should be established for not only privatization of parastatals but also direct private investment for irrigation development.

Typical Development Schemes of PPP



Source: Original source written in Japanese is, Motoji Muraoka, "Outline of the PFI Business in Japan", Business Research Institute of NTT DATA

8.2.4 Smallholder Support for Self-reliance

Extension services for irrigators' group through the DALDO should be continuously given a high priority for actualization of self-reliant irrigation development. The present situation of availability of training for irrigators' groups obtained through the inventory survey is shown in the next table. "Available and Satisfactory" accounts for slightly less than 10% and "Not Available" ranges between 30% and 65%. The present situation is unfortunately far from satisfactory. For the future requirement, training needs will be very high among the irrigator's groups, in particular, for operation & maintenance, but also for administrative, financial and technical management skills. The following subcomponents should be emphasized in the training programs for the irrigators' groups.

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

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

Present Situation and Future Requirement of Training for Irrigators' Groups

Present Situation

Traing Item	Available and Satisfactory	Available but Unsatisfactory	Not Available	No Answer
Operation & Maintenance	6.0%	34.4%	46.7%	12.9%
Accounting System	2.3%	18.2%	64.6%	14.9%
Water Management	4.6%	45.0%	38.7%	11.6%
Paddy Production	7.3%	35.8%	31.5%	25.5%
Upland Crops Production	10.6%	58.3%	19.2%	11.9%

Sample Size: 302

Future Requirement

Traing Item	Necessary	Not necessary	No Answer
Operation & Maintenance	95.0%	1.0%	4.0%
Accounting System	96.4%	1.3%	2.3%
Water Management	95.7%	1.7%	2.6%
Paddy Production	70.9%	14.9%	14.2%
Upland Crops Production	90.7%	3.3%	6.0%

Sample Size: 302

Source: Inventory Survey by the JICA Study Team, 2002

8.2.5 Monitoring and Evaluation of NIMP at Each Development Stage

The NIMP itself should be carefully monitored and evaluated on its performance at each development stage, just the same as an irrigation development scheme needs good operation and maintenance for satisfactory performance. Feedback through a reliable monitoring and evaluation mechanism should be promptly

given so that the NIMP can be revised. The role of monitoring and evaluation of the NIMP should be assigned to the Irrigation Section.

8.2.6 Supporting Programme

The supporting programme for institutional development is included in the Subject-wise Improvement Programme, which is discussed in Clause 8.3

8.3 Subject-wise Improvement Programme

8.3.1 Contents of Subject-wise Improvement Programme

The Subject-wise Improvement Programme is a series of management activities for software-like improvement, which are in various fields related to irrigation and irrigated agriculture. The Subject-wise Improvement Programme consists of several components related to the important subjects, which closely affect irrigation development in the Mainland. The components in the Subject-wise Improvement Programme are categorized as follows:

- Support scheme implementation directly,
- Strengthen management system and management of scheme implementation,
- Enhance benefit of irrigation more,
- Sustain implemented irrigation, and
- Restore irrigation practice when hindered

The components of the Subject-wise Improvement Programme were each formulated systematically and comprehensively, in the light of significance of the programme in the future irrigation development in the Mainland.

8.3.2 Formulation Procedure of Subject-wise Improvement Programme

“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 NIMP. To attain the “Consistency in the whole undertakings”, a rational task flow and close linkage between interested parties for irrigation development are 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 Clause 4.4. Consistency in the series of components proposed herein is carefully secured continuously keeping the conceptual feature shown in the figure in mind.

To attain the “Demand driven” principle soundly and to achieve the formulation without any substantial omissions, all valid results obtained through investigations inquired into problems and constraints are to be carefully analyzed. In the NIMP Study, several investigations and activities have been undertaken to investigate substantial constraints and inner meaning behind the outward signs. The series of

PCM workshops were typical. In addition, the "Problem Analysis on Selected Existing Irrigation Schemes" and "Inventory Survey" also gave noteworthy results on the problems and constraints concerning irrigation development.

Formulation of Subject-wise Improvement Programme is done through the process of; (i) identifying the problems and constraints of irrigation development, (ii) classifying the problems and constraints clarified, (iii) integrating problems and constraints into themes in consideration of their textures, (iv) formulating components so that signified problems and constraints are reflected without unnecessary omissions.

8.3.3 Formulation of Subject-wise Improvement Programme

The formulation of the Subject-wise Improvement Programme was carried out through the general process mentioned above.

(1) Arrangement of Problems and Constraints

Results of investigations related to the formulation of the Subject-wise Improvement Programme were arranged systematically in the courses of those investigations. Results of the Inventory Survey and PCM workshops and other studies were analyzed and presented in Figures 5.3.1 to 5.3.6.

(2) Classification of Problems and Constraints

Problems and constraints identified in those investigations are seemingly complicated and are sometimes duplicated. In order to reduce complexity, 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", and so on.

(3) Integration of Problems and Constraints into Themes

The advancing directions are subdivided into several themes at the process of irrigation development, namely, "Investigation and Survey", "Scheme Selection", "Planning", "Designing" and so on. In this respect, many numbers of themes are distributed on the texture between the directions and the developing processes as shown in Figure 8.3.1. Relationships between the themes and significant problems and constraints are summarized into Tables 8.3.1 and 8.3.2.

(4) Formulation of Components

Taking completed relationships 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 8.3.2, a total of 29 groups of components were identified to cover all requirements of improvement, and were categorized alphabetically from A to E by the aspect of conditions. However, some groups of components are not able to fulfill the objectives by themselves, and require the integrated approach with other similar components. Consequently, re-grouping of components was made, and finally 37 components were formed by the conceptualized aspects as shown in Tables 8.3.3 and 8.3.4. A linkage between the problems/constraints raised in the PCM workshops and 37 components of Subject-wise Improvement Programme is given in Figure 8.3.3.

From these formed components, a Project Design Matrix (PDM), or a Logical Framework, were individually prepared. All PDMs of the components were compiled in Appendix I.

Identification of redundancy between the proposed components and on-going (or planned to be implemented) projects is important and inevitable in order to avoid duplication of investments. The following on-going projects replace some related components.

List of Proposed Components Related to On-going Projects

No.	Proposed Component	Related On-going Projects	Status
B2	Contract Management System Improvement programme	RBMSIIP, ASPS-IC	To be updated and systematized.
C2.1	Planning Guideline Establishment Programme	RBMSIIP, ASPS-IC, PIDP	To be systematized.
C2.2	Designing Guideline Establishment Programme	RBMSIIP, ASPS-IC, PIDP	To be systematized.
C3.1	O&M Guideline Establishment Programme	ASPS-IC	To be systematized.
C4	Farmers' Participation in Irrigation Development Programme	SPFS, PIDP	To be generalized.
D3	Information and Database Improvement Programme	SUA*1, UDS*2	Partly related.
D4	Irrigation Development Contractors and Consultants' Listing Programme	RBMSIIP, ASPS-IC	To be updated and improved.
E1.6	Study of River-Basin Approach in Irrigation Development	RIPARWIN*3	Partly related.
E6.1	Irrigated Agriculture Training Programme for Rice Production Increase	JICA-KATC	Filled.
E7	Integrated Irrigation Development Model establishment Programme	JICA-SCSRD*4	Closely related.

**1: SUA(Soil-Water Management Research Group of the SOKOINE Univ. of Agr.) has prepared databases on water harvesting technology.*

**2: UDS(IRA of the Univ. of Dar es Salaam) has established GIS database system which is convenient for the tasks in irrigation development.*

**3: RIPARWIN(Project for Raising Irrigation Productivity and Releasing Water for Inter-Sectoral Needs) has been carried out by SUA.*

**4: JICA SCSRD (JICA's Project on SUA Centre for Sustainable Rural Development) has focused the integrated rural development which relate closely to irrigated agriculture development.*

8.3.4 Improvement Programme for the Year 2017

(1) Development Target

The subject-wise improvement aims at the creation of a foundation for the establishment of self-reliant irrigation development by a public sector and private sector partnership. Accordingly, the Subject-wise Improvement will be mostly executed in Short Term and Medium Term to be ready for the other projects of the Long Term. In Short Term, the executed programme focus is on fundamental themes such as institutional aspects and technical matters for the central government and farmers. In Medium Term, consideration is to be given to strengthening of LGAs on irrigation development in the light of decentralization.

(2) Stage-wise Development

Thirty-seven components are proposed in the Subject-wise Improvement Programme. These components will be implemented step by step based on the following aspects:

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

As a result, 29 components will be executed or started in the Short Term, and the remaining 8 components in the Medium Term as shown below:

List of Subject-wise Improvement Programme in Short Term

No.	Ref.	Components
1	A1	IS Institutional Improvement Programme
2	B1	IS Working Mandate Formulation Programme
3	B2	Contract Management System Improvement programme
4	B5	Cooperation Channeling within Irrigation-Sector Establishment Programme
5	B6	Sub-sectors Coordination System Establishment
6	C1	Survey and Investigation Guideline Establishment Programme
7	C2.1	Planning Guideline Establishment Programme
8	C2.2	Designing Guideline Establishment Programme
9	C3.1	O&M Guideline Establishment Programme
10	C3.2	Monitoring & Evaluation Guideline Establishment Programme
11	C4	Farmers' Participation in Irrigation Development Programme
12	C6	Farmers' O&M Manual Establishment Programme
13	C7	Establishment of DADP Formulation Guideline for Irrigated Agriculture Development
14	D1	Web-site and Networking Establishment Programme
15	D2	Technical Manuals Handling Guideline Establishment Programme
16	D3	Information and Database Improvement Programme
17	D4	Irrigation Development Contractors and Consultants' Listing Programme
18	D7	Existing-scheme Monitoring System Establishment Programme
19	E1.1	Irrigation Technology Research Center Establishment Programme

20	E1.2	Perennial Irrigation Method Improvement Programme
21	E1.3	Flood Irrigation Development Programme
22	E1.4	Small Dam Technology for Irrigation Development Establishment Programme
23	E1.5	Environmental Assessment Study for Irrigation Practice in Tanzania
24	E1.6	Study of River-Basin Approach in Irrigation Development
25	E3	IS's Equipment Management Programme
26	E4	Irrigation Development Contractors and Contractors' Training Programme
27	E5	Farmers' Participation Training Programme
28	E6.1	Irrigated Agriculture Training Programme for Rice Production Increase
29	E6.2	Irrigated Agriculture Training Programme for Cash Crops Production Increase

List of Subject-wise Improvement Programme in Medium Term

No.	Ref.	Components
1	A2	LGA Institutional Strengthening Programme for Irrigation Development
2	B3	Regulatory Networking System Establishment between LGAs and IS
3	B4	NGOs' Intervention in Irrigation Development Encourage Programme
4	C5	Village Irrigation Development Guideline Establishment Programme
5	D5	LGAs' Data Organization Programme
6	D6	LGA Networking System Establishment Programme
7	E2	Hydraulic Experimental Center Establishment Programme
8	E7	Integrated Irrigation Development Model Establishment Programme

Figure 8.3.4 shows the details of implementation schedule. Recently, a village irrigation scheme, sized less than 30 ha was observed under development. The scheme was being implemented on the basis of farmers' initiative without public intervention. To promote this scheme, the preparation of "Village Irrigation Development Guideline Establishment Programme" and "Integrated Irrigation Development Model Establishment Programme" is included in the Subject-wise Improvement Programme.

8.4 Scheme-wise Development Programme

8.4.1 Irrigation Development at National Level

As discussed in Clause 7.10, the possible irrigation development areas by 2017 are estimated at 405,400 ha under the "High Case" of financial resources. This area is the result of developing 626 irrigation schemes which are selected from the "A" and "B" Groups and Part of "C" Group as discussed in Clause 7.9 of this Main Report. The breakdown of 626 irrigation schemes is as follows:

Irrigation Development Areas by 2017

Type of Development	Nos.	Total Irrigation Area
Rehabilitation of Traditional Irrigation Schemes	462	274,600 ha
Rehabilitation/ New Construction of Water Harvesting Schemes	122	68,200 ha
New Construction of Smallholder Irrigation Schemes	42	62,600 ha
Total	**626**	**405,400 ha**

Source: JICA Study Team

8.4.2 Irrigation Development at Regional Level

The irrigation development programmes by each development type and Region are shown in the following table:

Irrigation Development Areas by 2017

Unit: ha

Region	Rehabilitation of Traditional Irrigation Schemes	Rehabilitation/ New Construction of Water Harvesting Schemes	New Construction of Smallholder Irrigation Schemes	Total
Arusha	62,200	800	1,100	64,100
Coast	900	400	6,900	8,200
Dar es Salaam	0	0	0	0
Dodoma	1,800	11,400	200	13,400
Iringa	13,200	0	800	14,000
Kagera	600	0	0	600
Kigoma	11,000	1,600	0	12,600
Kilimanjaro	68,600	0	13,400	82,000
Lindi	6,200	1,200	1,900	9,300
Mara	0	2,800	100	2,900
Mbeya	52,100	0	7,100	59,200
Morogoro	25,800	3,800	24,500	54,100
Mtwara	2,100	2,700	0	4,800
Mwanza	400	12,900	2,300	15,600
Rukwa	7,000	400	1,200	8,600
Ruvuma	2,100	1,600	1,200	4,900
Shinyanga	900	10,900	100	11,900
Singida	0	8,500	0	8,500
Tabora	2,200	8,800	1,500	12,500
Tanga	17,500	400	300	18,200
Total	**274,600**	**68,200**	**62,600**	**405,400**

Source: JICA Study Team

8.4.3 Development Programme for the Year 2017

Based on the results of prioritization of irrigation schemes and possibly available development budget in High Case scenario, that is US$ 454 million for 15 years, the irrigation development areas for 3 terms are determined as follows:

Accumulated Irrigation Development Area

Type of Irrigation Schemes to be Developed	Short Term 2003 - 2007	Medium Term by 2012	Long Term by 2017
(a) Rehabilitation of Traditional Irrigation Scheme	179.800 ha	216,100 ha	274,600 ha
(b) Development of Water Harvesting Schemes	41,600 ha	57,200 ha	68,200 ha
(c) New Smallholder Schemes	43,800 ha	51,600 ha	62,600 ha
Total	**265,200 ha**	**324,900 ha**	**405,400 ha**

Source: JICA Study Team

Details of scheme-wise development are mentioned in Appendix G.

8.5 Future Paddy Production

As discussed in Clause 7.10, irrigation development area of 405,400 ha would contribute to achievement of rice self-sufficiency by 2017 at national level. As well, rice status at regional level should also be examined taking into consideration the policy of “suitable product in suitable land” as mentioned in Clause 7.7. The comparison of projected demand of rice and development of

selected priority schemes indicates the following surplus and shortage of rice in 2017 at regional level.

Rice Status in 2017 at Regional Level

Region	Cultivated Area (ha)		Production (ton)			Demand	Balance
	Rainfed	Irrigated	Rainfed	Irrigated	Total	(ton)	(ton)
Arusha	6,100	9,500	3,100	18,600	21,700	78,900	-57,200
Coast	37,500	8,900	54,800	35,700	90,500	32,200	58,300
Dar es Salaam	0	0	0	0	0	86,900	-86,900
Dodoma	1,100	1,400	500	1,000	1,500	64,100	-62,600
Iringa	6,400	4,500	6,700	14,900	21,600	64,500	-42,900
Kagera	1,700	200	2,600	600	3,200	72,600	-69,400
Kigoma	2,700	7,200	4,100	22,500	26,600	45,800	-19,200
Kilimanjaro	1,800	12,900	1,700	31,000	32,700	76,700	-44,000
Lindi	8,600	8,000	11,600	36,000	47,600	32,400	15,200
Mara	700	1,400	1,100	6,400	7,500	52,700	-45,200
Mbeya	18,700	71,200	18,800	260,700	279,500	81,600	197,900
Morogoro	48,600	43,300	52,000	122,900	174,900	66,400	108,500
Mtwara	23,700	2,100	24,700	8,000	32,700	42,200	-9,500
Mwanza	67,600	19,900	102,200	78,300	180,500	99,300	81,200
Rukwa	25,200	9,200	48,200	40,100	88,300	42,400	45,900
Ruvuma	13,600	2,400	29,400	4,100	33,500	44,100	-10,600
Shinyanga	94,300	9,900	42,300	22,900	65,200	96,200	-31,000
Singida	5,800	6,200	2,000	15,100	17,100	41,500	-24,400
Tabora	45,000	9,400	41,100	10,200	51,300	53,800	-2,500
Tanga	7,500	19,300	5,900	59,800	65,700	66,200	-500
Total	**416,600**	**246,900**	**452,800**	**788,800**	**1,241,600**	**1,240,500**	**1,100**

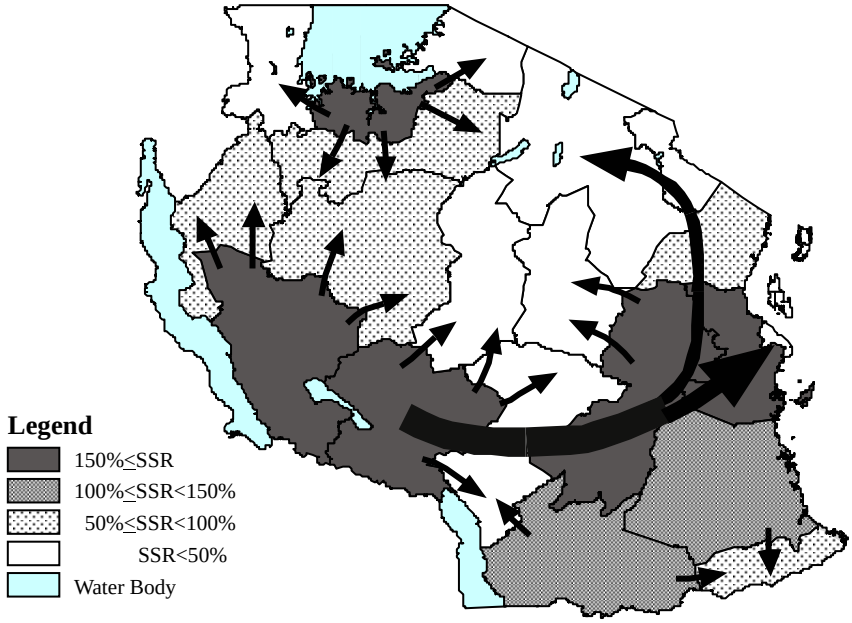
Source: JICA Study Team

As can be seen in this table, rice surplus in 2017 would occur in 5 regions out of 20 regions. Judging from the surplus amount of rice and road condition, the following distribution plan is recommended:

- Surplus rice in Mwanza region will be supplied for surrounding areas only because of poor road condition.
- Surplus rice in Rukwa region will be supplied for its northern and eastern areas and also for Dar es Salaam through national road.
- Surplus rice in Mbeya region will be supplied for its eastern areas and also for Dar es Salaam through national road.
- Surplus rice in Morogoro region will be supplied for its northern areas and also for Dar es Salaam and Kilimanjaro and Arusha regions via national road.
- Surplus rice in Coast region will be supplied for Dar es Salaam and Kilimanjaro and Arusha regions through national road.

The following figure presents the flow of surplus rice:

Flow of Rice on Regional Basis



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

The irrigation potential map which is prepared from viewpoints of water resources potential, land resources potential and socio-economic potential as explained in Clause 6.5, clarifies the extent of irrigation potential areas, out of which high potential areas extend over Mwanza, Arusha, Kilimanjaro, Morogoro, and Mbeya. New irrigation schemes should be therefore selected by referring to this irrigation potential map.

8.6 Cost Estimate on NIMP Implementation

(1) Subject-wise Improvement

Costs and programme period were estimated on the basis of the general plan as designed in the PDMs attached in Appendix I. Total required cost for implementation of all components (excluding the component of E6.1 in Table 8.3.3, because similar project JICA-KATC Phase-II has been commenced), was preliminarily estimated at US$ 23.0 million as shown in Table 8.6.1. The required implementation period of the components are also shown in the same table. The annually required cost is estimated based on the implementation period.

Annually Required Cost

Item	'03	'04	'05	'06	'07	'08	'09	'10	'11 – '17	Total
Subject –wise Improvement	2.5	4.0	4.3	4.6	4.7	1.4	0.9	0.6	-	23.0

Unit : million US$

(2) Scheme-wise Improvement

The project cost for irrigation schemes is estimated by referring to the guidelines

on irrigation development level discussed in Clause 7.4. The estimated project costs for 626 irrigation schemes selected in Sub-clause 8.4.3, are shown below:

Annually Required Cost for Scheme-wise Development

Items	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	Total
Total	6.1	15.4	23.5	27.6	30.8	34.3	36.0	36.7	37.7	41.4	47.2	49.5	52.6	55.5	58.9	553.1
GOT[1]	4.9	12.3	18.8	22.1	24.6	27.4	28.8	29.4	30.1	33.1	37.8	39.6	42.1	44.4	47.1	442.5
Farmers[2]	1.2	3.1	4.7	5.5	6.2	6.9	7.2	7.3	7.5	8.3	9.4	9.9	10.5	11.1	11.8	110.6

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

(3) On-going Irrigation Projects

Currently, the following projects are being executed with donors' assistance:

Budget for On-going Irrigation Projects

Project	Duration	Budget (US$ million)				Remarks
		2003	2004	2005	Total	
ASPS-IC	1998 - 2002	-	-	-	-	IC is not planed
PIDP	2000 - 2006	6.0	6.0	2.6	14.6	by 2005
RBMSIIP	1996 - 2002	3.0	-	-	3.0	Up to June 2003
SPFS	2002 - 2004	0.07	0.07	-	0.14	Irrigation only
Total		9.07	6.07	2.6	17.74	Irrigation only

The budget for these projects is regarded as a committed cost for the required cost estimate for irrigation development.

(4) Total Implementation Cost

The total implementation cost for the NIMP is estimated at US$ 593.9 million (including US$ 110.6 million of Farmers' contribution), is broken down to US$ 23.0 million for the subject-wise improvement, US$ 553.1 million for the scheme-wise development and US$ 17.8 million for on-going irrigation projects. The table below shows the comparison of the required cost for NIMP implementation (excluding farmers' sharing cost) with the projected development expenditures:

Annually Required Cost for Scheme-wise Development

Items	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	Total
Project Development Budget (High Case)																
	18.7	20.0	21.4	22.8	24.4	26.0	27.8	29.8	31.8	34.0	36.4	38.9	41.7	44.6	47.7	466.0
Government Shared Cost																
Scheme	4.9	12.3	18.8	22.1	24.6	27.4	28.8	29.4	30.1	33.1	37.8	39.6	42.1	44.4	47.1	442.5
Subject	2.5	4.0	4.3	4.6	4.7	1.4	0.9	0.6	-	-	-	-	-	-	-	23.0
On-going	9.1	6.1	2.6	-	-	-	-	-	-	-	-	-	-	-	-	17.8
Total	16.5	22.4	25.7	26.7	29.3	28.8	29.7	30.0	30.1	33.1	36.4	39.6	42.1	44.4	47.1	483.3
Balance	2.2	-2.4	-4.3	-3.9	-4.9	-2.8	-1.9	-0.2	1.7	0.9	-1.4	-0.7	-0.4	0.2	0.6	-17.3

Unit: Million US$

The comparison shows that the required cost would be slightly higher than projected development budget for some years, therefore these deficits are expected to be arranged by the GOT. In addition, participation of private sector in

irrigation development would mitigate this financial load on the government.

(4) Operation and Maintenance Cost

As discussed in Sub-clause 7.3.2, the projected operation and maintenance budget is estimated at US$ 9.01 million (Tsh. 85.9 billion equivalent) for 15 years, of which breakdown is given below:

Annual Operation and Maintenance Budget for High Case

Unit	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	Total
Tsh.[1]	3.4	3.7	3.9	4.2	4.5	4.8	5.1	5.5	5.9	6.3	6.7	7.2	7.7	8.2	8.8	85.9
US$[2]	0.36	0.39	0.41	0.44	0.47	0.50	0.54	0.58	0.62	0.66	0.70	0.75	0.81	0.86	0.92	9.01

1 : Billion Tsh., 2 : Million US$

The operation and maintenance cost is assumed to be US$ 15/ha, consisting of US$ 5/ha for government and US$ 10/ha for farmers. From this, the government's shared cost would be estimated at US$ 1.79 million (Tsh 17.0 million equivalent) in 2017 and its annual sharing cost would be as follows:

Annual Operation and Maintenance Cost for High Case

Unit	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	Total
Projected Government Budget																
US$[2]	0.36	0.39	0.41	0.44	0.47	0.50	0.54	0.58	0.62	0.66	0.70	0.75	0.81	0.86	0.92	9.01
Government Shared Cost																
US$[2]	0.97	0.99	1.02	1.09	1.16	1.21	1.24	1.34	1.38	1.42	1.49	1.56	1.64	1.72	1.79	20.02
Balance																
US$[2]	-0.61	-0.60	-0.61	-0.65	-0.69	-0.71	-0.70	-0.76	-0.76	-0.76	-0.79	-0.81	-0.83	-0.86	-0.87	-11.01

1 : Million US$

From this comparison, the projected government budget for operation and maintenance are nearly half of the required ones. These deficits should be allocated from the local fund of the government.

8.7 Appropriateness of Investment to Irrigation Development

The implementation of the NIMP consisting of 37 components of Subject-wise Improvement Programme and 626 irrigation schemes of Scheme-wise Development Programme, and will require about US$ 503.8 million for 15 years (government portion only). This implementation would produce a possibility of self-sufficiency of rice by 2017. In addition, the NIMP implementation would also bear the following other benefits to Tanzania:

(1) Creation of Job Opportunity

The implementation of irrigation schemes will promise stable water resource for irrigation. This will bring about a possibility of increase in agricultural production, which will encourage farmers to invest of capital to agricultural inputs such as purchase of seeds, fertilizers, agricultural chemicals and labour employment,

aiming at higher production. As a result, agricultural labour would increase 176 man-day/ha by 62 man-day/ha, and would additionally need 38 million man-day at full-development at 2017. This is big job opportunity creation in rural areas, which will lead to other growth in the rural area also.

(2) Poverty Reduction of Smallholders by Increase of Farm Income

Smallholders account for about 80 % of all farmers in the Mainland, and most are below the poverty line. Average farm income per one crop season for smallholder is estimated at US$ 143/ha (Tsh.136,000/ha) without irrigation development, increasing to an estimated US$ 450/ha (Tsh.427,000/ha) with irrigation development. Such a farm income improvement, approximately three times of current farm income would be highly expected to contribute to poverty reduction.

(3) Saving of Foreign Currency for Rice Import

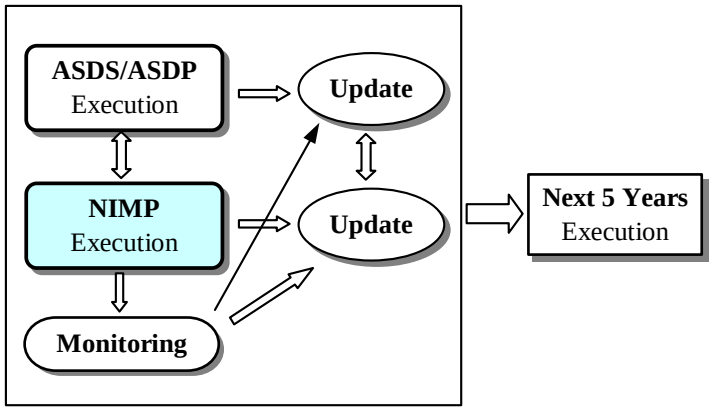
According to demand projection as mentioned in Sub-clause 7.3.3, demand of rice is estimated at 1,239,000 tons at 2017. The NIMP implementation would bring about a possibility of self-sufficiency of rice by 2017. If the NIMP were not implemented, rice shortage would occur every year, amounting to some 300,000 tons at 2017. This rice shortage at 2017 would require the foreign currency of about US$ 69 million for import of rice at 2002 current price (Tsh.220/kg). The NIMP implementation would therefore largely contribute to saving of such foreign currency.

With the above study result, it is judged that investment of US$ 503.8 million to the NIMP implementation would be appropriate from national viewpoint.

8.8 Need of Updating of NIMP

The NIMP provides the overall framework and strategies for irrigation development toward the year 2017, and is generally consistent with the ASDS. The ASDS only represents a time slice of 5 years from 2002 to 2007. As well, the ASDP is defined as a five-year rolling programme targeting the same period with the ASDS. This means that the ASDS

Monitoring and Update of NIMP



and ASDP require to be updated every 5 years. The NIMP also requires to be updated in conformity with the updated ASDS and ASDP, and in view of the actual progress of scheme-wise development and subject-wise improvement. In order to control the actual progress accurately, monitoring is essential. In particular, the monitoring shall focus on the effect of subject-wise improvement, and its results shall be reflected upon the update of the NIMP. The monitoring and update of the NIMP will be carried out by the central government, namely Irrigation Section of the MAFS in cooperation with the LGAs.

8.9 Tentative PDM for Implementation of NIMP

Based on the study results mentioned above, a tentative PDM for implementation of the NIMP was prepared as shown in Table 8.9.1.

CHAPTER 9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

The Study presents the framework and strategies for sustainable irrigation development for the Mainland with the target year of 2017, aiming to contribute to the creation of an enabling and conducive environment for improving productivity and profitability of the agricultural sector.

In order to achieve this aim, the Study selected "*Sustainable Irrigation Development*" as the primary purpose of the NIMP with emphasis on comprehensive measures through "*Effective Use of National Resources*", and prepared the development programme toward the year 2017 considering five elements: Economically Sound, Technically Appropriate, Sociologically Sustainable, Environmentally Friendly and Institutionally Reliable. The development programme consists of 37 components for a Subject-wise Improvement Programme and 626 irrigation schemes for a Scheme-wise Development Programme, including 29 on-going projects selected from the inventorized 1,426 irrigation schemes.

These proposed components and schemes were grouped by implementation horizon, namely Short Term (2003–2007), Medium Term (by 2012) and Long Term (by 2017), taking into account the need for urgent execution of the Subject-wise Improvement Programme and a priority ranking for the Scheme-wise Development Programme.

It is expected that completion of the proposed Scheme-wise Development Programme supported by the Subject-wise Improvement Programme will increase the rice production from the current 785,000 tons to 1,239,000 tons by 2017. This increase would likely meet the future demand for rice by 2017, provided that inter-sectoral coordination is successfully executed. The increase would also bring about the saving of about US$69 million that is estimated to be required for rice imports by 2017. It would also result in an increase in the farm income of smallholders. The income increase per crop season would be estimated at US$ 450 for smallholders, about three times the present income. Furthermore, it would contribute to the creation of job opportunities. The additionally required farm labor would be estimated at 38 million man-days at the national level. From these impacts, it can be seen that investment in the implementation of the proposed Scheme-wise Development Programme supported by the Subject-wise Improvement Programme would be in the national interest.

In preparation of the development programme, the Study established a prioritization system for the implementation of many irrigation schemes, and conducted a ranking for implementation using the data and information obtained through inventory survey. The availability of data and information on the schemes largely affected the priority ranking, and therefore it is essential to check the availability of data regularly, and to review and modify the selected schemes for early implementation using the updated data and information.

9.2 Recommendations

(1) Urgent Commencement of NIMP Implementation

The food shortage poses a serious problem in the Mainland. The increasing population pressure will further aggravate the situation if appropriate countermeasures are not taken on time. Irrigation development is a key factor to improve the productivity in agriculture. It is therefore recommended that the NIMP be implemented as early as possible.

(2) Urgent Need of Strengthening the Irrigation Section

The Study presents the needs of implementation of 37 components in the Subject-wise Improvement Programme and 626 irrigation schemes in the Scheme-wise Development Programme. The Irrigation Section of MAFS shall be responsible for smooth implementation of the programme, as a coordination agency for the different organizations involved. However, the present constitution of the Irrigation Section of MAFS, unfortunately, makes it unable to achieve the demarcated roles of coordinating and harmonizing the different organizations pertaining to irrigation development and, more importantly, unable to make prompt decisions. The Section also needs stronger mandates of the personnel administration and budget allocation and generally requires a stronger institutional and organizational position.

The Institutional Strengthening of the Irrigation Section has the following three subcomponents:

- Promotion of the Irrigation Section to Departmental status
- Strengthening of Monitoring Function
- Reform of Zonal Irrigation Office conforming to the LGRP

The plan should be a stage-wise programme responding to the Short Term (2003-2007), the Medium Term (by 2012) and the Long Term (by 2017). In order to smoothly implement the stage-wise reform plan of the Irrigation Section, it is essential to organize a task force of experts as an important first step toward sustainable and self-reliant irrigation development and a trigger of other institutional developments.

(3) Legal Framework Strengthening for Irrigation Development

A sound legal framework is a prerequisite for successful farmers-oriented irrigation development, empowering farmers and the other private sectors to enable them to secure ownership and to take full responsibility for all decisions and matters involved in development, operation and management of the irrigation schemes. Legal status of irrigators' groups, land tenure and water right, 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, such as the Land Acts, the Water Act, the Cooperatives Act, the Societies Ordinance, etc. In particular, a new legal framework exclusively for the irrigators' groups appears to be very important and necessary for securing their ownership and self-reliable 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 Irrigation Section in cooperation with the relevant governmental agencies, lawyers and technical specialists. The consultancy work should be coordinated with the amendments of Water Act.

(4) Arrangement of Financial Resource for NIMP Implementation

The inadequate financial resource is one of major constraints which may hinder the satisfactory implementation of the NIDP. In this Study, the financial resource envelope for irrigation development was assessed using past actual development expenditures allocated to the irrigation development and assuming an increase in the government budget in proportion to GDP growth rate, through the sensitivity analysis on three cases (High Case, Base Case and Low Case). The sensitivity analysis for the High Case projects the financial resource envelope at US$454 million for 15 years from 2003 to 2017, and would enable implementation of 37 components of the Subject-wise Improvement Programme and 626 Scheme-wise Development Programme projects (including 29 on-going projects with the slight possibility of deficit for operation and maintenance costs). This NIMP implementation for the High Case would also bring about the possibility of meeting the future demand of rice by 2017. It is therefore recommended that the GOT should arrange the necessary budget for the NIMP implementation, noting the study results mentioned above.

(5) Irrigation Development in River basin Management

Recently, a focus has been put on a river basin management approach from the viewpoint of effective use of water resources among many different stakeholders. This approach is considered reasonable and acceptable but it is important to

evaluate the effective use of water resources without a prejudice view such as consideration of economic return only. Over 70% of the total labor population is engaged in agricultural activities, and water is required both for domestic and agricultural purposes. Over 87% of all poor people live in rural areas where agriculture is a mainstay in livelihood. Under such situations, the effective use of water resources should be evaluated from an overall viewpoint, not just an economic viewpoint. On the other hand, irrigation also should be required to reduce water loss and more efficient overall water use.

(6) Need of Inter-sectoral and Inter-ministerial Coordination

Irrigation provides an effective environment for stability and increase of agricultural production. There is no doubt that while irrigation itself directly links with the stability of agricultural production, improvements to irrigation become a major factor for creating the physiological suitable environment for enhancing the agricultural production. Irrigation by itself could not realize the remarkable increase of agricultural production without assistance from other sub-sectors such as agricultural inputs and extension services. It is therefore recommended that other sub-sectors for agricultural inputs and agricultural extension services should be developed under the close inter-coordination with the irrigation sub-sector to enhance the respective effects on agricultural production.

In addition, a stable water resource is essential for irrigation development. In order to create sound watershed conditions required for stable water resource, it is important to keep in close communication with other sectors such as the forestry sector.

(7) Need of Updating of NIMP

The NIMP provides the overall framework and strategies for irrigation development toward the year 2017, and is based on the ASDP and the ASDS. The ASDP, which is defined as a 5-year rolling programme, will require updating every 5 years. The NIMP also needs to be updated at least every 5 years in conformity with the ASDP. If actual progress of scheme-wise development and subject-wise improvement are not satisfactory, and/or additional data on the irrigation schemes become available, the NIMP should be updated without waiting for the five-yearly review.

In order to grasp the actual progress accurately, monitoring is essential. In particular, the monitoring should focus on the effect of subject-wise improvement, and its results should be reflected in an update of the NIMP. The monitoring and update of the NIMP should be carried out by the central government, namely Irrigation Section of MAFS in cooperation with LGAs.