No. 3

MINISTRY OF IRRIGATION, POWER AND ENERGY
THE GOVERNMENT OF THE DEMOCRATIC
SOCIALIST REPUBLIC OF SRI LANKA

JAPAN INTERNATIONAL
COOPERATION AGENCY

THE FEASIBILITY STUDY ON THE REHABILITATION OF IRRIGATION AND DRAINAGE SYSTEMS IN THE RIVER BASINS OF SOUTHERN SRI LANKA

VOLUME II

APPENDIXES-1
(MASTER PLAN STUDY)

SEPTEMBER 1996

CHUO KAIHATSU CORPORATION
AERO ASAHI CORPORATION

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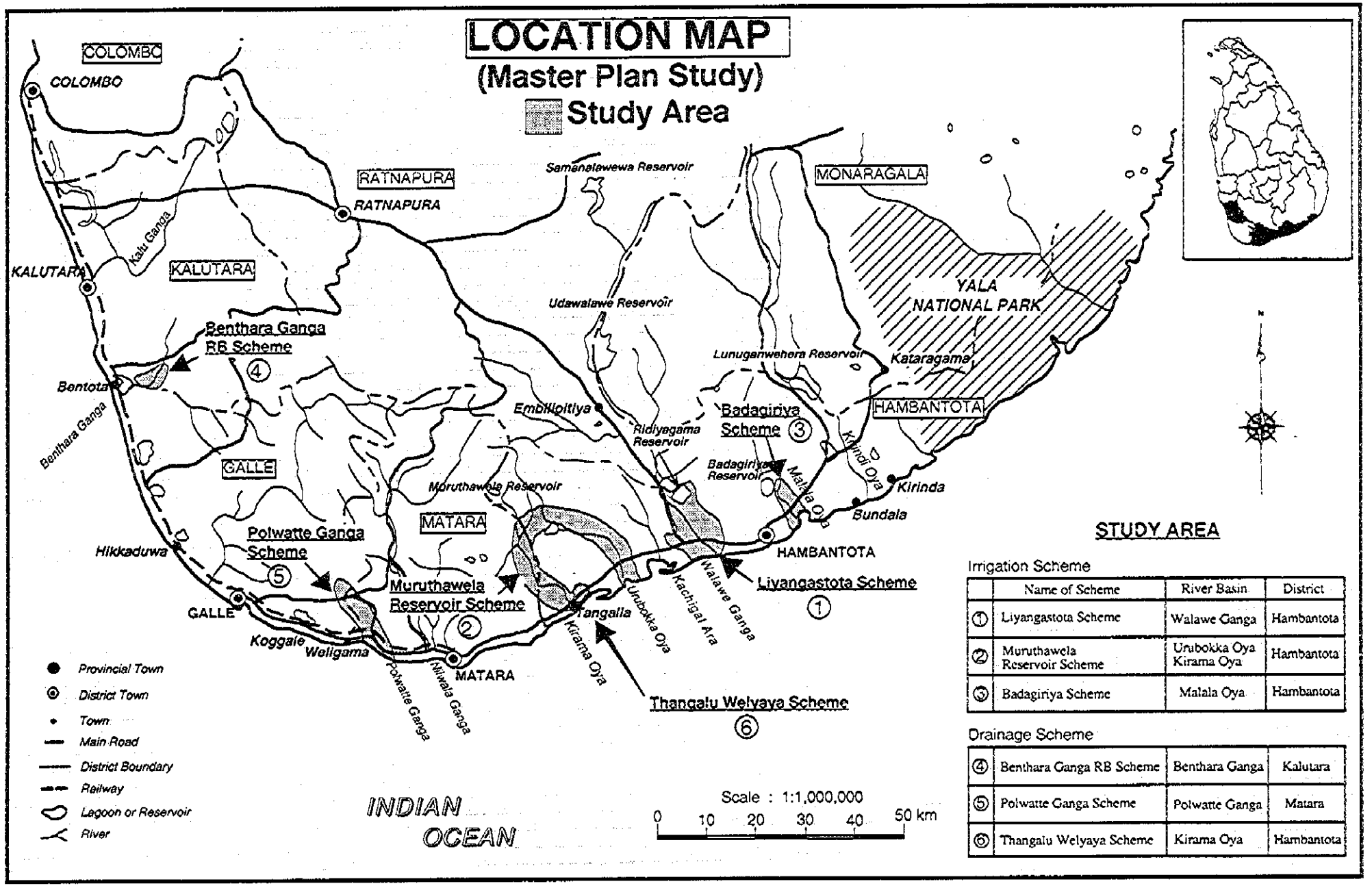


STUDY AREA

Irrigation Scheme

	Name of Scheme	River Basin	District
①	Liyangastota Scheme	Walawe Ganga	Hambantota
②	Muruthawela Reservoir Scheme	Urubokka Oya Kirama Oya	Hambantota
③	Badagiriya Scheme	Malala Oya	Hambantota

Drainage Scheme

④	Benthara Ganga RB Scheme	Benthara Ganga	Kalutara
⑤	Polwatte Ganga Scheme	Polwatte Ganga	Matara
⑥	Thangalu Welyaya Scheme	Kirama Oya	Hambantota

APPENDIXES-1 (MASTER PLAN STUDY)

TABLE OF CONTENTS

Location Map
Table of Contents
Abbriviations
Conversion Table

Page

CHAPTER ONE: INTRODUCTION

1.1 Objectives and Scope of the Study 1-1
1.2 Study Area 1-1
1.3 Related Government Agencies 1-2
1.4 Progress of the Study 1-2

CHAPTER TWO: BACKGROUND

2.1 National Economic Development Plan 2-1
2.2 Agricultural Sector 2-2
2.2.1 Agriculture 2-2
2.2.2 Irrigation and Rehabilitation Plan 2-3
2.3 National Environmental Strategy 2-3
2.4 Southern Region Development Strategy 2-4
2.5 Economic Conditions 2-6

CHAPTER THREE: EXPERIENCE AND LESSONS RELATED TO REHABILITATION

3.1 Irrigation Rehabilitation Projects 3-1
3.1.1 Tank Irrigation Modernization Project (TIMP) 3-1
3.1.2 Gal Oya Water Management Project 3-5
3.1.3 Major Irrigation Rehabilitation Project (MIRP) 3-7
3.1.4 Uda Walawe Rehabilitation Project 3-11
3.1.5 Irrigation Systems Management Project (ISMP) 3-14
3.2 Drainage Projects 3-19
3.2.1 Gin Ganga Regulation Project 3-19
3.2.2 Nilwala Ganga Flood Protection Scheme 3-22
3.3 Participatory Management Programs 3-24
3.4 Experiences and Lessons 3-32
3.4.1 Lessons Learned 3-32
3.4.2 Identification of Experience of FOs in Polonnaruwa 3-34

CHAPTER FOUR: PRESENT CONDITION OF SOUTHERN REGION

4.1 Natural Condition 4-1
4.2 Agro-economy 4-7

4.2.1 Agriculture 4-7
4.2.2 Livestock Industry 4-21
4.2.3 Fisheries Industry 4-23
4.2.4 Rural Industry 4-23
4.3 Socio-Economic Conditions 4-26
4.3.1 Rural Infrastructure 4-26
4.3.2 Poverty Alleviation 4-29
4.4 Land Use 4-30
4.4.1 General Land Use 4-30
4.4.2 Farm Land Use 4-30
4.5 Irrigation Development 4-31
4.6 Drainage Development 4-32
4.6.1 General 4-32
4.6.2 Representative Schemes Under the Category of Drainage 4-32
4.7 Environmental Conditions 4-33
4.7.1 Soil Erosion 4-33
4.7.2 Waterlogging and Salinity in Soil 4-33
4.7.3 Wildlife 4-33
4.7.4 Health 4-35
4.7.5 Education 4-38
4.7.6 Fishery 4-39
4.7.7 Women's Situation 4-39
4.8 Related Agencies 4-41

CHAPTER FIVE: PRESENT CONDITIONS OF STUDY AREAS

5.1 Meteorology and Hydrology 5-1
5.2 Liyangastota Scheme 5-25
5.2.1 Irrigation and Drainage System 5-25
5.2.2 Agriculture 5-37
5.2.3 Farmer Organizations 5-39
5.2.4 Management of System 5-42
5.2.5 Environmental Issues 5-43
5.3 Muruthawela Reservoir Scheme 5-55
5.3.1 Irrigation and Drainage System 5-55
5.3.2 Agriculture 5-85
5.3.3 Farmer Organizations 5-87
5.3.4 Management of System 5-89
5.3.5 Environmental Issues 5-91
5.4 Badagiriya Scheme 5-93
5.4.1 Irrigation and Drainage System 5-93
5.4.2 Agriculture 5-106
5.4.3 Farmer Organizations 5-108
5.4.4 Management of System 5-110
5.4.5 Environmental Issues 5-111
5.5 Kachigala Ara Scheme 5-114

5.5.1 Irrigation and Drainage System 5-114
5.5.2 Agriculture 5-119
5.5.3 Farmer Organizations 5-120
5.5.4 Management of System 5-120
5.5.5 Environmental Issues 5-120
5.6 Benthara Ganga Right Bank Scheme 5-123
5.6.1 Irrigation and Drainage System 5-123
5.6.2 Agriculture 5-132
5.6.3 Farmer Organizations 5-134
5.6.4 Management of System 5-135
5.6.5 Environmental Issues 5-136
5.7 Polwatte Ganga Scheme 5-139
5.7.1 Irrigation and Drainage System 5-139
5.7.2 Agriculture 5-144
5.7.3 Farmer Organizations 5-145
5.7.4 Management of System 5-146
5.7.5 Environmental Issues 5-146
5.8 Thangalu Welyaya Scheme 5-148
5.8.1 Irrigation and Drainage System 5-148
5.8.2 Agriculture 5-153
5.8.3 Farmer Organizations 5-154
5.8.4 Management of System 5-154
5.8.5 Environmental Issues 5-155

CHAPTER SIX: FORMULATION OF REHABILITATION PLAN

6.1 Basic Approach 6-1
6.2 Rehabilitation of Irrigation Systems 6-3
6.2.1 Design Area under the Plan 6-3
6.2.2 Estimate of Irrigation Water Requirement 6-3
6.2.3 Proposed Water Utilization for each Plan 6-8
6.2.4 Rehabilitation Plan for Liyangastota Scheme 6-10
6.2.5 Rehabilitation Plan for Muruthawela Reservoir Schem 6-12
6.2.6 Rehabilitation Plan for Badagiriya Scheme 6-13
6.3 Rehabilitation of Drainage Systems 6-27
6.3.1 General Concepts and Engineering Approach for Rehabilitaion . . 6-27
6.3.2 Rehabilitation Plan for Benthara Ganga Right Bank Scheme 6-28
6.3.3 Rehabilitation Plan for Polwatte Ganga Scheme 6-30
6.3.4 Rehabilitation Plan for Thangalu Welyaya Scheme 6-30
6.4 Agricultural Development 6-44
6.4.1 Basic Concept 6-44
6.4.2 Present and Proposed Cropping Pattern 6-45
6.4.3 Proposed Farming Practice 6-50
6.4.4 Expected Yields and Production 6-51
6.4.5 Crop Budget 6-52
6.5 Institutional Strengthening 6-53

6.6 Improvement of System Management 6-58
6.6.1 Government Policy of System Management 6-58
6.6.2 Program for Handling over to DCs 6-58
6.6.3 Basic Plan 6-61
6.7 Environmental Conservation Plan 6-64
6.7.1 Basic Concept 6-64
6.7.2 Related Legislation and National Action Plan 6-66
6.7.3 IEE 6-68
6.7.4 Alleviation and Conservation Plan 6-80
6.7.5 Participation of Farmers 6-86
6.7.6 Elevaion of Women's Situation 6-86
6.7.7 Education and Subsidy for Farmers 6-86
6.8 Economic Evaluation 6-87
6.8.1 Objective of Project Evaluation 6-87
6.8.2 Methodology 6-87
6.8.3 Financial Evaluation and Economic Evaluation 6-87

CHAPTER SEVEN: SELECTION OF THE SCHEMES

7.1 Criteria for Selection of the Schemes 7-1
7.2 Ranking of the Schemes 7-2
7.3 Schemes Proposed for Feasibility Study 7-3

Annexes

Annex-1 Agriculture
Annex-2 Agro-economy
Annex-3 Environment
Annex-4 Farmer Organizations
Annex-5 Facility Design and Cost Estimation
Annex-6 Hydrology
Annex-7 Record of the Meetings

LIST OF TABLES

		Page
Table 3.1.1-1	Major Cost Components of TIMP (in 1976 currency)	3-4
Table 3.1.2-1	Cost Composition of the Gal Oya Water Management Project (in 1978 Currency)	3-6
Table 3.1.3-1	Cost Components of MIRP (in 1984 Currency)	3-10
Table 3.1.4-1	Cost Composition of the Uda Walawe Rehabilitation Project (in 1985 Currency)	3-13
Table 3.1.5-1	Schemes Covered by ISMP and Their Areas	3-15
Table 3.1.5-2	Cost Composition of ISMP (in 1985 Currency)	3-17
Table 4.7-1	Plant Communities by Bioclimatic Zone	4-34
Table 4.7-2	Number of Endemic Species by Bioclimatic Zones	4-34
Table 4.7-3	Leading Causes of Hospitalization, 1988	4-36
Table 4.7-4	Source of Drinking Water in Southern Region in %	4-36
Table 4.7-5	Type of Toilets in Southern Region in %	4-37
Table 4.7-6	Number of Students and Dropout Rate in 1993	4-38
Table 4.7-7	Literacy Rate of Persons 10 Years and Over in Southern Reagion (1981)	4-38
Table 4.7-8	Active Fishermen Population (1989) and Main Fish Production (1991)	4-39
Table 4.7-9	Literacy Rates in the Urban and Rural Sector in Sri Lanka, 1981	4-40
Table 5.1-1	Schemes and Their Relevant Basins and Basin Catchment Areas	5-1
Table 5.1-2	Available Meteorological Data	5-4
Table 5.1-3	Available Rainfall Data	5-11
Table 5.1-4	Summary of Climate Condition of Target Areas	5-5
Table 5.1-5	Monthly Mean Rainfall and Annual Total of Each Rainfall Gauging Station	5-12
Table 5.1-6	Max. Daily Rainfall, Max. 3 Days Rainfall and Max. 5 Days Rainfall	5-13
Table 5.1-7	Probable Annual Rainfall at Each Rainfall Gauging Station / Flood Year	5-14
Table 5.1-8	Probable Annual Rainfall at Each Rainfall Gauging Station / Drought Year	5-15
Table 5.1-9	Probable Max. Daily Rainfall, Max. 3 Days Rainfall and Max. 5 Days Rainfall	5-16
Table 5.1-10 (1/2)	Probable Areal Rainfall of Each River Basin	5-17
Table 5.1-10 (2/2)	Probable Areal Rainfall of Each River Basin	5-17
Table 5.1-11	Availability of Hydrological Data	5-6
Table 5.1-12	Monthly Mean Runoff	5-6
Table 5.1-13	Daily Mean Discharge Data of Polwatte Ganga at Yakkalamulla	5-18
Table 5.1-14	Sea Level Observed at Colombo Port	5-10
Table 5.1-15	Sea Level in Southern Region	5-10

Table 5.2.1-1	Parameters of Irrigation System of Liyangastota Scheme	5-31
Table 5.2.1-2	Water Issue Records in Present Cropping Pattern and Water Balance Calculation for Ridiyagama Tank	5-32
Table 5.2.1-3	Existing Field Water Requirement for Paddy (105 Days Variety)	5-33
Table 5.2.3-1	Project Management Committee of Liyangastota-Left Bank (Ridiyagama)	5-40
Table 5.2.5-1	Results of Soil Analysis	5-46
Table 5.2.5-2	Results of Water Quality Analysis	5-47
Table 5.2.5-3	Approximate Limits of Salinity Classes for Soil	5-48
Table 5.2.5-4	Classification of Irrigation Water Quality	5-48
Table 5.3.1-1	Parameters of Irrigation System of Muruthawela LB Scheme	5-69
Table 5.3.1-2	Parameters of Anicut Scheme in Urubokka Oya	5-70
Table 5.3.1-3	Parameters of Anicut Scheme in Kirama Oya	5-71
Table 5.3.1-4	Construction Cost of Kirama Oya Scheme (Annual Expenditure Statement)	5-72
Table 5.3.1-5	Implemented Anicut Scheme under IRDP in the Kirama Oya Scheme	5-72
Table 5.3.1-6	Existing Field Water Requirement for Paddy (105 Days Variety)	5-73
Table 5.3.1-7	Existing Field Water Requirement for OFC (Soya Beans 105 Days Type)	5-74
Table 5.3.1-8	Water Issue Records in Present Cropping Pattern and Water Balance Calculation (Case I) for Muruthawela Reservoir Scheme	5-75
Table 5.3.1-9	Water Issue Records in Proposed Cropping Pattern and Water Balance Calculation (Case II) for Muruthawela Reservoir Scheme	5-76
Table 5.3.1-10	Water Balance in Proposed Cropping Pattern and Water Balance Calculation (Case III) for Muruthawela Reservoir Scheme	5-77
Table 5.3.1-11	Tank Data under High Level Canal	5-78
Table 5.4.1-1	Parameters of Irrigation System of Badagiriya Scheme	5-100
Table 5.4.1-2	Water Issue Records in Present Cropping Pattern and Water Balance Calculation for Badagiriya Scheme	5-101
Table 5.4.1-3	Water Issue Records in Proposed Cropping Pattern and Water Balance Calculation for Badagiriya Scheme	5-102
Table 5.6.1-1	Parameter of Benthara Ganga RB Scheme <Meegama Section>	5-126
Table 5.6.1-2	Parameter of Benthara Ganga RB Scheme <Ittapana Section - 1/2>	5-127
Table 5.6.1-3	Parameter of Benthara Ganga RB Scheme <Ittapana Section - 2/2>	5-128
Table 5.6.1-4	Degree of Deterioration of Main Structures in Benthara Ganga RB Scheme	5-129

Table 5.7.1-1 Summary of Major Facilities in the Scheme 5-140
Table 5.7.1-2 Survey Results for Degree of Deterioration of the Major Facilities 5-141

Table 5.8.1-1 Survey Results for Degree of Deterioration of the Facilities 5-149

Table 6.2.4-1 Construction Cost for Rehabilitation Works under Liyangastota Scheme 6-14
Table 6.2.4-2 Liyangastota (WLB) Canal Length - Proposed - 6-15
Table 6.2.4-3 Liyangastota (WRB) Canal Length - Proposed - 6-16
Table 6.2.5-1 Construction Cost for Rehabilitation Works under Muruthawela Reservoir Scheme 6-17
Table 6.2.5-2 Muruthawela LB Scheme Canal Length - Proposed - 6-18
Table 6.2.5-3 Urubokka Oya Scheme Canal Length - Proposed - 6-19
Table 6.2.5-4 High Level Canal Length - Proposed - 6-19
Table 6.2.5-5 Kirama Oya Canal Length - Proposed - 6-20
Table 6.2.6-1 Construction Cost for Rehabilitation Works under Badagiriya Scheme 6-21
Table 6.2.6-2 Badagiriya Canal Length - Proposed - 6-22

Table 6.3.2-1 Construction Cost for Rehabilitation Works under Benthara Ganga RB Scheme (Alternative I) 6-36
Table 6.3.2-2 Construction Cost for Rehabilitation Works under Benthara Ganga RB Scheme (Alternative II) 6-36
Table 6.3.3-1 Construction Cost for Rehabilitation Works under Polwatte Ganga Scheme 6-37
Table 6.3.4-1 Construction Cost for Rehabilitation Works under ThangaluWelyaya Scheme 6-38

Table 6.6.2-1 Collection of O/M Rates and Disbursements 6-60
Table 6.6.3-1 Classification of Schemes 6-63

Table 6.7-1 Tolerance Limits of Water Quarity in Sri Lanka 6-67
Table 6.7-2 Results of IEE 6-70

LIST OF FIGURES

		Page
Fig.1.3-1	Organization Chart of Irrigation Department (1993)	1-4
Fig.3.3-1	Organization Chart of INMAS Program	3-31
Fig.4.1-1	Topography	4-3
Fig.4.1-2	Annual Rainfall	4-4
Fig.4.1-3	Hydrological Zone	4-5
Fig.4.1-4	Agro-Ecology	4-6
Fig.4.2-1	Channels of Paddy and Rice Distribution	4-24
Fig.4.2-2	Channels of Fertilizer Distribution (1993)	4-25
Fig.4.8-1	Organizational Structure of Agricultural Development within the Province	4-44
Fig.5.1-1	Hydrological Map of Walawe Ganga Basin and Kachigala Ara Basin	5-19
Fig.5.1-2	Hydrological Map of Malala Oya Basin	5-20
Fig.5.1-3	Hydrological Map of Urubokka Oya Basin and Kirama Oya Basin	5-21
Fig.5.1-4	Hydrological Map of Polwatte Ganga Basin	5-22
Fig.5.1-5	Hydrological Map of Welipenne Ganga Basin	5-23
Fig.5.1-6	Location Map of Meteorological Station, Rainfall Gauging Station and River Gauging Station	5-24
Fig.5.2.1-1	Schematic Diagram of Liyangastota Scheme	5-34
Fig.5.2.1-2	Water Issue Records for Ridiyagama Tank	5-35
Fig.5.2.1-3	Present Cropping Pattern for Liyangastota Scheme	5-36
Fig.5.2.3-1	Liyangastota FOs Organization Chart	5-41
Fig.5.2.5-1	Location of Sampling Sites (1/6 - 6/6)	5-49 to 54
Fig.5.3.1-1	Schematic Diagram of Muruthawela Reservoir Scheme	5-79
Fig.5.3.1-2	Schematic Diagram of Muruthawela Left Bank Scheme	5-80
Fig.5.3.1-3	Present Cropping Pattern for Muruthawela L/B Scheme	5-81
Fig.5.3.1-4	Present Cropping Pattern for Urubokka Oya and Kirama Oya Scheme	5-82
Fig.5.3.1-5	Water Issue Records for Muruthawela Reservoir	5-83
Fig.5.3.1-6	Proposed Water Issue by Case III for Muruthawela Reservoir	5-84
Fig.5.3.3-1	Muruthawela FOs Organization Chart & Management	5-88
Fig.5.4.1-1	Schematic Diagram of Badagiriya Scheme	5-103
Fig.5.4.1-2	Present Cropping Pattern for Badagiriya Scheme	5-104

Fig.5.4.1-3 Water Issue Records for Badagiriya Tank 5-105

Fig.5.4.3-1 Badagiriya FOs Organization Chart 5-109

Fig.5.5.1-1 Kachigala Ara Area under Uda Walawe RB Project 5-116
Fig.5.5.1-2 Schematic Diagram of Kachigala Ara Scheme 5-117
Fig.5.5.1-3 Present Cropping Pattern for Kachigala Ara Scheme 5-118

Fig.5.6.1-1 Schematic Diagram of Benthara Ganga Right Bank Scheme 5-130
Fig.5.6.1-2 Present Cropping Pattern for Benthara Ganga R/B, ... 5-131
Polwatte Ganga and Thagalu Welyaya Scheme

Fig.5.7.1-1 Schematic Diagram of Polwatte Ganga Scheme 5-143

Fig.5.8.1-1 Parameters Schematic Diagram of Thangalu Welyaya Scheme 5-152

Fig.6.2.2-1 Proposed Cropping Pattern for Liyangastota Scheme 6-23
Fig.6.2.2-2 Proposed Cropping Pattern for Muruthawela L/B Scheme 6-24
Fig.6.2.2-3 Proposed Cropping Pattern for Urubokka Oya 6-25
and Kirama Oya Scheme
Fig.6.2.2-4 Proposed Cropping Pattern for Badagiriya Scheme 6-26

Fig.6.3.2-1 Benthara Ganga Right Bank Scheme 6-39
Rehabilitation Plan Alternative - I
Fig.6.3.2-2 Benthara Ganga Right Bank Scheme 6-40
Rehabilitation Plan Alternative - II
Fig.6.3.3-1 Polwatte Ganga Scheme Rehabilitation Plan 6-41
Fig.6.3.4-1 Thangalu Welyaya Scheme Rehabilitation Plan 6-42
Fig.6.3.4-2 Present Cropping Pattern for Benthara Ganga R/B, ... 6-43
Polwatte Ganga and Thagalu Welyaya Scheme

ABBREVIATIONS

AGA	Assistant Government Agents
ASC	Agrarian Service Center
CEA	Central Environmental Authority
DAS	Department of Agrarian Service
DCO	Distributory Canal Organization
DFAR	Department of Fisheries and Aquatic Resources
DFEO	Divisional Fisheries Extention Office
DIE	Department of Immigration and Emigration
DM	Department of Meteorology
DOA	Department of Agriculture
FO	Farmers' Organization
FOO	Farmers' Organizations (*pl.*)
HIRDEP	Hambantota Integrated Rural Development Project
ID	Department of Irrigation
IIMI	International Irrigation Management Institute
IMD	Irrigation Management Division
IMF	International Monetary Fund
IMPSA	Irrigation Management Policy Support Activity
INMAS	Integrated Management of Major Irrigation System
IRDP	Integrated Rural Development Project
KOISP	Kirindi Oya Irrigation and Settlement Project
LCD	Land Commissionere Department
MANIS	Management of Irrigation Systems
MASL	Mahaweli Authority of Sri Lanka
MEA	Mahaweli Economic Agency
MIPE	Ministry of Irrigation, Power and Energy
MLLD	Ministry of Lands and Land Development
MOA	Ministry of Agriculture
MPCS	Multi-purpose Co-operative Society
NARA	National Aquatic Resources Agency
NAREPP	Natural Resources and Environmental Policy Project
NIRP	National Irrigation Rehabilitation Project
NORAD	Norwegian Agency for Development Cooperation
PMC	Project Management Committee
SAG	Study Advisory Group
SAM	Special Area Management
SD	Survey Department
SIDA	Swedish International Development Agency
SLFO	System Level Farmer Organization
SLPA	Sri Lanka Ports Authority
WLAC	Working Level Advisory Committee
WUG	Water Users' Group
AI	Agricultural Instructor (DOA)
AO	Agricultural Officer (DOA)
CRE	Chief Resident Engineer
DA	Divisional Assistant (ID)
DDI	Deputy Director of ID
DI	Director of ID
DO	Divisional Officer (DAS)
FI	Fisheries Inspector
IE	Irrigation Engineer

IO	Institutional Organizer
PE	Project Engineer (IRDP)
PM	Project Manager (IMD)
RE	Resident Engineer
RPM	Resident Project Manager (IMD)
RO	Research Officer
TA	Technical Assistant
EIA	Environmental Impact Assessments
EIRR	Economic Internal Rate of Return
IEE	Initial Environmental Examination
SWE	Salt-water Exclusion
WID	Women-in-Development

Conversion Factor

	From Metric System			To Metric System		
Length	1cm	=	0.394 inch	1inch	=	2.54 cm
	1m	=	3.28 ft	1 ft	=	30.48 cm
	1km	=	0.621 mile	1 mile	=	1.609 km
	1chaine	=	30.48 m	1 m	=	0.033 chaine
Area	1 cm^2	=	0.155 sq.in	1 sq.ft	=	0.0929 m^2
	1 m^2	=	10.76 sq.ft	1 sq.yd	=	0.835 m^2
	1 ha	=	2.471 acres	1 acre	=	0.4047 ha
	1 km^2	=	0.386 sq.mile	1 sq.mile	=	2.59 km^2
Volume	1 m^3	=	35.3 cu.ft	1 cu.ft	=	0.0283 m^3
	10^6 m^3	=	810.7 acre.ft	1 acre.ft	=	1,233.5 m^3
Velocity	1 m^3/s	=	35.3 cusec	1 cusec	=	0.0283 m^3/s
	1 ton/ha	=	891 lb/acre	1 lb/acre	=	1.12 kg/ha
Paddy/Rice	1 kg	=	0.048 bushels	1 bushel	=	20.87 kg
	1 kg/ha	=	0.019 bushel/acre	1 bushel/acre	=	51.55 kg/ha
	1 ton paddy	=	0.7 ton rice	1 ton rice	=	1.43 ton paddy

CHAPTER ONE :
INTRODUCTION

CHAPTER ONE : INTRODUCTION

1.1 Objectives and Scope of the Study

The objective of the Study is to carry out a "master planning approach" for the rehabilitation projects for existing irrigation and drainage schemes in Kalutara, Matara and Hambantota districts in southern Sri Lanka (total benefitted area of about 20,000ha, originally estimated by Department of Irrigation) and carry out a feasibility study for the same in the selected irrigation and drainage schemes through the said master planning approach.

The scope of the Study is divided into two phases: Phase I (stage 1), were carried out between end of January and early April 1995, comprise data collection, reconnaissance and basic strategy setting, resulting in the identification of proposed 7 schemes. And Phase I (stage 2) contains selection of the Target Schemes for the Feasibility Study and Delimitation of the Area for the Topographic and Detailed Survey which will be scheduled between middle of June and October 1995. Phase II, between November 1995 and April 1996, consists of field investigation of selected Feasibility Study Area and formulation of Irrigation and Drainage System Rehabilitation plan.

1.2 Study Area

The Study Area comprises the following four irrigation schemes and three drainage schemes were identified by the Study Team as blow. The breakdown of these identified study areas were discussed between Department of Irrigation and the Study Team during Phase I (stage 1) work, and they were agreed on the followings as Study Area.

Irrigation schemes

Scheme	River	Benefit area (ha)	District
1.Liyangastota	Walawe Ganga	6,121	Hambantota
2.Moruthawela Reservoir	Urbokka Oya, Kirama Oya	6,149	Hambantota
3.Badagiriya	Malala Oya	703	Hambantota
4.Kachigala	Kachchigal Oya	516	Hambantota
	Subtotal	13,486	

Drainage schemes

Scheme	River	Benefit area (ha)	District
1.Benthara Ganga Right Bank	Benthara Ganga	965	Kalutara
2.Polwatte Ganga	Polwatte Ganga	560	Matara
3.Thangalu Welyaya	Kirama Oya	395	Hambantota
	Subtotal	1,920	
	Total:	15,409	

1.3 Related Government Agencies

The implementing agency for the Study is the Irrigation Department (ID) which is the national level agency of government responsibility for design, planning design and construction of all irrigation works and for the operation of all major irrigation schemes. ID is an agency within the Ministry of Irrigation, Power and Energy (M/IP&E). Organization structure of the ID is given in Fig.1.3.-1.

The Study is supervised and coordinated by a Study Advisory Group (SAG) chaired by the additional Secretary, MIPE. All agencies related to the Study at national level are in the SAG. They are:

- The Ministry of Agriculture, Lands and Forestry (MALF) and the agencies under it, viz. the Department of Agriculture (DOA) responsible for agricultural research and extension, the Department of Agrarian Services (DAS) responsible for agricultural support services including the registration of farmer organizations, the Surveyor General's Department (SGD) responsible for preparation of maps and aerial photography.

- The Irrigation Management Division (IMD) of MIPE responsible for the INMAS program and related institutional development activities.

- The Ministry of Fisheries and Aquatic Research (MFAR) together with the Fisheries Department (FD) and the Coast Conservation Department (CCD) whose roles are self explanatory.

The work of these departments relate closely to the environmental aspects of the Study:

- The Central Environment Authority under the Ministry of Transport, Environment and Women's Affairs is the national level agency responsible for all matters relating to environmental effects and impacts.

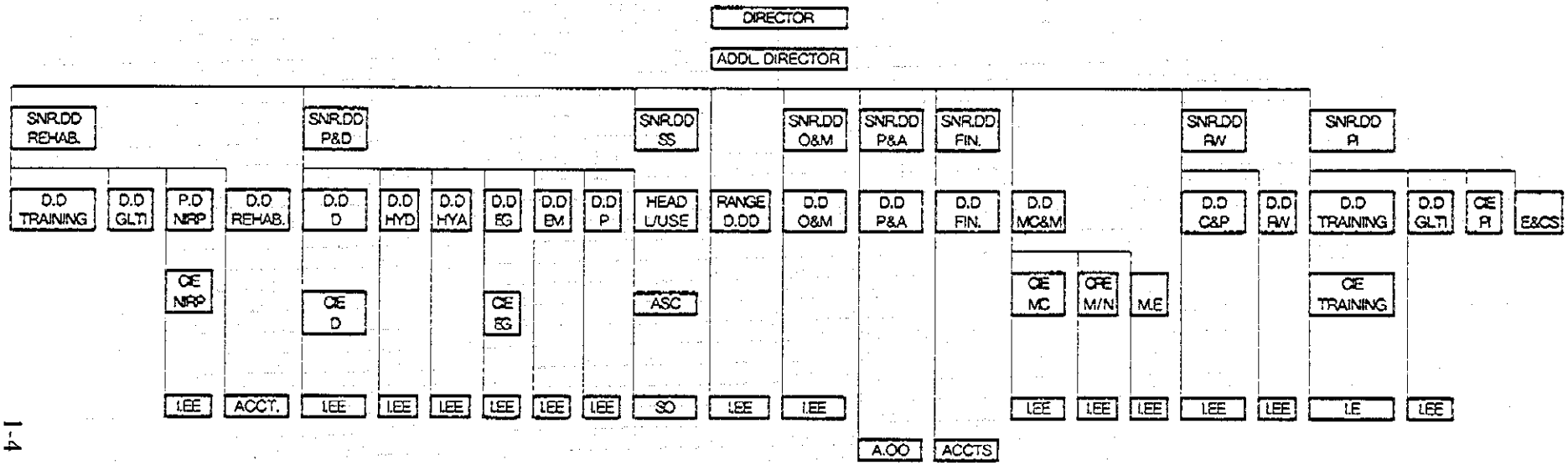
- The Department of National Planning (DNP) is responsible for overall national economic planning and review of sectoral plans and programs while the Department of External Resources is responsible for dealing with external agencies to mobilize resources for national programs. Both agencies function under the Ministry of Finance, Planning, National Integration and Ethnic Affairs.

- The Department of Meteorology under the Ministry of Science, Technology and Human Resources Development is responsible for meteorological data collection and records.

1.4 Progress of the Study

The overall Study comprises a Phase I component and a Phase II component. The Phase I study consists of Stage 1 field survey and home office works which form the basis for the selection of the schemes to be targeted for feasibility study, and Stage 2 field survey of the selected F/S schemes (topographical survey, topo-map preparation, etc.). Stage 1 field survey was carried out over a 78 day period from January 25 to April 12, 1995. The content and findings of this survey is set out in the Progress Report submitted in the field to the Sri Lankan

government. After achieving a consensus with the concerned officials and personnel of the Sri Lankan government regarding the content of the said report, the Study Team returned to Japan to carry on with home office works which comprise analysis of Stage 1 field survey data, formulation of a base plan for irrigation and drainage system rehabilitation, and selection of schemes targeted for subsequent feasibility study. This Interim Report embodies the findings and recommmendations of the foregoing work.



SNR.DD : Senior Deputy Director
P.D : Project Director
D.D(D) : Deputy Director(s)
CE : Chief Irrigation Engineer
CPE : Chief Resident Engineer
ASC :
I.E(E) : Irrigation Engineer(s)
M.E Mecanical Engineer
ACCT(S) : Accountant(s)

SO : Special Officer
A.OO : Administrative Officers
REHAB : Rehabilitation
GLTI : Galgamuwa Training Institute
NIRP : National Irrigation Rehabilitation Project
P&D : Planning and Design
SS : Special Services
P&A : Personnel Administration
FIN. : Finance

L/USE : Land Use
O/M : Operation and Maintenance
RW : Regional Works
PI : Planning Implementation
D : Design
HYD : Hyodology
HYA : Hydraulic
EG : Engineering Geology
EM : Engineering Materials

P : Planning
MC&M : Machinery and Major Construction
C&P : Contract and Procurement
MC : Major Construction
M.E : Mecanical Engineer
E&CS : Environment and Computer Services

Fig.1.3-1 Organization Chart of Irrigation Department (1993)

CHAPTER TWO:
BACKGROUND

CHAPTER TWO : BACKGROUND

2.1 National Economic Development Plan

Although Sri Lanka enjoys a relatively high per capita GNP among Asian countries, and exhibits healthy social indicators including life expectancy, literacy rate, school enrollment rate, etc. (see App. 2.1-1), prolonged ethnic conflict in the Northern and Eastern provinces has actualized expansion of fiscal deficits, deterioration of international balance of payments, high unemployment rate, acceleration of inflation and economic stagnation.

In order to address this economic crisis, the Sri Lankan Government in collaboration with the World Bank and IMF drew up a Policy Framework Paper comprising target macro-economic indicators and a proposed structural adjustment program to achieve the same, and restructuring of the economic industrial structure in line with the program is now being pursued.

Essential features of the structural adjustment program with regards to the agricultural sector include:

- elimination of subsidies for production of rice and milled wheat,
- privatization of agro-related public firms,
- lowering of tariff rates for agricultural produce, and
- promotion of private sector participation in the distribution market for rice, fertilizer and milled wheat.

These measures are aimed at achieving the principal policy targets of stability of the macro-economy, rationalization of the public sector, promotion of private sector activities and alleviation of poverty. Reinforcement of measures to alleviate poverty is accorded particularly high priority in order to minimize any social inequities occurring in the course of implementing the structural adjustment program. In addition to the agricultural sector, the said program targets financial, transport and telecommunications sectors as well, and future economic growth performance is expected to hinge on the success or failure of the Sectoral Reform Policy formulated in collaboration with the World Bank and IMF.

Although government publications on the present administration's national economic policy are not as yet available, the general policy speech of the president cites targets of reduced inflation, rapid economic growth, creation of employment opportunities, and equitable distribution of benefits accompanying economic growth. In the same speech the president expresses continued support for the existing structural adjustment program and strengthening of efforts towards reduction of fiscal deficit, promotion of economic infrastructure projects, and privatization of public firms. Also, in order to improve the quality of life over the term, budget allocations are to be expanded for social services, education, medical services, health and sanitation and social welfare and private sector participation encouraged through market friendly policy to give impetus to the government's program to strengthen and invigorate the nation's economy.

2.2 Agricultural Sector

2.2.1 Agriculture

It is generally agreed that the weakness in the past agricultural policy was an over-emphasis on industrial protection policy at the expense of the agricultural sector. To rectify this, new agricultural development strategy accords a high priority to loosening of the various government controls and regulations affecting the agricultural sector to encourage independent spirit and creative energy among farmers, and promote a shift from monoculture to a more diverse, export-oriented agricultural structure.

Objectives of the new agricultural development strategy include:

- removal of institutional and policy obstacles in order to foster higher farm profitability and promote agricultural investment,
- restraints on government intervention in the agricultural sector,
- shift from subsistence to commercial farming, and
- encouragement of exports of agricultural produce.

To achieve these, the said strategy stresses on the importance of the following:

- eliminate hidden discrimination against agriculture from the viewpoints of macro economic and trade policies
- eliminate all types of monopolies in agricultural markets and introduce competitive principals
- raise domestic agricultural prices
- improve the agricultural research system
- enhance agricultural productivity and income as well as create non-farm jobs (only viable solution to rural poverty)
- attract private sector investment in projects to improve rural infrastructure
- abolishment of land lease system under settlement programs and replacement with step-wise granting of freehold title to settlers
- shift from over-dependence on chemical fertilizers and agro-chemicals to use of organic manures and adoption of pest management measures
- conjunctive and effective use of surface and groundwater
- reorganize agrarian services centers as productive services centres
- effect stricter consideration of environmental issues

2.2.2 Irrigation Rehabilitation Plan

The strategic importance of agricultural policy until the mid 1980s was the implementation of new irrigation development schemes such as the Mahaweli Development Programme in order to achieve self-sufficiency in domestic rice production. Construction of irrigation facilities under these schemes expanded cropped area and improved land productivity, resulting in a dramatic increase in rice production. In order to diffuse population pressure on major urban areas, settlement in the Dry Zone was encouraged under the Mahaweli Development Programme.

The objectives of this resettlement were both to contribute to increase in rice production and to reduce unemployment. Self-sufficiency rate in rice production peaked in the mid 1980's at almost 100%, after which it went into a declining trend with corresponding decrease in rice production. (see App. 2.1-2)

With the above trend, a shift began away from the construction of new irrigation facilities to facility rehabilitation in order to upgrade the irrigation efficiency of obsolete irrigation facilities, as a means of increasing the productivity and cropping intensity of existing cultivated land. Under this new approach, institutional and organizational aspects affecting irrigation system operation were given priority in addition to facility rehabilitation per se, and the importance was recognized of appropriate operation and maintenance of the said facilities which maximizes farmer participation. Furthermore, this approach is anticipated to prove to be of higher economic profitability than investment in new irrigation facilities.

Against the above background, the Major Irrigation Rehabilitation Project and other projects were formulated to rehabilitation irrigation facilities nation-wide. These projects aims to increase agricultural productivity and farmer income and improve living standards in rural areas through the rehabilitation of existing irrigation facilities and the introduction of appropriate O/M by FOs.

2.3 National Environmental Strategy

The following three cardinal principles of conservation policy are contained within the Sri Lanka National Conservation Strategy (1988). These stress the importance of ecological processes, ecosystem conservation and increasing the productivity of natural resources is line with population growth:

i) Only ecological processes can assure the ability of a natural resource to produce harvestable amounts of food and other basic necessities of life.

ii) Over-exploitation of any one component of an ecosystem, specially a life-supporting ecosystem, upsets the equilibrium of the whole ecosystem and thereby endangers its productivity.

iii) The needs of an increased population can be met by making the country's natural resources more productive by recourse to science and technology.

Under the Action Plan of the above strategy to achieve sustainable agricultural development

which adheres to the foregoing principles, the need for irrigation system rehabilitation, water management improvement, and reassessment of land ownership systems is emphasized, and the dangers of contamination to the surrounding environment from fertilizers and agro-chemicals is cited as follows:

- Minor and major tanks and irrigation delivery systems should be rehabilitated, water management improved and land tenure reforms introduced to stimulate and sustain agricultural productivity.

- Measures should be taken to minimize pollution of surface and ground water through excessive or careless use of fertilizer and agro-chemicals. A strong extension-education programme must be launched simultaneously with rigorous enforcement of the law.

Also, under the National Environmental Action Plan 1992-1996, the following policy is set out in the chapters on Water Resources:

i) Water Management, and Conservation

Water management is becoming increasingly important with population increase, necessitating the maximum participation of water users in the management system. This pertains in particular to the participation of FOs, which represent the largest scale users. Furthermore, liaison and coordination between farmer groups, and full mutual understanding between concerned government agencies and the farmers in order for farmers to enjoy maximum benefits under agricultural development.

ii) Alleviation of Water Quality Problems

The main pollutants may be chemical residues, fertilizer leachate and silt loads, which originate from poorly managed agricultural lands. These have not been continuously monitored over the long term. Existing data is not well collected and generally unavailable.

iii) Prevention of Adverse Environmental Impacts due to Irrigation

Poor irrigation causes problems of salinity, water logging, siltation, increase in the disease transmitting vectors and water borne diseases, loss of land due to borrow areas and ecological problems related to large inland bodies, etc. But the extent of environmental impacts are not accurately known yet.

2.4 Southern Region Development Strategy

Under the Government's policy of devolution of power to the provincial level, responsibility for formulation and implementation of regional development planning was transferred to provincial governments with the introduction in 1987 of the provincial council system. Under this new approach, it now became possible to effect development strategy more responsive to the immediate needs of the local population. The current focus of regional development planning is directed at (i) acceleration of regional economic growth, (ii) expansion of economic

production activities, (iii) maximization of potential resources, and (iv) rectification of skewed development levels between sectors and regions. In line with these objectives, provincial governments formulate the optimal regional development strategies based on identification and recognition of regional specific problems, and with emphasis on proper balance between economic growth per se and equitable distribution of the benefits of development. To achieve this, the need is further emphasized to fully understand factors of (i) related backward sectors and geographical areas, (ii) potential development areas, (iii) socio-economic characteristics of the area (distribution of unemployed and impoverished groups, current status of health and sanitation, education and medical services), etc.

The Southern Province (within which 3 out of the 4 subject districts, i.e. Galle, Matara and Hambantota lie) accounts for 13% of the total national population (1993), and 8.5% of the nation's GDP (1990). Economic growth rate of the province for 1981~90 exhibited a low level of 3.8% compared to the national average of 4.1%. Agriculture including plantation, paddy and OFCs is the mainstay of the provincial economy (accounting for 29.5% of total provincial GDP), followed by wholesale and retail sector (24.7%), manufacturing sector (11.7%), and transport and telecommunications sector (9.3%). The agricultural sector accounts for about 50% of all employment. Unemployment in the province, however, is at a high 17.6% which is well above the national average of 13.2%. Compared to the other two districts in the province, Hambantota in particular shows a relatively high level of unemployment and a low literacy rate. The central government directs 11.3% of current expenditure at the Southern Province which is the third largest total islandwide behind Western and Central provinces. Breakdown of this expenditure is 13.1% (11.7% in 1981) in the education sector, 11.3% (10.2% in 1981) in the health and sanitation sector, and 11.2% (11.0% in 1981) in the service sector.

Against the above background, agriculture is clearly a base industry in the southern region, and in this regard numerous development projects to improve agricultural production and to upgrade the quality of life in rural areas are currently being pursued under funding assistance from various international lending agencies and donor countries. The Southern Province Rural Development Project funded by ADB represents one component of the overall regional development strategy, and has as its objectives income increase and creation of employment opportunities through the extension of credit to individuals embarking on various types of industrial and self-employment enterprises. This also includes the extension to small and medium firms located in the Charley Mount industrial estate in Weligama and to small and medium entrepreneurs engaged in production activities in rural areas of the Southern Province. Another project of note in this regard is the Small Farmers and Landless Credit Scheme funded by IFAD and CIDA, aimed at economic development and welfare improvement for impoverished families in Galle and Matara districts.

In recent years, the Government has expressed its intention to expand the existing Galle port into a major transshipment nerve center under its policy of modern infrastructure as crucial to high economic growth, particularly port and harbor facilities. The nationwide trend towards export-oriented industrialization has of course affected the southern region as well. Specifically, the 200 Garment Industries Programme is being pursued, and a free trade zone centered on the garment industry has been established at Koggala in Galle district. This free trade zone is planned to play an important role in absorbing surplus labor into labor intensive, export promoting industries (including small and medium enterprises).

2.5 Economic Conditions

The present administration is currently in the process of drafting a Stable Economic and Financial Framework, which emphasizes the strengthening of the role of the private sector in the economy through the promotion of various market friendly policies. In consultation with the World Bank and IMF, the Government has formulated policy to accelerate economic growth through (i) creation of a saving surplus to be targeted for investment in the private sector by greatly reducing the Government's fiscal deficit, and (ii) lowering of interest rates through reduction of the inflation rate to induce investment. Major target economic indicators include 1) economic growth rate of 8%, 2) inflation rate under 5%, 3) fiscal deficit at 3~4% of GDP (by 2000), 4) private investment at 25% of GDP, and 5) foreign investment ratio at 20% (by 2000).

As can be seen in App. 2.1-3, although economic growth rates for 1991 and 1992 were low following inauguration of the Economic Structural Adjustment Programme in collaboration with the World Bank and IMF, a growth rate in 1993 of 6.9 % was achieved which was well above the target for that year of 5.5%. For the past 3 years (1991~1993), inflation reached a level around 12% which is considerably below the 21.5% figure for 1990; however, actual targets were achieved only for 1989 and 1991. Proportion of fiscal deficit to real GDP showed some recovery through 1993 due to Government efforts to reduce expenditure; however, this situation deteriorated in 1994 with the said rate being at 10% in contrast to the target value of 7.1%.

According to agricultural statistics for 1994 (see App. 2.1-4), the agricultural sector (including forestry and fisheries) accounted for 20.9% (4.9% increase over the previous year) of real GDP. Within this, paddy production alone accounted for 4.3% of the GDP, which represents a 9.6% increase over the previous years. This is attributed mainly to a combination of favorable weather conditions, increased use of chemical fertilizers and rise in the guaranteed price for rice. Paddy production exhibited a 9.9% increase in 1993 at 2.57 million tons compared with 1992 (2.1% decrease over the previous year). Paddy production in 1993 was at the highest level in six years. Subsidiary food crops and minor export crops showed production increases for the same period of 5% and 14%, despite the drought in 1992.

Agricultural products accounted for 22.9% (Rs 31,618 million) of total export value in 1993, showing a growth of 19.3% over the previous year. Imports of rice, and chemical fertilizers were at Rs 11,655 million (19.3% increase over the previous year) were 1.2% (16.3% drop over the previous year) and 1.6% (31.4 increase over the previous year), respectively, of total imports. Fertilizer consumption in particular showed recovery to levels on a par with those before elimination of subsidies in 1990.

Proportion of labor force population to total national population rose from 48.9% in 1992 to 49.5% in 1993. Of this, the agricultural sector accounted for 38.5% of the employed population, showing a steady year by year decrease in proportion.

Government expenditures related to agriculture / irrigation were 5.7% of the total (10.6% increase over the previous year).

CHAPTER THREE:
EXPERIENCE AND LESSONS RELATED TO REHABILITATION

CHAPTER THREE: EXPERIENCE AND LESSONS RELATED TO REHABILITATION

3.1 Irrigation Rehabilitation Projects

Numerous projects to rehabilitate irrigation schemes have been carried out in Sri Lanka over the past 15 years. Donor funded projects including major, medium and minor schemes are as indicated below:

- Tank Irrigation Modernization Project (TIMP)
- Gal Oya Water Management Project
- Major Irrigation Rehabilitation Project (MIRP)
- National Irrigation Rehabilitation Project (NIRP)
- Village Irrigation Rehabilitation Project (VIRP)
- Uda Walawe Rehabilitation Project
- Irrigation Systems Management Project (ISMP)

The relevant agencies have gained much experience and learned many valuable lessons as a result of the above projects. Here, examination will be made of the five major scheme projects, excluding VIRP and NIRP. (VIRP is targeted at minor schemes. The performance of NIRP cannot be accurately evaluated as the project is still on-going.)

3.1.1 Tank Irrigation Modernization Project (TIMP)

(1) Introduction

The Tank Irrigation Modernization Project is the first large scale irrigation rehabilitation project undertaken in Sri Lanka. The project covers a total area of 12,753 ha of irrigable land in five major irrigation schemes located in the North Central Dry Zone, which had previously been restored in the early 1950s. The schemes consist of Mahawilachchiya (1,053 ha), Mahakanadarawa (2,429 ha), Pavatkulam (1,619 ha), Vavunikulam (2,429 ha) and Padaviya (5,061 ha). The project was planned during 1974 and implemented during 1976-82.

Climatically, the project is located in a relatively dry area. The area is affected by severe droughts, almost once in 5 years, causing major setbacks to its agricultural production. All tank schemes in TIMP are associated with small catchments and, as a result, the agricultural production pattern in the project area shows a remarkable variability by rainfall fluctuations.

(2) Project Objectives

The basic goal of TIMP was to increase the agricultural production in the irrigable lands in the project area through increased land-use intensity and the adoption of a package of irrigation and agricultural innovations. The TIMP plans to increase annual cropping intensity of the irrigated land in the area, from 83 percent to 170 percent, within a period of 5 years. The project was aimed at conserving irrigation water stored in the reservoir and maximizing the use of maha rainfall, thereby increasing the agricultural potential.

Along with this increase in cultivated land, large increases in crop yields were also anticipated. Rice yields during the maha season were expected to double, from 1.7 tons per ha to 3.4 tons per ha.

The total maha season rice production was expected to increase from 1,567 metric tons to about 4,180 metric tons, reflecting an increase of about 270 percent.

The increases in agricultural production in yala were expected furthermore. For instance, in Mahawilachchiya Scheme, the cultivated area during the yala season was projected to increase four-and a-half times, from 81 ha to 365 ha. The area under nonrice crops, mainly pulses, was projected to increase sevenfold in a five-year period. The plan expected a major increase in nonrice crop production, from 19.8 tons to 700 tons. Total rice output during the yala season was estimated to increase from 154 tons to 1,386 tons, a ninefold increase.

The goals of TIMP were, therefore, based on radical transformations of the agricultural pattern in the area through which significant increases in farm incomes were anticipated. Net farm income was expected to rise from the existing level of Rs 2,850 to a post-project level of Rs 7,650.

(3) Basic Strategy

The basic strategy underlying the TIMP development plan involved two major components:

- Increase of agricultural production in the area.
- The improvement of the irrigation water use and management.

The agricultural component recommended a package of practices to be followed by the farmers. This included:

- Preparation of rice lands under dry soil conditions (dry tillage) without waiting for the maha rains.
- Advancing the sowing time of rice to benefit from initial maha season rains that would otherwise be unutilized.
- Dry sowing of ungerminated seed paddy as a substitute for the conventional system of sowing germinated seed paddy under wet conditions (to reduce high levels of water use in land preparation under wet conditions).
- Cultivation of short-duration (3 to 3 1/2 month) rice varieties during the maha season to reduce the irrigation period

These recommendations, therefore, constituted a package requiring a high level of tractor use, timely availability of water supplies, better water control and the availability of short-duration rice varieties.

The irrigation improvement strategy of TIMP, on the other hand, involved the adoption of

several innovations that basically require major structural changes in the water conveyance system to allow better water control and delivery. Such changes were aimed at introducing a rotational (intermittent) system of irrigation water distribution at the farm level. In order to introduce the system of rotations, the canal system was redesigned and new controls and measurement devices were installed along the canals .

The major irrigation-related innovations in TIMP were:

- Introduction of rectangular canals of one cusec (28.3 liters per second) capacity.
- Construction of a lined canal system to reduce seepage losses.
- Installation of larger (15 cm) farm pipe outlets.
- Construction of control and measuring structures.
- Implementation of a strict 12-hour rotational system of water issues.

These changes necessitated a great deal of construction works, and provided a heavy engineering orientation to TIMP.

(4) Project Planning Process

The TIMP plans were largely based on the socio-economic information provided by the Agricultural Economics Division of the Department of Agriculture.

The planning process, in general, reflects a relatively rigid, top-down approach with little participation of the actual beneficiaries. The proposed improvements appear to have been conceived and designed centrally, with little involvement of the officials and farmers. In fact, farmers' organizations were not present in the project area at the time of initiating the project and this appeared to be a major cause for the lack of farmer participation.

(5) Project Costs and Components

The project was funded by the World Bank. The total estimated cost was about US$ 30.0 million (Rs 225 million), including about US$ 7.0 million in import taxes and duties (1976 prices). The project activities broadly included: construction work for improving irrigation, drainage facilities, and farm roads; provision of equipment for land preparation and plant protection; strengthening of agricultural support services; and provision of technical support for strengthening O&M work.

The cost data (Table 3.1.1-1) show that civil works, and equipment and machinery imports accounted for nearly 85 percent of TIMP' s total project costs. The irrigation improvement components accounted for 29 percent of the total cost. The cost profile indicates a large foreign exchange component allocated for importing machinery and vehicles. As part of the project, a large number of tractors were imported to be sold to the settlers.

Table 3.1.1-1 Major Cost Components of TIMP (in 1976 currency).

Item	Cost	
	(US$M)	(%)
Civil works	8.7	29.0
Construction equipment and vehicles	5.6	18.7
Agricultural equipment and vehicles	5.6	18.7
Technical assistance	0.3	1.0
Engineering and administration	1.3	4.2
Contingencies	1.7	5.7
Price contingencies	6.8	22.7
Total	30.0	100.0

source: Project Appraisal Report, World Bank, 1976

(6) Project Achievements

Despite a large capital expenditure, the actual performance of TIMP in the initial years was disappointing (Abeysekera 1983). The rotational system of irrigation water distribution led to many major operational problems. The modernized conveyance systems suffered considerable damage, often at the hands of farmers responding to the nonfunctioning of the new construction work.

Post-evaluation studies indicate that, for many reasons, farmers did not accept the improvement package and were reluctant to change their traditional cultivation practices. Practices such as dry sowing and early sowing were completely rejected by farmers. As regards rice, they continued to show their traditional preference to ensure one good maha season rice crop using long-duration (4 ~ 4 1/2 months) varieties, planted rather late in the season when the tank was full.

Despite the formation of many committees, the project administration also showed major weaknesses. As a result, virtually all activities and responsibilities of undertaking the project work were in the hands of the project engineers in the respective schemes. This led to a perception of the project as an engineering activity with a strong construction orientation. This perception led to the neglect of other complementary aspects of the problem such as the multidisciplinary aspect and beneficiary participation.

The analysis in the study by Abeysekara showed that TIMP was introduced in a complex situation involving a number of fundamental problems like the growing population pressure, rainfall uncertainty and withdrawal of government support. It also showed that the rejection of the solutions offered (such as dry tillage, dry sowing, irrigation rotation at the field canal level and growing nonrice crops in the dry season) to solve the basic problems in the area was mainly due to uncertainty of rainfall and lack of profitability. With the rejection of

recommended practices, by the farmers, the physical improvements implemented under TIMP also became redundant.

3.1.2 Gal Oya Water Management Project

(1) Introduction

Gal Oya Water Management Project was initiated with the assistance of USAID and involved the rehabilitation of one of the largest irrigation schemes in Sri Lanka. Feasibility studies were completed in 1979 and the project was implemented through December 1985.

(2) Project Objectives

The objectives outlined in the project paper (USAID 1979) were:

- Physical rehabilitation of the Gal Oya Left Bank Irrigation System, where command area is about 23,000 ha. The main canal and distributary canals were to be redesigned and repaired, primarily with a view to bringing the system back to its original design specifications.

- Preparation of water management plans for the Gal Oya Left Bank, based on on-farm research, with a view to minimizing water losses.

- Training of Irrigation Department personnel, farmers and others in water management practices.

- Training of officials engaged in agriculture and other technical fields in the Gal Oya Left Bank, provision of improved central support for the development of a water management unit of the Irrigation Department to administer the project in Gal Oya, and the development of the Galgamuwa Irrigation Training Institute to provide operation and maintenance support throughout the country.

- Organizing farmers and conducting socio-economic research relating to the development of farmers' organizations or local water users ' associations in the Gal Oya Left Bank as well as evaluating the impact of the project.

(3) Project Costs

The development strategies adopted in Gal Oya were influenced by TIMP and other experiences, particularly with respect to issues such as beneficiary participation as well as capital costs and operation and maintenance costs. Unlike in TIMP, the Gal Oya Project, from the inception, placed a heavy emphasis on farmer involvement in system rehabilitation and improvement, reflecting a "bottom up" development approach. The creation of farmers' organizations was facilitated by the Institutional Organizers (IOs) functioning at the field level.

The emphasis on farmer involvement, however, is not seen in the original project design, but came as a subsequent development, mainly because of the involvement of the Agrarian Research and Training Institute (ARTI) and Cornell University in project implementational

activities.

(4) Project Planning Process

The overall planning process underlying the Gal Oya Water Management Project reflects a high degree of flexibility. The actual implementation of the project differed significantly from that envisaged in the original project design. The original project paper, for instance, laid major emphasis on the use of heavy equipment for physical rehabilitation. Although the equipment was provided, because of problems such as low utilization and difficulties of maintenance, arrangements were later made to make use of local labor wherever possible. The original plan also emphasized detailed planning and the preparation of master plans, but these were later de-emphasized. A realistic approach to design and implementation of civil works was later modified through the adoption of a "pragmatic" approach to design and construction, as suggested by the mid-term evaluation. In the original plan, a specific plan and specific funding for rehabilitation of distributary and field canals were not included, but these were provided in a later amendment to the project paper.

(5) Project Costs

The total project cost, as estimated in 1978 (Table 3.1.2-1), amounted to US$ 18.34 million (USAID 1979) . of this, US$ 3 .0 million was from proposed USAID grant funding, US$ 6.8 million from loan funding and US$ 8.54 million (rupee equivalent) from the government.

Table 3.1.2-1 Cost Composition of the Gal Oya Water Management Project (in 1978 Currency)

Item	Cost	
	(US$'000)	(%)
Technical assistance	2,450	13.4
Commodities	6,250	34.1
Training	930	5.1
Personnel	1,540	8.4
Other costs (including construction)	2,980	16.2
Contingencies and inflation	4,190	22.8
Total	18,340	100.0

source: USAID 1979

(6) Project Achievements

The Gal Oya Project was esteemed an important event in the history of rehabilitating irrigation systems in Sri Lanka. A significant aspect of this project was the use of farmer participation as a means of achieving low-cost rehabilitation, and operation and maintenance. A key strategy adopted in the Gal Oya Water Management Project is "pragmatic rehabilitation." The main

objective of pragmatic rehabilitation was to ensure canal safety, stability and utility with a minimum level of expenditure (Keller et al. 1982). The approach reduced the costs of surveying, designing and construction substantially.

Another key strategy adopted in this project is the mobilization of local knowledge and user participation in system improvement and management, and these strategies proved quite successful (Uphoff 1986). Farmer participation in the design process through group approaches was encouraged. During the early phase of project design, each farmer group had two rounds of meetings with the engineers.

Unlike TIMP, the Gal Oya Water Management Project did not include a specific agricultural development strategy. A basic assumption implicit in the project plans appears to be that when the water management activities are improved, the agricultural activities would also be transformed favorably.

The final official evaluation of the Gal Oya Left Bank Rehabilitation Project was conducted by the International Institute for Science and Technology (ISTI) in 1985.

The overall assessment of the project given in this report indicates that the project as a whole has been a success. The achievements listed are: 1) rehabilitation of a badly deteriorated major irrigation scheme in a cost effective manner: 2) formation of viable farmers' organizations, which are functioning despite a fragmented social structure, 3) changes in agronomic practices, increased yields and increased cropping intensity, all due, at least partly, to improved water delivery and reliability.

Based on its findings, ISTI concluded that the project had substantially achieved its purpose of developing an institutional capability, which can be replicated to manage large irrigation schemes in Sri Lanka more efficiently and effectively with active farmer assistance. The report suggests that the methodology developed at Gal Oya needs to be extended to other schemes, with necessary adaptation to suit different physical and social environments.

3.1.3 Major Irrigation Rehabilitation Project (MIRP)

(1) Introduction

The Major Irrigation Rehabilitation Project (MIRP) is funded by the World Bank (IDA) and co-financed by the Canadian International Development Agency (CIDA) and the Swiss Development Corporation (SDC). Initially, the project was planned to be implemented in the period 1985-90, but it was later extended to mid 1992. The original project plans covered seven major irrigation systems: Kantale (6,990 ha), Mora Wewa (1,960 ha), Iranamadu (9,430 ha), Giant's Tank (12,460 ha), Rajangana (5,910 ha), Nachchaduwa (5,400 ha) and Huruluwewa (4,090 ha) . The total project area is 46,240 ha. However, in three of these schemes (Morawewa, Iranamadu and Giant's Tank), rehabilitation work was not undertaken due to civil disturbances.

MIRP is primarily aimed at increasing agricultural production in the irrigation schemes mainly through improvements in water control and management. The specific activities of the project, as outlined in the appraisal report, are:

1. Rehabilitation of physical irrigation systems for optimum utilization of water.

2. Development of institutional organizations in each of the schemes.

3. Rehabilitation of roads and regularization of encroached lands.

4. Undertaking investigations on catchment management and socio-economic studies.

5. Strengthening agricultural support services and input supply.

In four of the schemes of MIRP, an experimental area covering about 150-200 ha per scheme has been identified to serve as a pilot program for testing selected technical options, mainly new types of irrigation structures for improving irrigation water control and delivery in the scheme. Another significant component of MIRP is to rehabilitate the lift irrigation system operating in the Rajangana Scheme by improving the PHI system and providing new pump sets.

(3) Development Strategy

The development approach adopted in MIRP involves: a) the rehabilitation of the irrigation conveyance system; b) the development of the institutional organizations; and c) the improvement of crop production in the schemes through the strengthening of input supply services.

a) Irrigation Development

Most of the rehabilitation work in MIRP appears to be centered on irrigation development, more specifically, on physical improvement of the canal and the headworks. Large-scale adoption of lined rectangular canals with one cusec capacity was a major innovation planned initially in MIRP. However, the TIMP experience showed that under many circumstances, canals with one cusec capacity are likely to fail in delivering expected quantities of water. Therefore, this has not been attempted in MIRP. Instead, the canals have been designed to carry up to 2 cusecs, if all free board is used; lining is done only when needed and canals are made trapezoidal in cross section, not rectangular.

The intensity of construction activity was highest in the pilot, experimental area. This work mostly involved the installation of new, modern types of control and measurement structures in two pilot distributaries.

b) Institutional Development

Unlike in the case of TIMP, the establishment of farmers' organizations has been considered a major development strategy of MIRP from its inception. As a step in this direction, MIRP funds have been used to strengthen the Irrigation Management Division (IMD) of the Ministry of Lands, Irrigation and Mahaweli Development. Institutional Organizers (IOs) whose task is to organize farmers into field-canal and distributary groups have been employed as catalysts to involve farmers in rehabilitation and O&M work. The approach of utilizing the services of IOs is modeled on the Gal Oya Water Management Project and was based on the lessons learned

from TIMP as well.

(3) Agricultural Development

The approach adopted in MIRP differs sharply from that of TIMP. The practices of dry sowing and dry tillage have been completely given up. However, planting of short-duration varieties has been recommended during the dry season and attempts to achieve crop diversification in rice lands have been pursued. The MIRP development strategy does not emphasize the adoption of specific measures for improving agricultural activity in the project area.

(4) Project Planning Process

Planning of MIRP has been influenced to a large extent by the experiences from TIMP and Gal Oya. Unlike TIMP, most of the planning and designing activities in MIRP have been undertaken on site. The irrigation schedules have been prepared to allow discharges that permit all gate operations during daylight hours. The installation of cross-regulators in MIRP has been a major benefit for water control in the main canals of the systems. Although TIMP relied very heavily on weir boxes for measurements at distributary canal and field canal levels, they were perceived by farmers as restricting flow and were, therefore, damaged by them. Learning from this experience, MIRP has installed broadcrested weirs.

In general, MIRP appears to reflect a relatively greater flexibility in preparing and implementing its rehabilitation plans.

However, despite the existence of a higher degree of operational flexibility of MIRP when compared to TIMP, the available information also suggests that rehabilitation of most irrigation structures and canal layouts has followed a "blueprint approach" which is based on standard norms and guidelines; once drawn and decided, there is little room for any change.

Further, the rehabilitation plans of MIRP in the later years have not been able to benefit at all from the performance results of the "experimental" irrigation structures installed in the pilot areas. This shows a rigidity of the implementational approach followed in MIRP.

(5) Project Costs

The project was estimated to cost about US$ 43.2 million (1984 currency). This included US$ 10.2 million for price escalation and US$ 2.6 million for taxes and duties (Table 3.1.3-1).

Table 3.1.3-1 Cost Components of MIRP (In 1984 Currency)

Item	Cost	
	(US$M)	(%)
Civil works	30.2	69.9
Equipment and vehicles	8.4	19.5
Mechanical assistance	1.7	3.9
Engineering and administration	2.9	6.7
Total	43.2	100.0

source: Appraisal Report, World Bank, 1984

(6) Project Achievements

The executing agency of MIRP is the Irrigation Management Division (IMD), but all civil works are undertaken by the Irrigation Department. The project organization is also linked to the Integrated Management of Major Irrigation Systems (INMAS) Program. INMAS is a national program designed to meet the needs of integrated management.

Data available in the Irrigation Department do not suggest encouraging development trends underlying MIRP. For instance, water consumption of rice in the individual irrigation schemes since the introduction of MIRP in 1985 has continued to show wide disparities within as well as between seasons. Rajangana Scheme, in general, appears to consume very large amounts of water even after rehabilitation. In fact, it is reported that efforts by the project management to reduce water consumption have been largely rejected by farmers in the case of Rajangana Scheme.

The observed pattern of highly variable water consumption by rice cultivations in different schemes in MIRP is an issue that requires deeper attention. In fact, the reported data reflecting "with project situation" suggest that there is no systematic relationship between water use, crop area and crop yields.

The performance indicators relating to agriculture in the project area during the past few years such as cropped area, cultivation intensity, crop yield, and shift towards high-value crops do not indicate encouraging changes. Despite high expectations of the project to achieve higher cropping intensities, the actual accomplishments during the initial five years are unsatisfactory. Similarly, data also show that although the area cultivated in the maha season is generally stable, the area cultivated in yala is still highly variable.

The crop yields in the MIRP schemes too have shown wide variations. Despite the efforts made by MIRP and INMAS, rice yields in the schemes during the period 1985-91 have not shown sustained increases, suggesting that the crop yields are determined by many factors outside water management.

Two important factors that determine the area cultivated and crop yields in the MIRP schemes

are the amount of water received from Mahaweli through the feeder canals and its timeliness.

Except in a few isolated instances, crop diversification does not seem to have achieved much sustained success in MIRP.

Data on agricultural production in the individual schemes suggest that it is most unlikely that the project would make significant headway in achieving its high production targets. The problem is partly due to the influence of a range of constraints outside irrigation water supply and distribution, in areas such as marketing, generation and dissemination of research results, and institutional performance.

3.1.4 Uda Walawe Rehabilitation Project

(1) Introduction

The Uda Walawe Irrigation Scheme, located in the southern dry zone of Sri Lanka, was initiated in the 1960s. The total command area of the project is about 17,000 ha. The rehabilitation work was begun in 1985 with funding from the Asian Development Bank (ADB). This work is being implemented only in the right bank, with a command area of about 12,000 ha. Walawe is managed by the Mahaweli Authority of Sri Lanka (MASL). In the 1980s, the Uda Walawe Irrigation Scheme received increasing attention mainly because of its poor performance in realizing the original project targets. Although a rehabilitation and development projects with the assistance of ADB, was implemented in the 1970s, the project failed to achieve its objectives. Subsequently, in the mid- 1980s, a feasibility study for rehabilitating the system under a new project was undertaken. The feasibility report identified that most irrigation-related problems in the Uda Walawe Irrigation Scheme arise basically from excessive water use and wastage in the head-end blocks. Some of the specific problems mentioned in the report are: inefficient on-farm water use resulting from cultivation of rice in permeable soils, excessive conveyance losses, inequity of water distribution, faulty design and poor control structures, and poor operation and maintenance of the conveyance system.

(2) Project Objectives

The primary objective of the rehabilitation project is to improve the irrigation water use efficiency in the scheme mainly through reducing conveyance losses and improving water control and delivery facilities.

(3) Development Strategy

The specific approaches adopted by the rehabilitation project can be summarized as follows:

- Physical improvements in the conveyance system, including rehabilitation of structural defects in the main system and the branch canal system.

- Improvements in the water distribution system through rehabilitation of the distributary-canal and field-canal systems, including the installation of one-cusec field canals parallel to the distributary canals.

- Improvement of O&M activities.
- Rehabilitation of roads.
- Improvement of domestic water supply by providing wells.
- Provision of equipment and vehicles.

The development strategy of the Uda Walawe Project seems to be based on the principal assumption that the primary constraint affecting the farm output in the Project area is the inadequacy and ineffective use of irrigation water due to the poor physical status of the project; once the water conveyance system is improved, resource productivity and total output of the project would be enhanced.

In planning, it is recognized that rice cultivation would remain as the dominant crop in most of the project area in the future. Yields of rice in the Uda Walawe Project, particularly in the upper reaches, are already close to the maximum potential achievable under current production technology. Hence, no improvements in rice yields in this area are envisaged. However, there is scope for increasing yields in the tail end of the project area by improving irrigation water use efficiency.

(4) Planning Process and Implementation

The preparation of project development plans reflects a strong top-down approach, with a bias towards construction and other capital-intensive activities. The project development plans have been made at the center, with little information from and participation of those at the project and field levels.

The implementation of the project has fallen far behind scheduler. The delay is attributed to a number of problems, most of which are related to administrative factors such as lack of sufficient staff, ineffective communication and an unsatisfactory security situation. However, studies conducted by IIMI indicate that the basic problems affecting the project stem from management and organizational issues (IIMI 1990).

The information on the organizational structure indicates that until recently most of the major decisions regarding project operation and maintenance activities were made outside the project, in Colombo, with little or no input from the project beneficiaries. As a result, farmers in the project have become passive receivers of the improvement package. Furthermore, the management style adopted in the project largely reflects a rigid pattern, with little flexibility to change and respond to specific beneficiary needs.

However, the nature of the project organization changed substantially with the reformulation of the project in 1990. These changes have facilitated the incorporation of the needs of the farmers as well as of the officials in the scheme regarding the type and nature of improvements they require.

(5) Project Costs and Components

Nearly 90 percent of the allocated funds for rehabilitation is reported to be earmarked for civil works and equipment. Since the project implementation has been delayed substantially, project costs have nearly doubled.

The appraisal report prepared by SOGREAH (1985) estimated that the rehabilitation cost would be less than US$ 1,000 per ha and that the internal rate of return to the rehabilitation investment would be about 35 percent. The project costs are shown in Table 3.1.4-1.

It is significant to note that activities such as training farmers, farmer leaders and others connected with developing farmers' organizations received virtually no attention in the original project formulation.

Table 3.1.4-1 Cost Composition of the Uda Walawe Rehabilitation Project (In 1985 Currency)

Item	Cost	
	(US$'000)	(%)
Irrigation system improvement	14,669	66.4
Road rehabilitation	612	2.8
Domestic water supply	709	3.2
Equipment and vehicles	850	3.8
Adaptive research	86	0.4
Consultancy services and training	1,472	6.6
Administration (CECB)	3,314	15.1
Service charge and others	374	1.7
Total	22,086	100.0

source: project appraisal report prepared by SOGREAH, 1985

(6) Project Achievements

According to the IIMI studies, an assessment of the overall performance of the rehabilitation project suggests that due to many problems, the project has so far shown little success. The project implementation has run into major delays and cost overruns. One of the major problems that has led to this unsatisfactory outcome is that the project, in general, has been conceived mainly as a construction-oriented investment, with little or no effort to diagnose actual problems faced by farmers and prescribe solutions to them.

A major recommendation emerging from the IIMI studies is that if the project is to show successful results, the project design and formulation should undergo drastic changes . The IIMI studies point out that heavy emphasis has been placed on construction activity, but the project implementors have not given much attention to farmers' organizations, training, research, and feedback mechanisms.

In order to remedy these complex problems, many suggestions have been made. Among them, the most significant, is the introduction of a participatory approach to irrigation water management that would emphasize farmer needs and aspirations. It has also been suggested that the existing, centrally controlled system of project management needs to be replaced with a new system in which officials in the project are given autonomy to take decisions in close consultation with farmers.

As a preliminary step to increasing farmer involvement in system management, the IIMI studies suggest that it would be necessary to repair the main canals and the distributary canals as early as possible. The rationale for this is that unless a reasonably good main canal and branch canal conveyance system is first established, it is difficult to seek farmer participation for undertaking O&M of the system.

MASL has been implementing some of the recommendations proposed by IIMI. Under the second phase of the IIMI studies, IIMI is assisting project officials and farmers to test and implement some management innovations. It is too early to judge the outcome of these efforts.

3.1.5 Irrigation Systems Management Project (ISMP)

(1) Introduction

The Irrigation Systems Management Project (ISMP), funded by USAID, was designed mainly on the basis of experiences gained from the Gal Oya Water Management Project. The project agreement was signed in August 1986. It is attempting to implement an irrigation systems management approach centered on farmer's organizations and to test alternative rehabilitation procedures that would be cost-effective.

The project covers six major irrigation schemes with a total command area of about 76,500 ha (Table 3.1.5-1).

Table 3.1.5-1 Schemes Covered by ISMP and Their Areas

Scheme		Area (ha)
Gal Oya:	Left Bank	26,316
	Right Bank	12,955
Parakrama Samudra		9,716
Giritale		3,036
Minneriya		8,927
Kaudulla		12,955
Ridi Bendi Ela		2,632
Total		76,537

source: USAID, 1986

(2) Project Objectives

In addition to the rehabilitation of the above schemes, the project aims at developing the national institutional capacity to manage and operate major irrigation systems and to establish strong farmers' organizations that are capable of catering to the demands in the irrigation sector.

(3) Strategy and Planning

ISMP is based on the concepts of the Gal Oya Water Management Project and the lessons learned from it. Thus, as in the case of Gal Oya, a high degree of management orientation is a key feature in the ISMP plans.

The project activities are mobilized mostly through the INMAS (Integrated Management for Major Irrigation Schemes) Program, launched in 1984 to provide a solution for the low productivity in major agricultural Settlements outside the Mahaweli System.

An implicit assumption underlying the project design appears to be that the relatively low productivity in the irrigation schemes is mainly due to institutional and managerial problems, particularly the lack of farmer participation and other "software" problems affecting the irrigation Settlement schemes.

The development strategies of ISMP are implemented in the irrigation schemes through the Project Management Committee (PMC) system. This system is composed of a project manager, farmer representatives and officials in the line agencies serving the direct and indirect agricultural needs of the scheme. At the local level, farmers' organizations are utilized to mobilize farmer participation in operation and maintenance activities. The PMC, therefore, is expected to represent farmer interests, with the responsibility of ensuring overall supervision. This design of the organizational structure is based on the experiences gained from previous rehabilitation projects, particularly, the Gal Oya Project.

The project manager's main task is to coordinate activities at the scheme level. Institutional Organizers (IOs), functioning under the broad supervision of project managers, have been appointed at the scheme level. The IOs are, basically, expected to play the role of catalysts in mobilizing farmer participation for O&M activities. The project managers as well as IOs are provided with intensive job oriented training on a wide range of activities.

(4) Project Costs and Components

ISMP consists of the following components:

- Establishment and strengthening of farmers' organizations.
- Improvement of operation and maintenance of irrigation systems.
- Enhancing financial management capabilities of farmers and others who are dealing with O&M fees and other sources of funds.
- Monitoring and evaluation of project activities and feedback.
- Enhancing training capacity.
- Applied research into the working of the project with a view to providing feedback information and improved guidelines .

Project costing for rehabilitation was based on two major concepts: Essential Structural Improvement (ESI) and Pragmatic Rehabilitation. These two concepts are defined as two methods of improving an existing irrigation system to an acceptable functional level using cost-effective and economic methods. The project paper explains that the difference between the two approaches relates to the financial input into the improvement. For instance, in ESI, the O&M staff are utilized throughout, whereas Pragmatic Rehabilitation involves temporary design and construction staff to carry out rehabilitation works.

The project, estimated to cost about US$ 28.3 million in 1985 currency, is funded by USAID (USAID 1986). The funds include a foreign contribution of US$ 18.6 million (66%) consisting of a grant of US$ 6.9 million and a loan of US$ 11.7 million. The local contribution is estimated at US$ 9.7 million (34%). A summary of the project-cost composition is given in Table 3.1.5-2.

Table 3.1.5-2 Cost Composition of ISMP (in 1985 Currency)

Item	Cost	
	(US$'000)	(%)
Technical assistance	4,590	16.2
Commodities	4,865	17.2
Training	1,140	4.0
Facilities (construction)	330	1.2
Rehabilitation (construction)	11,830	41.8
Research / studies	540	1.9
GSL personnel	4,490	15.9
GSL personnel (IOs)	380	1.3
Evaluation	135	0.5
Total	28,300	100.0

source: USAID, 1986

According to the original project plans prepared in 1984/85, the estimated cost of system rehabilitation was around Rs 4,446/ha for Essential Structural Improvements (ESI) and Rs 6,175/ha for Pragmatic Rehabilitation, which values are equivalent to US$ 170/ha and US$ 237/ha, respectively, at the exchange rates prevailing in 1985 (USAID 1986).

(5) Project Achievements

Compared to the other projects, ISMP has been in operation for a relatively short period and less information is available on its overall performance. However, from the information generated so far, it is clear that ISMP has played a largely complementary role to most other rehabilitation activities.

Because of its wide-ranging objectives, focused on a management orientation, a comprehensive evaluation of the performance and output of ISMP is a complex task. The project is mainly aimed at strengthening and expanding the farm-level and system-level institutions in the irrigation systems concerned.

A useful source of information regarding the performance of ISMP in its early stages is the mid-term review (ISPAN 1 990a).

In assessing project progress, the mid-term evaluation has placed a special emphasis on the institutional development and sustainability aspects of the project. The evaluation has concluded that ISMP is a useful learning experiment with considerable potential impact on the future of irrigation systems management in Sri Lanka. The report states that ISMP has been instrumental in creating a clear recognition among officials that farmers must play a substantial role in

irrigation system development and management. The evaluation concludes that ISMP has been instrumental in strengthening government commitment to increasing farmer participation in decision making and planning, in integrating technical and institutional development and in institutionalizing participatory management.

3.2 Drainage Projects

Generally speaking, it may be said that less attention has been paid to drainage rehabilitation projects compared to irrigation rehabilitation projects in Sri Lanka. However, need of rehabilitation of previously implemented drainage schemes has been increasing because those drainage schemes have become quite old and have lost their originally designed functions as drainage schemes. Some of the major drainage schemes implemented in Sri Lanka aided by foreign donors are summarized below.

3.2.1 Gin Ganga Regulation Project

(1) Introduction

The Gin Ganga originates from the southern slope of the Adam Range located in the middle-south of Sri Lanka and empties into the sea in the vicinity of Galle Harbor. The overall length of the main stream totals about 113 km with a catchment area of 960 km² and mean gradient of 0.24 %. This scheme located in the north of Galle district was completed in 1983 under assistance by the People's Republic of China. This project provided flood protection for rain-fed cultivation of 4,944 ha of lands on the both banks at the downstream of Gin Ganga. According to the project report, Gin Ganga was divided into 11 drainage sections and drainage was entirely provided by gravity in section DL_1 and by a combination of gravity and pumping in other sections. The salient features of the drainage sections are given below.

Location	No.	Designation of Sections	Catchment Area in Km²	Protected Area in Ha.	Remarks
Right Bank	1	DR1	24.41	1,302	Corresponding Pumping Station: PS1
	2	DR2	4.06	113	PS2
	3	DR3	1.77	55	PS3
	4	DR4	9.74	331	PS4
	5	DR5	1.36	41	PS5
	6	DR6	2.49	98	PS6
Left Bank	7	DL1	71.00	1,740	Widening and extension of Kepu Ela.
	8	DL2	3.57	154	Corresponding Pumping Station: PS10
	9	DL3	15.04	801	PS9
	10	DL4	4.61	249	PS7
	11	DL5	1.40	60	PS8
Total			139.45	4,944	

(2) Project Objectives

The main objectives of the schemes were to protect the area of 4,944 ha under the scheme by combination of pump drainage as well as by gravity drainage. The installed pump units for drainage purpose consisted of 7 sets of pumps with each capacity of 55 Kw and 30 sets of

pumps with each capacity of 155 Kw. These pumps were planned to run by electricity.

(3) Basic Strategy

The basic strategy included in this project were to adopt drainage by gravity as much as possible and drainage by pumps was adopted only for such basins (sections) where drainage by gravity was very difficult or impossible. In the design of required capacities of pump units and other hydraulic structures under the project, hydrological and hydraulic data based on 5-day storm with a frequency of approximately once in ten years were used. However, the flood protection bunds were designed for the flood stage occurred once in twenty years with provision of freeboard of 1.5 m in general.

(4) Project Planning Process

This project was originally formulated based on the " Agreement and Protocol of Economic and Technical Cooperation " agreed upon and signed between the then Republic of Sri Lanka and the Government of the People's Republic of China on July 12, 1974 as well as based on the "Reached Agreements on the Criteria of Flood Protection of Gin Ganga and the Related Matters of Construction", signed on December 31, 1974. These two documents were the main bases of the design of the project. In the project planning process, the following items were taken into consideration and those were treated as below.

Hydrology and Meteorology

Meteorological analyses for the project were made based on the records at Galle station located at the downstream of Gin Ganga. And floods conditions at different stages were studied based on the actually-measured data (covering years 1928 to 1973) at Agaliya gauging station. The said data showed that the maximum measured flood amounted to 1,170 m³/sec (recorded in May, 1940). Also these studies suggested that floods (storms) occurred mostly in May and October and the storm centers generally appeared at the middle and upper reaches of the Ganga and duration of one storm generally lasted for about 5 days with concentrated rains of strong intensity. These facts were fully taken into consideration in the design of the project.

Design Flood

The design flood was derived from the series of annual maximum flood discharge of 45 successive years. And the design flood discharge with 10 year's return-period was estimated at 754 m³/sec.

Drainage Design

Special attention was made to the water -logging on the farmlands along the planned bunds. For this, several existing drainage schemes near the project were carefully studied.

Geology and Construction Materials

In the project planning process, geology in the project area as well as construction materials (mainly earth materials for construction of bunds) to be used were also carefully studied. And

this contributed to minimize the project costs.

(5) Project Costs and Components

According to the report titled as " Preliminary Design Report of the Gin Ganga Regulation Project " prepared in September 1975, the project costs were estimated as follows.

Supply from China	RMB 11,250,000
Local Costs	RMB 23,740,000
Unforeseen Costs	RMB 2,800,000
Total Project Costs	RMB 37,790,000

Also, the project included the following components.

(a) Provision of 74 Nos. of flood protection bunds.
(b) Provision of 37 pump units with total drainage capacity of 74.76 m^3/sec.
(c) Provision of 36.63 Km of high voltage electric power transmission lines.
(d) Provision of 33.70 Km of drainage canals and 21 Nos. of spillways etc.

(6) Project Achievements

The project was implemented and completed in 1983 without serious modification of the original plan. And, it had been functioning well for several years and evaluated as one of the most successful drainage projects implemented in Sri Lanka. However, with years the project has been loosing originally designed capacities and functions due mainly to lack of maintenance of the project. Interview to the project engineer in charge during the phase-I field survey revealed that the annual O&M cost for running these pump units amounted to about Rs.13 million which consisted of Rs.4 million for administrative cost and Rs.9 million for running the pump units during the floods season.

These pump units are run by electricity of which unit costs are Rs.5.8 /Kwh at peak load and Rs.3.8 /Kwh at normal load condition. The said O&M cost per ha amounts to Rs.2,630. This seems to be very high compared to other schemes. This may be partially attributed to rise in electric fee, however, this situation suggests that introduction of large scale pumping units for drainage purpose should be carefully studied, otherwise, it will become another burden in budget allocation for O&M of the facilities in the future.

3.2.2 Nilwala Ganga Flood Protection Scheme

(1) Introduction

Nilwala Ganga rises in the vicinity of Deniyaya at an altitude of approximately 1,050 m and flows into the sea at Matara after covering the distance of about 70 km. The Ganga is on the eastern edge of the wet zone of Sri Lanka in which annual rainfall ranges between 3,000 to 4,000 mm. This scheme was originally implemented in early 1950's and is located in Matara district and has a catchment area of about 1,000 km^2. The protected area under the scheme is 5,942 ha. In the original rehabilitation plan, 57 nos. of vertical screw pumps with total installed capacity of 13,000 Kw driven by diesel motors were to be installed to improve the drainage condition of the scheme. The rehabilitation plan also included improvement of existing bunds and additional provision of flood control structures.

(2) Project Objectives

The major purpose of rehabilitation of the scheme was to protect the best part of the paddy fields in the protected areas from the floods. Accordingly, the main induced effect would be a considerable increase in crop yield. Another purpose of the rehabilitation was to protect Matara town, neighboring village, roads and other plantations in the protected areas.

(3) Basic Strategy

The basic strategy for protection of the farmlands under the scheme was to drain the excessive water during floods and to avoid intrusion of saline water from the sea by use of pumps and construction of flood protection bunds and additional drainage networks for which three alternative solutions were studied. During the study for alternative solutions, a mathematical simulation model which made it possible to take into account all the hydraulic phenomena which would occur during floods was fully utilized. The size of drainage structures including pumps was mainly decided on the basis of peak flood with ten years return period. And flood bunds were designed on the basis of flood with twenty years return period.

(4) Project Planning Process

As stated above, three alternative solutions i.e., Solution-1, Solution-2 and Solution-3 were studied in the process of rehabilitation planning (for detailed information on each solution, see Phase-2 Feasibility Report on Nilwala Ganga Flood Protection Scheme, October, 1981). These solutions included construction of flood protection bunds and roads, provision of pumps and additional drainage networks, river improvement etc. especially Solution-3 included construction of small dams.

During the study for Solutions 1 to 3, full attention was paid to the design criteria prepared by Department of Irrigation as well as to the existing drainage schemes with same nature. As a result, Solution-1 was selected as a proposed rehabilitation plan.

(5) Project Costs and Components

Project costs were estimated as follows based on Solution-1.

Work Items		Foreign	Local	Total (in 10^3 Rs.)
1.	Bunds and connected structures	95,512	53,279	148,791
2.	Roads of other works	9,227	4,968	14,195
3.	Pumping stations			
	3.1 Equipment	252,163	-	252,163
	3.2 Civil engineering	37,783	56,674	94,457
	3.3 Total pumping stations	289,946	56,674	346,620
4.	Drainage	35,810	23,874	59,684
5.	River improvement	38,350	29,150	67,500
6.	Total for structures	468,845	167,945	636,790
7.	Engineering	50,942	12,735	63,677
Total		519,787	180,680	700,467

Solution-1 included the following main components.

1.	Cultivated Protected Area	5,940 ha.
2.	Bunds:	
	Total length	24 km.
	Maximum elevation	6.20 m.
	Purchase of land	105 ha.
	Number of anicuts	14
3.	Pumping Stations:	
	Number	16
	Total pumping capacity	175 m^3/sec.
	Total installed capacity	13,000 Kw.
4.	River Development:	
	Length	3.4 km.
	Volume of earthworks	540,000 m^3.
	Purchase of land	54 ha.

(6) Project Achievements

This rehabilitation project was intended to be completed during 1984 to 1993 by the aid from France, however, it is still going on. In spite of this situation, however, it is evaluated that there has been significant improvement in flood control for the scheme because floods can be evacuated much faster than before the rehabilitation project has been implemented. However, costs for running the installed pump units have become a heavy burden to be borne by the Government of Sri Lanka.

3.3 Participatory Management Programs

(1) Introduction

The need to improve the productivity of major irrigation schemes was recognized as early as the mid 1960's. Nearly all of the early programs designed for this purpose focused on increasing the use of inputs, viz. improved seed, chemical fertilizers, farm power and agro-chemicals. Adequacy and predictability in the supply of irrigation water was not an important concern of this strategy. With government plans to make further investments in large irrigation projects such as Mahaweli in the early 1970's interest in irrigation water management came to the forefront. Early experiments in on-farm water management and in system rehabilitation projects such as TIMP and GOWMP were part of this orientation. Nearly all farmers in Sri Lanka being small holders many of them having single holdings, equity in irrigation water supply too was an important social consideration.

Water Management and Rehabilitation

By the early 1980's it was apparent that some degree of system rehabilitation was a pre-requisite to introduce good water management. The Government therefore accorded high priority to water management and to irrigation rehabilitation programs alongside the development of new irrigation systems.

The main features of this program were:

(i) to broadbase the rehabilitation and management improvements to cover all existing systems

(ii) to keep costs down in order that some part of the program could be nationally funded

(iii) to ensure that O/M of schemes was funded at reasonable levels in order to prevent further system deterioration

(iv) to provide for the sustainability of the system after rehabilitation through improved management

Important programmatic developments that took place concurrently were:

(i) isolated water management initiatives such as in Minipe and in Kimbulwana which attempted to improve decision making at the scheme level and to promote farmer participation in management

(ii) the water management program of the government which emphasized adherence to cultivation calendar, and optimum use of available human and financial resources through better coordination and management at the scheme level and with no additional investment.

(iii) donor interest in funding rehabilitation projects like MIRP and ISMP based on

lessons learned from previous projects and to support the Government's program for rehabilitation.

(iv) proposals made in the National Agricultural Food and Nutrition Strategy (NAFNS, 1984) to accord priority to irrigation rehabilitation and to prepare a cyclical rehabilitation program (15 to 25 years) for all categories of irrigation schemes.

(iv) establishment of the Irrigation Management Division (IMD) in the Ministry of Lands and Land Development to implement the INMAS program and the major rehabilitation projects.

(2) INMAS and MANIS Programs

The INMAS program formalized in 1984 attempted to combine and fuse the objectives of previous experiments and projects to a comprehensive, mutually reinforcing long term program for participatory management. The program made interlocking implementing and institutional strengthening arrangements with MIRP and ISMP to mutually access from the available resources.

Among the objectives of the INMAS program were:

(i) increasing agricultural production per unit of irrigation water and per unit of land

(ii) adequate and equitable distribution of irrigation water to farmers

(iii) arrange for funding supply of agricultural inputs and for marketing

(iv) develop farmer organizations to participate in management

(v) maintain the irrigation system at optimum levels of performance

(vi) identify major systems needing rehabilitation

The long term focus of the program was the integrated development of farm holdings through crop diversification, agro-processing / marketing and other diversified activities and to eventually turn over to the farmer organizations some of the management and operational functions of the projects.

Fig. 3.3-1 presents the original organizational structure of the INMAS program. It was designed to operate in a highly decentralized manner integrating with existing institutions at the District level such as the District Agricultural Committee and enhancing management capacity at the project level with the central agency determining policy and playing an advisory and supportive role.

Between 1984 and now, however, drastic and frequent changes have occurred in the District and Provincial administration making the original assumptions invalid. There is now a need to strengthen management capacity at the center as well, to direct project management.

The INMAS program started with 35 projects in major irrigation schemes where conditions were considered favourable at the time to initiate a program of this nature. During the intervening period, two other programs based on the INMAS model have been introduced: (i) MANIS by the ID for some 160 medium scale schemes and (ii) by MEA for Mahaweli schemes.

(3) Current Status

The Participatory Management Program has been evaluated recently by IIMI and ARTI in a joint study the results of which are expected soon.

Although the programs may not have achieved all of the objectives originally set forth, they have made some significant contributions towards institutionalizing participatory management.

The more important of these can be listed as the following:

(i) development of Farmer Organizations

(ii) establishment of Project Management Committees

(iii) system turnover

(4) Farmer Organizations

The guidelines for INMAS advocated the establishment of a pyramidal structure operating in 3 tiers: the Field Canal Group (FCG), Distributory Canal Organization (DCO) and the Project Management Committee.

FCG are informal organizations of groups of 15-20 farmers within a hydrological command which meets regularly to discuss and resolve problems as they arise and take timely action. Problems that cannot be resolved at this level are referred to the next higher level or to the concerned agency.

Representatives from several FCG form the DCO. It is a formal organization with a constitution, and elected office bearers from among farmer representatives. The DCO is chaired by a farmer representative and field level officers attend meetings on invitation. The DCO can now gain legal recognition through registration under the Agrarian Services Act as well as under the Irrigation Ordinance.

Representatives from DCOs have a right to be represented in the Project Management Committee (PMC) which includes officials of line agencies such as ID, DOA, DAS and LCD.

The more successful FOs have federated into a System Level Farmer Organization (SLFO) independent of the PMC. Membership of SLFO is made up of farmers while chairmen of DCO who have contributed to the share capital form the Board of Directors. Government officials have no membership in this organization. SLFO undertake a wider range of activities starting with trading activities related to farming.

All active FOs participate in water management, system maintenance, supply of inputs and marketing, and in conflict resolution. Many FOs have started income generating activities, like seed farms, and tractor services to build up their financial reserves.

FOs are often represented in the official Agricultural Committee of the Government at the Divisional and District levels enabling them to participate in decision making on agricultural policies and programs. FOs in systems served by the Mahaweli Project are represented in the Mahaweli Water Management Panel, a national level body for allocating Mahaweli water.

Although not uniformly, Institutional Organizers (IOs) or catalysts were employed as resources permitted, to assist farmers to organize themselves into groups and understand their role. This method has accelerated the pace of FO development and helped the FOs to develop as independent and non-partisan institutions. The role of the IO is therefore now considered crucial in the early stages of establishing farmer organizations. FOs can now receive legal recognition by registering themselves under the Agrarian Services Act (Amendment Act No. 4 of 1991) and the Irrigation Ordinance (Amendment Act No. 13 of 1994).

Currently around 85% of all major an medium schemes have FOs and according to a recent IIMI study have contributed significantly to improve water management and system maintenance.

FOs being new institutions which in some ways have to challenge and to compete with entrenched institutions need much official and institutional support to develop. The rapid development of FOs under GOWMP and ISMP is to some extent indicative of the level of resources that needs to be applied. The INMAS and MANIS programs received much lower levels of resources.

(5) Project Management

Instituting a viable project management system was the primary objective of the INMAS program. The Project Manager's function was to create an environment where officers of various line agencies on the one hand and farmers on the other could work to a coordinated program, to achieve the overall objectives of the project. Coordination among officials was as important as interaction with the farmers. A forum where all groups could meet as equals, discuss programatic issues and resolve problems was necessary.

With the formation of FOs at FC and DC levels the opportunity for officials to interact with farmers through their representatives became available. INMAS provided for a hierarchy of representative committees at DC, subproject and project levels. At the Field Canal Level is the Field Canal Group (Keth Ela Kandayama) an informal group made up only of farmers in the FC or turnout area. Representative selected by consensus from this level form the Distributory Canal Organization DCO (Bedum Ela Sanvidanaya). The elected Chairmen (farmers) of the DCO form the Sub-Project Committee covering several DCO. Chairmen of Sub-Project committees constitute the Project Management Committee (PMC) of which the Project Manager is Chairman. From DCO upwards officers of relevant government agencies, particularlly those associated with agricultural production such as ID, DOA, DAS, PMB and state banks, are represented in the committees. However there is always a majority of farmer representatives in each committee. The above process has been designed to ensure proper representation of

farmers for decision making at different levels and to provide leadership to the farmers in project management. The participatory method and the decision making process is presented below.

LEVEL Name of Organization	Frequency of meetings	Membership	Responsibility
NATIONAL LEVEL			
Central Coordinating Committee on Irrigation Management (CCCIM)	every 3 months	Rep's of related ministries and dept's' chair :S/IPE	Review of policies and programs
PROJECT LEVEL			
Project Management Committee (PMC)	min. 1meeting/month, special meetings as required	Line dept, officials and DCO rep's, chair: Project Manager	Coordination and review of all project activities
SUB-PROJECT LEVEL			
Sub-Project Committee (SPC) (only in large projects)	once a month	DCO chairman and departmental officials, chair: farmer rep. (DCO chairman)	Sub-project level decisions
DC AREA			
Distributory Canal Organization Committee (DCO) (Bedum Ela Sanvidanaya)	once a month	FC level chairman and field level staff, chair: farmer rep.	DCO area issues
FIELD CANAL AREA			
Field Canal Group - FCG (Keth Ela Kandyyama (KEK))	as often as required	All farmers in the field canal, no officials, chair: farmer	Decisions on day to day matters

This model is now adopted as far as possible under the MANIS program and in the Mahaweli areas.

The Project Management Committee (PMC) and its hierarchy of committees is responsible for seasonal planning, water allocation to different parts of the system, coordinating with different agencies and institutions, monitoring the programs, resolving disputes and improving communications. The Central Coordinating Committee on Irrigation Management (CCCIM) chaired by the Secretary, IP&E directs and monitors the overall Irrigation Management Program.

The PMC and the Project Manager have now received legal recognition and authority under the Irrigation Ordinance to coordinate all project management activities and to make recommendations regarding cultivation and system operations.

Since PMCs operate in a dynamic environment where the needs and demands of farmers keep moving from one stage to another there is no denying that there is ample room for improvement of the performance and effectiveness of PMCs to transform irrigation schemes to dynamic production systems. Since PMCs operate at the periphery with poor infrastructure and communication facilities the central agencies need to focus on improving the institutional capacity of the PMCs.

The success of PMCs depends on the leadership provided by the Project Manager, the willingness of field level officers to participate and the enthusiasm of FOs to work in collaboration with the agencies. A recent IIMI study has assessed the levels of participation as satisfactory and the decision making in most PMCs as effective. PMCs would be more effective if the CCCIM and the line agencies at higher levels adopt a more supportive approach to decentralized decision making.

(6) System Turnover

System turnover which was identified as a long term objective of INMAS once the FOs had developed to an acceptable level to take on responsibilities for system management occurred earlier then anticipated probably for the following reasons.

(i) the rather rapid development of the institutional capacity of FOs and their willingness and enthusiasm take control of the system

(ii) the Government's interest in handing over the O/M of the system as a substitute for recovering O/M fees, due to the difficulties experienced in sustaining a fee collection scheme.

The earliest experiment in turning over DCs and FCs was around 1987 in Nagadeepa scheme initiated on an informal basis with the assistance of an NGO. The potential seen in this experiment was adopted by INMAS to incorporate system turnover as part of its program. The initial experiences helped to formulate procedures and technical criteria for handing over DCs and FCs to FOs. Main requirements were:

(a) that the FO had reached a stable level as an institution

(b) that the irrigation system was in a reasonable good operating condition to regulate water issues, and

(c) that there was mutual understanding between FO and the ID Engineer

A more comprehensive set of criteria were worked out under the ISM project to enable the handing over of rehabilitation systems under a formal agreement. (A copy of the agreement is annexed.)

Although the turnover of systems on an informal basis is reported to have progressed satisfactorily island-wide, formal turnover has not been so widespread. FOs now insist that before they could takeover the system formally, the system should be rehabilitated and brought up to a good operating condition. In many instances of informal turnover the irrigation agency continues to support either maintenance or repairs to the system. The feasibility of turning over has to be examined case by case.

A recent study by IIMI has shown that FOs need both continued technical advice and financial support to effect repairs to structures which either deteriorate or get damaged. FOs often find it difficult to mobilize the materials required for such repairs, the cost of which is estimated at between 25~50% of the total cost.

Based on current experience and the needs of proper system maintenance, the modalities and criteria for system turnover have to be refined further. It is likely that under this program some parts of the system will be "joint managed" while others will be 'self managed' by FOs. The extent to which farmers incomes would be adequate to maintain the system to the desired level and what kind of technical advice and support and what level of financial support will be required has to be carefully assessed. Nevertheless, the IMPSA studies had made it clear that farmers are indeed willing to take on responsibilities to manage their irrigation systems and that turnover with adequate devolution of authority motivates farmers to accept such responsibilities.

INMAS PROGRAM

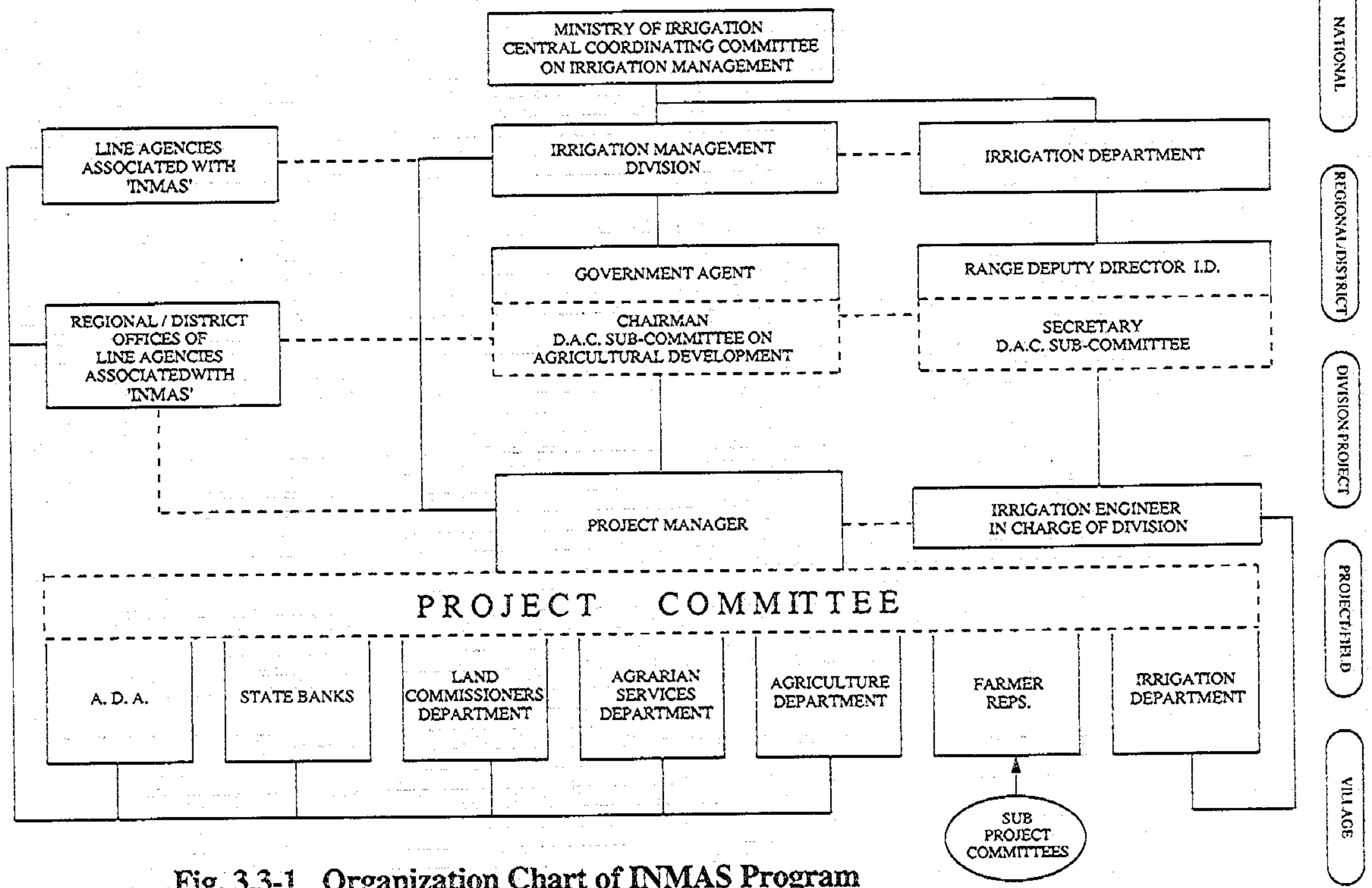


Fig. 3.3-1 Organization Chart of INMAS Program

3.4 Experiences and Lessons

3.4.1 Lessons Learned

Following are some of the lessons learned from the above rehabilitation projects implemented in Sri Lanka.

(1) Cost-effective Rehabilitation

In the absence of convincing evidence that irrigation rehabilitation by itself has led to increases in crop production, it would be safe to assume that returns to investments in rehabilitation schemes are obtained through the prevention of potential reduction in the cropped area and in crop production by ensuring greater predictability and equity in the supply and allocation of water. Hence, to maximize returns to investment, low cost rehabilitation to insure safety of the system accompanied by improved water management cropping and strengthened institutions would be more desirable than capital intensive hardware oriented projects.

(2) Designing for Sustainability

The rehabilitation, apart from being less capital intensive should be designed for cost-effective management of all the key operations. The level of technology should be one which the Agency and the FOs would be able to manage on a sustainable basis at the level of resources available to them. In this process it may be necessary to modify the original design and canal layout to meet new needs and policy changes. Rehabilitation programs therefore may need to include access roads, bridges, cattle and tractor crossings, etc. to facilitate transport of inputs and produce, as essential compnents of the infrastructure improvement effort.

(3) Data and Information

Before embarking on the design of the rehabilitation program planners should secure the best and most reliable information regarding the present functioning and behavior of the system, desired improvements and visualize how the system will be operated and managed after rehabilitation. Quite often the actual operating conditions are not recorded with the Irrigation Agency unlike designing a new system, in rehabilitation the behavior of the system and its demands are best known to the farmers and field staff working in the area. Steps should therefore be taken to consult farmers and field officers to gather the required information based on actual field conditions. It is possible that all the required information, especially on the secondary and tertiary levels would not be available at the outset; therefore the plan should be sufficiently flexible to incorporate new information that would be forthcoming after commencing rehabilitation.

(4) Farmer Participation

Past experience demonstrates very clearly that where farmers and officials have participated in the planning, design and implementation of the rehabilitation, the results have been more encouraging and lasting. Hence arrangement for active participation of farmers in the rehabilitation process should precede the rehabilitation proper. The institutional models for farmer participation are already in place in some Sri Lankan irrigation systems. They should be

reviewed and modified to suit the needs of each project. Well organized FOs should be given the opportunity to participate in the planning and design of the rehabilitation in order that they would "own" both the process and the system eventually.

(5) Project Management

Participatory project management is one of the most important features of the INMAS and MANIS programs, and is an approved policy of Government. The PMC where both farmers and officials are well represented can play a major role in planning, design and monitoring of the rehabilitation program. Technical expertise and farmer knowledge are combined at the PMC to both secure the necessary information and data required as well as to mobilize resources for project implementation. Strengthening the PMC and DCOs to a level that would enable them to take on that responsibility should precede the rehabilitation.

(6) System Turnover

As part of government policy, FOs are expected to takeover the system below the D canal for operation and maintenance, a precondition for which is that the system should first be rehabilitated. Farmers are unwilling to take over the system unless they have been fully associated in the rehabilitation. Therefore, it is very necessary that the entire process be made transparent, and the designs and costs of rehabilitation as well as the likely costs of O/M fully shared with PMCs and FOs in advance in order that FOs will make a firm commitment to manage the system after rehabilitation.

(7) Influence of Non-water Factors

Physical rehabilitation and improvement of water management alone does not improve the benefit stream on a sustainable basis. Many other factors relating to agricultural technology, cropping, and institutional arrangements for agricultural credit, processing and marketing seem to have a strong bearing on the success of a rehabilitation project. These aspects should be factored into the plans and designs for rehabilitation.

(8) Mid-Term Evaluation

In rehabilitation projects, a mid term review, say after the 2nd and 3rd year of implementation, would help the planners and project staff to take stock of the situation and make mid course corrections both to the concept and design as well as the processes adopted in the program. The real ground situation in regard to the operation of the system and the actual working conditions together with working relationships between and among the different stakeholders will surface only after implementation has started. Hence a mid-term evaluation by an independent professional group would be a very effective means of improving project efficiency and the eventual impact of the project.

3.4.2 Identification of Experience of FOs in Polonnaruwa

During Phase I of the current Study, the Study Team visited Polonnaruwa District which has the largest extent of major irrigation systems recently rehabilitated under ISMP and had meetings with the Project Managers and FOs of Giritale and Minneriya schemes. (Notes of the meetings are in Appendix-4.)

Some of the important observations that can be made on the basis of the visit are:

1) FOs in Polonnaruwa District are quite well developed and mature taking on many responsibilities relating to system management, input supplies, marketing and the social activities for the welfare of the community.

2) PMC's are working well with the active cooperation of FOs.

3) FOs have formed their own independent organization, viz. System Level Farmer Organization (SLFO), to undertake a wider set of social and economic activities.

4) All FOs have informally taken on the O/M of the systems; but only a few have taken over formally by signing an agreement with ID. FOs are of the view that due to inadequate initial consultation about the rehabilitation program, the level of rehabilitation is not adequate for them to take over the maintenance of the system by themselves.

5) According to FO representatives, management of the schemes has changed from a "top down" to a "bottom up" approach, resulting in a higher degree of awareness among farmers about their rights and obligations and led to improved relations with government officials.

6) FOs are now represented in higher level bodies, e.g. Mahaweli Water Management Panel and Committees at the district level.

7) Several FOs have built up substantial financial reserves by undertaking ID contracts and through trading activities. FOs have successfully negotiated discounts on purchases and passed on part of it to farmers; similarly their intervention has helped to maintain high prices for farmer produce.

CHAPTER FOUR :
PRESENT CONDITION OF SOUTHERN REGION

CHAPTER FOUR: PRESENT CONDITION OF SOUTHERN REGION

4.1 Natural Condition

(1) Location and Topography

The seven schemes under the Study are located in the districts of Kalutara, Matara and Hambantota. As discussed in more detail in the following section, these schemes lie within seven separate river basins. Of these basins, Benthara (Bentota) Ganga and Polwatta Ganga are relatively isolated, while the remaining five are situated close and adjacent to one another.

The southern region of Sri Lanka within which the target basins are found topographically ranges from the central upland in the north with peaks over El 2,000 m to low coastal areas to the south. A mountainous area lies roughly in the center of the region with elevations over 500 m. A major peak in this mountain group is Gongala (El 1358). The Shinharaja Forest Reserve (virgin forest) is located at one edge of this area.

The benefit areas of the 7 schemes are under El 50 m. (see Fig. 4.1-1)

(2) Climate

Climatically, the southeastern part of the region belongs to Dry Zone, while the western part belongs to Wet Zone. The Walawe Ganga basin area is either Wet Zone or intermediate between Wet Zone and Dry Zone at its upper reaches, with the downstream benefit area belonging to Dry Zone. Rainfall in the southeastern Dry Zone is under 1500 mm while that in the coastal area stretching across the western and southwestern part is over 2,500 mm. At the western edge of the central upland in the northwest of the region, rainfall reaches 4~5,000 mm.(see Fig. 4.1-2)

Rainfall at the upper reaches of the Walawe Ganga is 2,500 mm, and about 1,000 mm in downstream areas. Hydrological zone boundaries as determined by the Irrigation Department are as shown in Fig. 4.1-3.

(3) Geology

In the Southern region, two types of geological formation are recognized, i.e Highland Series and Vijayan Series. The Highland Series comprises granulite facies rocks, and the Vijayan Series is amphibolite facies rocks, predominantly. In the three districts, Kalutara, Galle and Matara, the Highland Series is distributed. Hambantota district lies largely in a transitional zone, between the Vijayan Series and the Highland Series. The Walawe river demarcates, rather roughly, the boundary between the Highland Series to the west and the Vijayan Series to the east.

(4) Soils

On hilly, rolling and undulating terrain, red-yellow podzolic soils are principally distributed in the wet zone, and reddish brown earths in the dry zone. Along the rivers in the southern region,

alluvial soils are dominant, also bog and half-bog soils in the wet zone. These soils are mostly suitable for food crop cultivation.

(5) Natural Environment

Sri Lanka is divided into 6 bioclimatic zones (see App.3-1). Specifically in the southern region, these are (moving from east to west) Arid Zone, Dry Zone, low and mid country Intermediate Zone, and low and mid country Wet Zone. These zones are chiefly determined by rainfall and elevation, and essentially demarcate the differing distribution patterns for flora and fauna, i.e. wet evergreen forest or tropical rainforest in the low and mid country Wet Zone, intermediate evergreen forest in the low and mid country Intermediate Zone, dry mixed evergreen forest in the Dry Zone, and thorn forest in the Arid Zone.

Biodiversity in Sri Lanka is extremely high compared with other countries of the South Asian region. This is due to a wide range of differing climatic zones despite a relatively small land area, sharply changing topography from the coast to the high central upcountry, and the tenants of Buddhism against the killing of living things. A large proportion of living species are indigenous, and particularly numerous in Wet Zone forest in the southwestern part of the island. Nevertheless, over 94% of the indigenous tree species in Wet Zone are considered to be threatened. Forested area decreased from 44% of total island land area in 1956 to 24% in 1989. Forested area remains to a relatively larger extent in the northern region and southern region Dry Zone, with forested area accounting for 34% of total Dry Zone land area. In the case of Wet Zone, forested area has dwindled to 12%.

(6) Agro-ecological zones

The southern region widens to about 1,350 km in the southern part of Sri Lanka, with the region having various ecological parameters, i.e., rainfall, soils, vegetation and land use. According to these, the region is divided into all three agro-ecological zones, i.e. wet, intermediate and dry zone. Kalutara, Galle and Matara districts belong to the wet zone, while the western part of Hambantota District bordering on Matara district belongs to the intermediate zone and the other part of the same district to the dry zone (See Fig. 4.1-4).

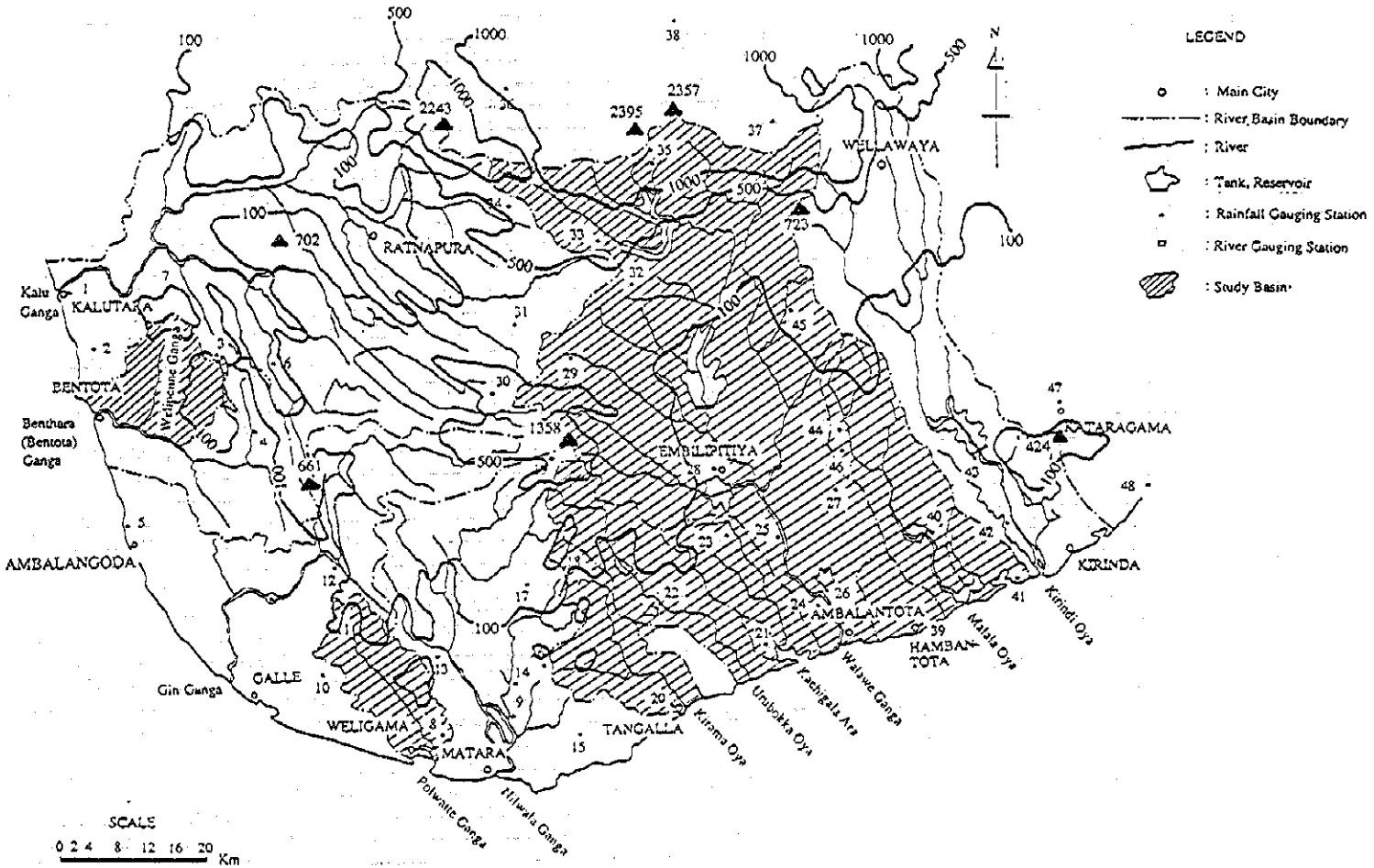


Fig. 4.1-1 Topography

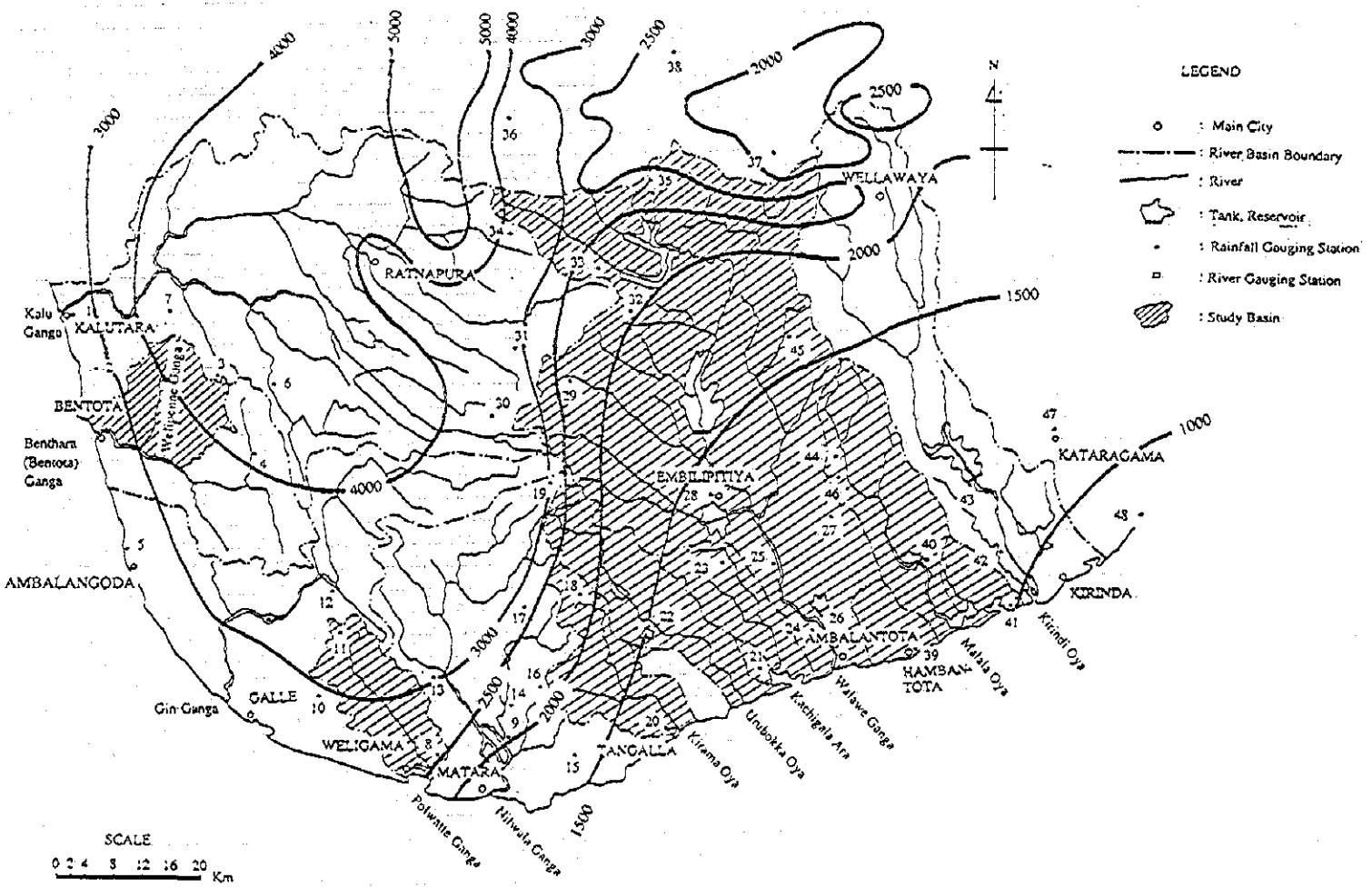
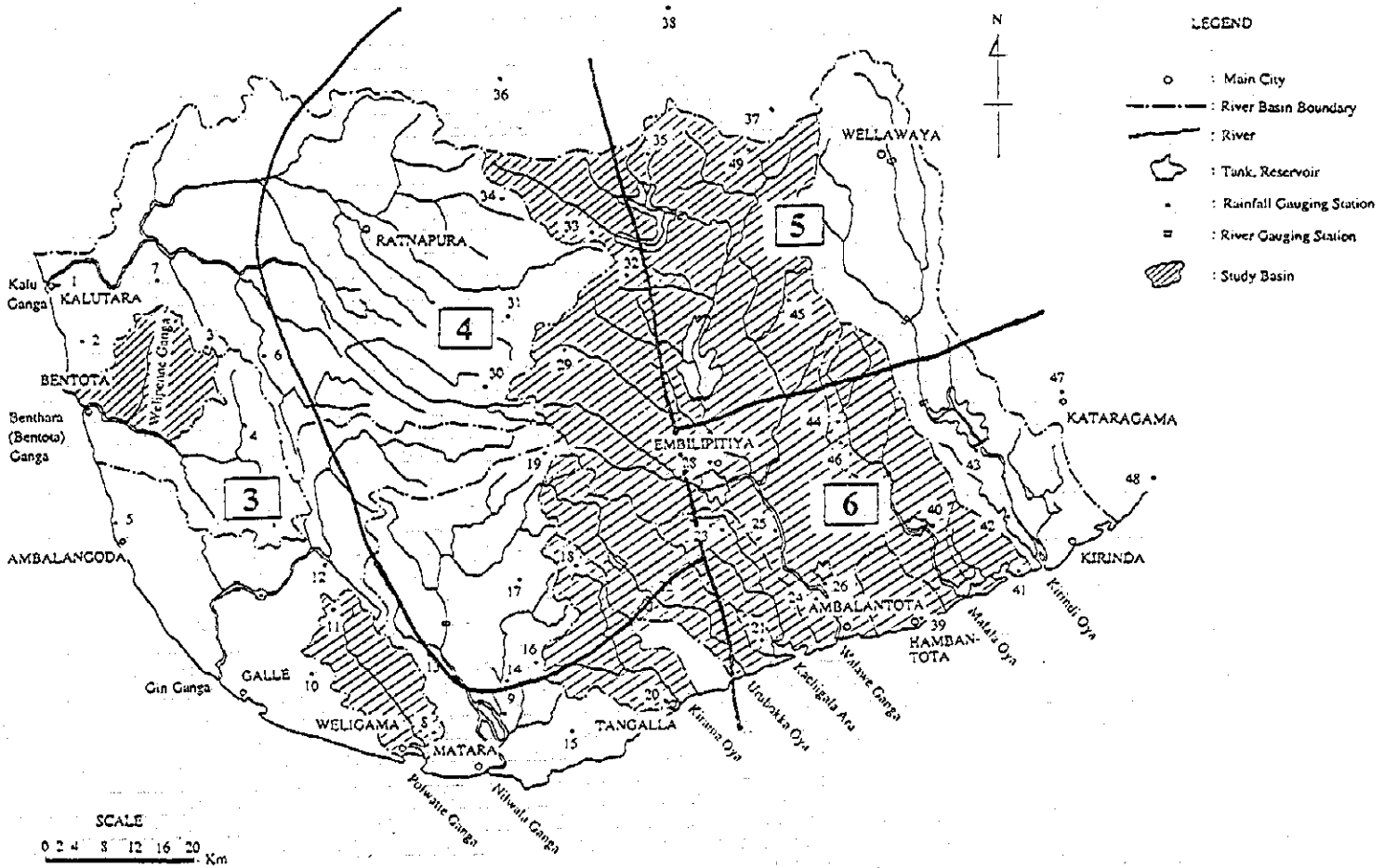


Fig. 4.1-2 Annual Rainfall



Source : Irrigation Department

Fig. 4.1-3 Hydrological Zone

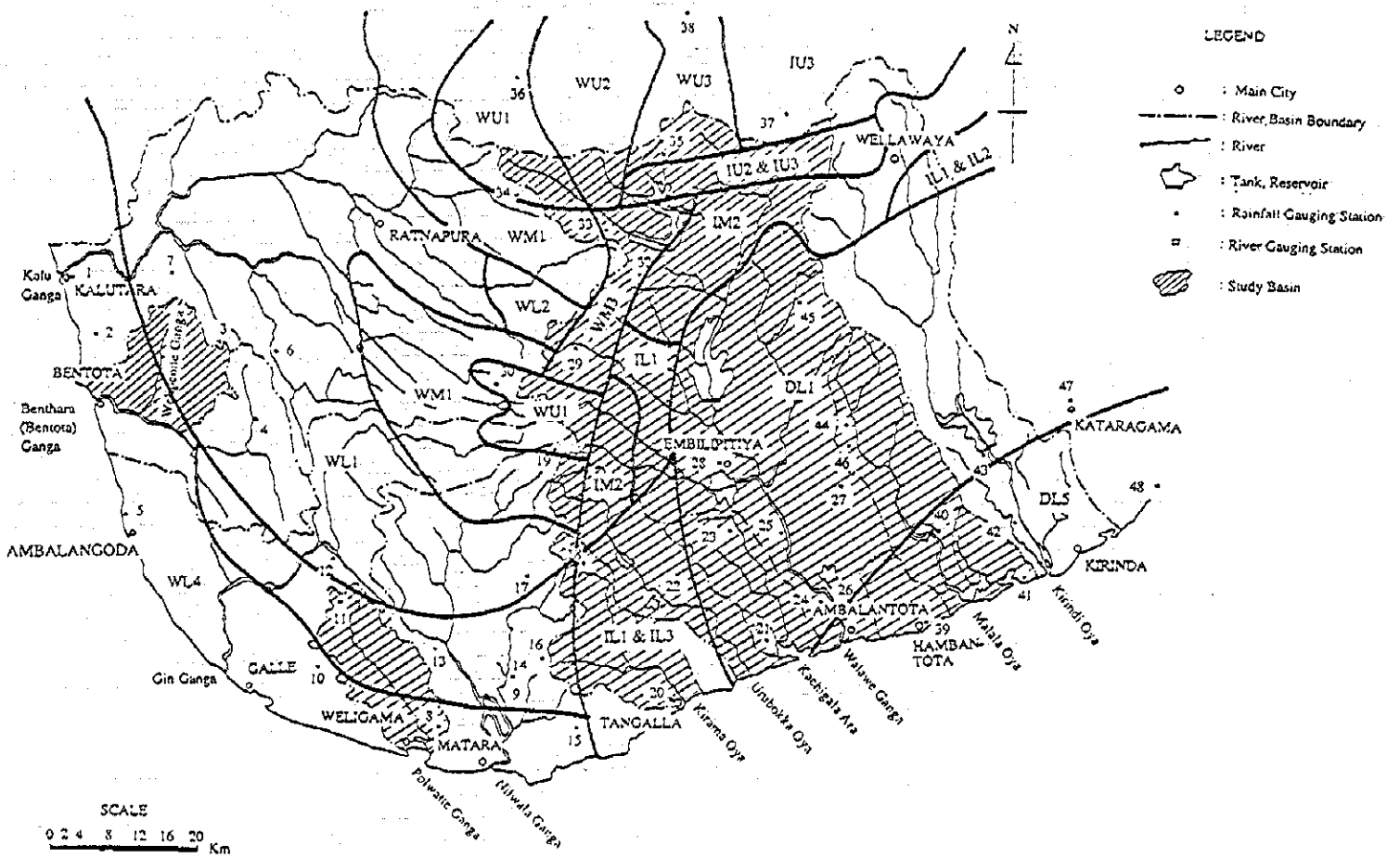


Fig. 4.1-4 Agro-Ecology

4.2 Agro-economy

4.2.1 Agriculture

(1) Population and Households

The districts of Kalutara, Galle, Matara and Hambantota, within which the Project areas lie, had total respective populations as of 1993 of 961,000 (2.9% increase over 1990), 971,000 (4.2% increase over 1990), 797,000 (4.2% increase over 1990) and 531,000 (4.1% increase over 1990). With the exception of Kalutara, population growth rates are strong and steady. Matara District exhibits the highest population density at 621 persons/km² (2.3 fold the national average) and Hambantota exhibits the lowest at 206 persons/km² (24.5% below the national average). (see App. 2.2-1)

According to D.S. Division statistics as of March 1995, each scheme encompasses a population of 40,000 to 70,000. Average household size is estimated at 4.4 persons. Proportion of total households accounted for by farm households is highest for Hambantota Division at 89.2% and lowest for Tangalle Division at 59.0%. The Division with the highest population density (1,298 persons/km²) is Weligama, within which the Polwatte Ganga scheme benefit area lies. Hambantota Division which contains the Badagiriya Scheme exhibits the lowest population density at 94 persons/km². (see App. 2.2-2) This signifies that the average farm size in the Division is relatively large.

(2) Cropped Area

a) Paddy

Kalutara, Galle and Matara districts belong climatically to the Low-Country Wet Zone, while Hambantota belongs to the Dry Zone. Cultivation is primarily controlled by the factors of meteorological and topographical conditions, and the status of irrigation facilities. Irrigated agriculture in Sri Lanka is broadly classified into 3 types: i) major irrigation schemes (benefit area 80 ha or over; operation and maintenance by the Irrigation Department), ii) minor irrigation schemes (benefit area under 80 ha; operation and maintenance by the farmers themselves), and iii) rainfed farming.

As a general trend, paddy is cultivated in rainfed fields in Wet Zone and in irrigated fields in Dry Zone. Reflecting this, as of 1993, rainfed farming accounted for an extremely high 99.7% of paddy cropped area in Galle District, which belongs to Wet Zone, while the same proportions for Kalutara and Matara Districts were 85.2% and 54.7%, respectively.

In contrast, the greater part of paddy cultivation in Hambantota District, which belongs to Dry Zone, is under major irrigation schemes which account for 79.9% of such farming (national average: 49.1%). Minor schemes account for 15.1% (national average : 21.0%) and rainfed farming for 5.0% (national average : 29.9%) of paddy cropped area. (see App. 2.2-3)

In 1993, total paddy cropped areas were 30,519 ha (3.7% of the national total) for Kalutara District, 34,617 ha (4.1% of the national total) for Galle District, 35,682 ha for Matara District (4.3% of the national total) and 33,776 ha (4.1% of the national total) for Hambantota District.

These figures represent, respectively, an 11.1% decrease for Kalutara District, a 10.3% decrease for Galle District, a 6.7% increase for Matara District and a 7.3% increase for Hambantota District as compared with 1991. This figures are all well below the national average growth rate in paddy cropped area over the same period of 21.6%. (see App. 2.2-3)

Target cropped areas for 1995 are 37,880 ha (24.1% increase over 1993) for Kalutara District, 41,485 ha (19.8% increase over 1993) for Galle District, 35,030 ha (1.8% decrease over 1993) for Matara District and 42,255 ha (25.1% increase over 1993) for Hambantota District. Of the four districts, only Hambantota exceeds (slightly) the national average of 24.4% increase. (see App. 2.2-4)

Paddy cropped areas by D.S. Division in 1994 were: 10,351 ha (75.8% increase over 1992) for Hambantota Division, 7,039 ha (decrease of 26.7% over 1992) for Ambalantota, 6,487 ha (94.1% increase) for Weeraketiya Division, 4,491 ha (increase of 34.2% over 1992) for Weligama Division, 3,517 ha (312% increase over 1992) for Tangalle Division, 3,106 ha (12.8% decrease over 1992) for Angunakolapelessa, 2,152 ha (403.8% increase over 1992) for Walallawita Division, and 1,838 ha (15.4% increase over 1992) for Matugama Division. Divisions significantly affected by the drought of 1992 were Walallawita, Tangalle, Weeraketiya, and Hambantota. (see App. 2.2-5)

Average cropping intensity for paddy (obtained by dividing cropped area by the cultivated area) in 1993 was 153% for Kalutara District (1995 target cropping intensity : 159), 164% for Galle District (1995 target cropping intensity : 173), 174% for Matara District (1995 target cropping intensity : 168), and 130% for Hambantota District (1995 target cropping intensity : 148). In contrast to the high rate of utilization of cultivated land in Matara District, Hambantota exhibits a relatively low utilization rate. Nevertheless, values for all 4 districts are well above the national average of 134% (1995 target cropping intensity : 115). (see App. 2.2-6)

App. 2.2-7 indicates the harvest rate and degree of crop failure for paddy for the period 1991~1995. In the case of all the subject districts, degree of crop failure is slightly below the national average. However, it can be noted that the crop failure rate for major irrigation schemes in Hambantota District showed a high value of 7.7%. This is attributed to not only meteorological conditions by also continuing deterioration of existing irrigation facilities.

b) Subsidiary Food Crops and Vegetables

Upland field crops other than paddy (cereals, pulses, vegetables, etc.) are collectively referred to as OFC (Other Field Crops) in Sri Lanka. Of these, Subsidiary Food Crops are those excluding vegetables. Cereals comprise such crops as kurakkan, maize, etc.; pulses comprise soy beans, green gram, black gram, cowpea, etc.; and vegetables include chilies, manioc, red onion, brinjal, okura, bitter gourd and snake gourd.

As with paddy, constraints on cultivation of upland field crops greatly depend on meteorological conditions. In the case of Hambantota which lies in Dry Zone, subsidiary food crops are an important source of nutrition following the staple rice, and are widely cultivated primarily in the Maha season. On the other hand, no significant cultivation of such crops occurs in the three districts of Kalutara, Galle and Matara which lie in Low-Wet Zone. Regardless of meteorological conditions, vegetables are cultivated year round in all four districts.

Proportions of cropped area by principal type of subsidiary food crop in Hambantota District in 1993 were: 3,952 ha for green gram (15.7% of the national total), 1,204 ha for cowpea (5.4% of the national total), 1,145 ha for kurrakan (11.1% of the national total), 676 ha for maize (2.1% of the national total) and 594 ha for sesame (6.3% of the national total). Under vegetables, cropping rate for chillies was the highest at 2,121 ha (6.1% of the national total). Target cropped areas in 1995 are 6,700 ha for green gram (69.5% increase over 1993), 2,870 ha for cowpea (238.4% increase over 1993), and 2,840 ha for maize (33.9% increase over 1993).

A comparison of cropped areas in 1993 with those in 1991 show a 51.1% decrease for cowpea, and 26.3% decrease for sesame, a 17.7% decrease for green gram, a 29.3% significant increase for maize, and a 14.6% increase for kurrakan. (see App. 2.2-8)

According to division-wise statistics for 1994, high cropping rates for various upland field crops are exhibited by green gram and cowpea in Hambantota and Angunakolapelessa; maize, kurrakan and sesame in Hambantota and Tangalle; chillies in Angunakolapelessa and Tangalle; brinjal in Hambantota and Angunakolapelessa; okura in Weeraketiya and Weligama; and bitter gourd and snake gourd in Tangalle. (see App. 2.2-5)

c) Minor Export Crops

Minor export crops (perennial crops other than the major exports crops of tea, rubber and coconut) are mainly cultivated in home gardens or other small plots. As indicated in App. 2.2-9, minor export crops with the exception of citronella (i.e. cocoa, coffee, cinnamon, cardamon, pepper, clove, nutmeg, etc.) are essentially products of Wet Zone areas.

As of 1993 for the four districts in question, planting area for minor export crops was the largest in Matara District at 8,513 ha (10.7% of the national total), followed by 7,141 ha in Hambantota District (8.9% of the national total), 5,869 ha for Galle District (7.3% of the national total), and 1,459 ha for Colombo/Kalutara (1.8% of the national total). Hambantota is a principal producer of citronella (90.1% of the national total); and Matara and Galle are major producers of cinnamon (40.9% and 31.2%, respectively, of the national total). Particularly in Katuwana Division of Hambantota District, cinnamon, pepper and citronella are widely grown, with citronella cultivation also being pursued in Weeraketiya and Tangalle divisions as well.

(3) Crop Production and Yield

a) Paddy

In general, average yield per cropping season for paddy varies greatly depending on regional factors of prevailing meteorological conditions, status of irrigation facilities and degree of fertility of cultivated land. Not only are major rice producing areas located in Dry Zone, land productivity in Dry Zone is greater compared to Wet Zone.

Paddy production in 1993 was 2.57 million tons, representing a 9.9% increase over the previous year and marking the highest level for the past 6 years. This is attributed to expansion of cropped and harvested area, and favorable weather conditions inducing increased yield. Hambantota District produced 136,000 t of paddy (equivalent to 5.3% of total domestic

production), which is the largest amount of the four districts. Compared to 1991, this is a 24.8% increase in production greatly exceeding the island-wide average increase of 7.6%. In contrast, production in Kalutara and Galle districts fell by 17.3% and 7.6% respectively for the same period. (see App. 2.2-3)

Paddy production by D.S. division in 1994 was the largest at 38,000 t in Hambantota (66.1% increase over the previous year), followed by 28,000 t in Ambalantota (29.3% decrease over the previous year), and 23,000 t in Weeraketiya (86.5% increase over the previous year). (see App. 2.2-10)

In the case of Hambantota situated in Dry Zone, major irrigation schemes account for a high proportion of paddy cropped area with a unit yield in 1993 above the national average (3.1 t/ha) at 4 t/ha. Conversely, in Kalutara and Galle where the proportion of rainfed paddy is high, unit yields are low at 2.1~2.2 t/ha during the Maha season, and less than 2 t/ha during the Yala season. (see App. 2.2-3)

D.S. Division-wise unit yield in 1994 ranged a high 3.5~4.0 t/ha in Hambantota District, and less than 3 t/ha in Kalutara and Matara districts. (see App. 2.2-11)

b) Subsidiary Food Crops and Vegetables

Hambantota District is a major producer of subsidiary food crops. According to 1993 statistics, green gram production in the District in the Maha season is the highest island-wide at 24.7% of the national total, and production of the same in the Yala season is the second highest at 17.5% of the national total. Production of kurakkan is the second highest for this crop island-wide at 16.4% of the national total during the Maha season and 18.2% during the Yala season. Production of gingelly during the Maha season is second island-wide at 18.4% of the national total. Production of cowpea as well is at a high level compared to the country as a whole. (see App. 2.2-8)

Division-wise statistics for 1994 indicate the following divisions as major producers of the relevant crop: Hambantota for green gram, Angunakolapelessa for kurrakan, Hambantota for gingelly, and Hambantota for cowpea. In all cases the greater part of production occurs during the Maha season. Among vegetables, chillies, okura and bitter gourd are produced on a large scale respectively in Tangalle, Weeraketiya and Tangalle divisions. (see App. 2.2-10)

Unit yields for subsidiary food crops in Hambantota District in 1993 were above the national average. Of particular note are green gram, productions of which during the Maha season showed a 42.5% increase at 1,238 kg/ha and during the Yala season showed a 48.0% increase at 1,134 kg/ha. (see App. 2.2-8) Divisional level data indicate yields of 0.9 t/ha for green gram, 1 t/ha for cowpea, 2 t/ha for kurakkan, 22 t/ha for brinjal, 17 t/ha for okura and 30 t/ha for bitter gourd, implying in particular a fluctuation in vegetable yields depending on regional differences in meteorological conditions. (see App. 2.2-11)

c) Minor Export Crops

Production breakdown for minor export crops in 1993 shows 11,449 t for cinnamon (39.1% increase over 1990), 8,359 t for pepper (4.2 fold increase over 1990), 3,660 t of coffee (2.4

fold increase over 1990), 1,476 t for clove (40.8% decrease over 1990), 1,451 t for cocoa (59.1% increase over 1990). In contrast to the significant increase in production of pepper, clove and cardamon exhibit decrease in production. (see App. 2.2-12)

Of the four Study area districts, Hambantota is a particularly major producer of citronella as are Matara and Galle for cinnamon.

Minor export crops are mainly grown on a small scale in home gardens, making data on district-wide production generally not available.

(4) Chemical Fertilizer Use

Fertilizers generally used in Sri Lanka for paddy cultivation are TDM, urea, and compound fertilizer; organic fertilizer is rarely used. This is likewise true for cultivation of pulses. Conversely, use of organic fertilizer is proportionally high in the case of vegetable farming with low use of chemical fertilizers. (see App. 2.2-13)

Fertilizer consumption for 1993 was 548,100 t, indicating an overall increase of 25.4% compared to 1990 immediately following elimination of subsidies. Rates of crop-wise fertilizer consumption in 1990 were 36.9% for paddy, 30.7% for tea, 5.1% for rubber, 5.4% for coconut, 10.6% for OFC and 1.7% for minor export crops. In 1993 these rates had become 45.2% for paddy, 26.8% for tea, 3.3% for rubber, 6.4% for coconut, 8.1% for OFC and 1.3% for minor export crops. In contrast to steady increase in crop-wise fertilizer use exhibited by paddy and coconut, rubber and OFC show a decline. Fertilizer consumption by type of nutrient in 1990 for paddy was 61.6% for nitrogen, 15.3% for phosphoric acid and 23.1% for potassium. In 1993, these rates had become 61.5% for nitrogen, 18.7% for phosphoric acid and 19.8% for potassium indicating an increase in phosphatic fertilizer and a drop in the use of potassic fertilizer. In the case of OFC, utilization of phosphatic fertilizer has decreased significantly. (see App. 2.2-14 and App. 2.2-15)

Target application amounts of fertilizer for paddy cultivation in 1995 are indicated in App. 2.2-16. In the case of all 4 subject districts, application rate for compound fertilizer (V-mixture and NPK) is high, followed by TDM and organic fertilizers. Of particular note here is that use of compound fertilizer exhibits a distinct regional distribution, with V-mixture being used only in Hambantota District, and NPK only being utilized in the other 3 districts.

Target application amount of fertilizer for paddy cultivation specifically in Hambantota District is 344 kg/ha, which is a slight 3.9% above the national average of 331 kg/ha. Target levels for the other 3 districts are below the national average. Particularly in the case of Galle which is heavily dependent on rainfed cultivation, target amount is 35.0% below the national average at 215Kg/Ha. (see App. 2.2-17)

(5) Seed Varieties

Improved varieties of paddy comprise (i) new improved (referred to as BG) and (ii) old improved. Improved varieties include short term varieties with a growing period of 3~3.5 months and long term varieties with a growing period of over 4 months, and cultivation of a particular variety is encouraged on the basis of cropping season and regional meteorological,

topographical conditions, etc. As indicated in App. 2.2-18, planting ratio for new improved variety in 1993 in all four districts was generally high; although in Kalutara District the planting ratio of old improved variety and traditional variety is also relatively high compared to the other subject districts. Hambantota District shows the most significant introduction of new improved variety, and can be considered an advanced area for paddy cultivation.

(6) Land Preparation

Methods of land preparation comprise three methods: (i) tilling by tractor, (ii) tilling by draft animal (cattle, buffalo), and (iii) tilling by hand. Land preparation statistics for 1993 indicate Hambantota District as having achieved the highest level of farm mechanization among the 4 districts, with 88.3% of cultivated land prepared by tractor, and 11.7% by draft animal / manually. Conversely, labor intensive methods are pervasive in Kalutara District where tilling by draft animal accounts for 73.7% of all land preparation. The foregoing indicates a regional distribution in land preparation methods, with the predominant method being tilling by draft animal or manually in Low-Wet Zone, and tilling by tractor in Dry Zone. (see App. 2.2-19)

(7) Sowing

Sowing methods comprise broadcasting and transplanting, with the former generally being the typical method adopted due to less intensive labor requirement. According to 1993 statistics, Galle shows the highest ratio of broadcast method at 99.8%. With regards sowing by transplanting, Hambantota exhibits a relatively high ratio among the subject 4 districts, but even so the said rate remains at about 3%. (see App. 2.2-20)

(8) Weeding

Weeding methods comprise manual, use of weedicide and inundation. According to 1993 statistics, weedicides are in general use with application rates in all four districts ranging 60~85%. Rate of weedicide use is highest for Matara District at 84.9% and lowest for Kalutara at 61.2%. (see App. 2.2-21)

Regionally, the unweeded category follows use of weedicide with the second highest rate in Low-Wet Zone; while in Hambantota which belongs to the Dry Zone hand weeding is widely done in addition to use of weedicides (inundation is not practiced). What can be concluded here is that weeding is often not performed in areas where sowing by broadcasting is widespread, while weeding by hand is common in areas where sowing by transplanting is a common practice.

(9) Pest Control

Agro-chemicals applied for pest control comprise a variety of insecticides and fungicides. Hambantota exhibited the highest use rate of fungicides in 1989 among the four districts, being particularly high at 37.9% in the Maha season which is well above the national average of 21.8%. In contrast, use of fungicides in Kalutara District in Low-Wet Zone is almost nil. (see App. 2.2-22)

(10) Marketing System of Agricultural Products

a) Paddy and Imported Rice

Purchase of paddy from farmers can be broadly classified into that by the public sector and that by the private sector, the former comprising the Paddy Marketing Board (PMB) and the Multi-purpose Co-operative Societies (MPCS) and the latter comprising private marketing agents. (see Fig. 4.2-1).

The PMB is a government agency under the jurisdiction of the Ministry of Agriculture, Lands and Forestry and engages in the purchase of paddy island-wide under the guaranteed price scheme (GPS). The PMB maintains branch offices at the district level, and functions with the aim of providing a smooth and efficient marketing mechanism for rice. The PMB office for the Southern Province is located at Tangalle in Hambantota District.

Trend in paddy purchase levels by the PMB is indicated in App. 2.2-23. As can be seen from the table, no purchases were made by the Board in 1993 in Kalutara, Matara and Galle districts, with 667 t being purchased in Hambantota District only. This represents only 1.5% of total purchases nation-wide and is equivalent to only 0.49% of the gross paddy production in Hambantota District. Purchase total in 1994 in Hambantota District was 1,487 tons (1.2% of total purchases nation-wide) which is a 2.2 fold increase over the previous year.

Paddy is purchased either directly from the farmer or from the MPCSs under the guaranteed price scheme at Rs 7.42/kg. In the case of purchase from the MPCSs, a commission charge of Rs 0.25/kg is paid.

Post harvest facilities owned by the PMB include mills and storage facilities. Four mills are located in Hambantota District (Ambalantota, Moraketiya, Kachigala Ara, Lunganwehera). However, the mill at Kachigala Ara is the only such facility currently in operation, and even in its case inspection and repair of obsolete equipment thereat are underway in preparation for the 1994/1995 Maha season.

The said mill at Kachigala Ara was constructed in 1977 and is equipped with machinery from Japan. Processing capacity is 3 t/hour, with 1 ton of paddy producing 640 kg of milled rice, 250 kg of chaff and 60 kg of bran. Bran is sold to the Ceylon Oils and Fats Corporation for use as livestock feed at Rs 3/kg. Chaff has no market value and is incinerated. Each mill site also includes rice storage facilities, and total storage capacity for Hambantota District is 5,850 tons, equivalent to 3.3% of the national total.

Rice milled at the PMB mills in the Southern Province is transported for storage at the warehouse of the Food Commissioner's Department in Colombo, from where it is then transported to the Northern Province for marketing. Ex-mill prices are Rs 14/kg for raw rice and Rs 15/kg for parboiled rice. Milling costs for the same are Rs 300~320/t for raw rice and Rs 800/t for parboiled rice.

The other public sector entity engaged in paddy purchase are the MPCSs which are semi-government organizations which obtain their management expenses from a combination of government subsidy and annual membership fees from member farmers and merchants (Rs 100

per person). MPCSs perform a range of services including (i) paddy purchase from members, private dealers and farmer organizations, but also engage in (ii) the supply to members of various multifarious consumption goods including agricultural production materials (seed paddy, fertilizer, agro-chemicals), food items (rice, wheat flour, pulses, powder milk, sugar, etc.), construction materials, and daily necessities, (iii) allocation of food stuffs to food stamp holders, (iv) leasing of farm equipment and machinery such as tractors and sprayers, and (v) extension of credit to members for paddy cultivation.

MPCS branches exist at the D.S. divisional level, with 10 such offices in Kalutara District, 18 in Galle District, 8 in Matara District and 7 in Hambantota. The sales network of the MPCSs extends to the Grama Niladhari level with direct outlets operated by each field office. Branch offices at Hungama and Weeraketiya in Hambantota District operate 42 and 41 nos. of direct outlets, respectively, providing various support services as well to increase agricultural productivity of member farmers.

Paddy purchased form member farmers by the MPCS is milled at its milling facilities scattered throughout the region and is then passed on to the consumer through its branch office network and directly managed outlets. Milling facilities in Hambantota District total 5, located at Beliatta, Hambantota, Tissamaharama, Angunakolapelessa and Weeraketiya. The mill at Angunakolapelessa was constructed in 1991 and is equipped with machinery procured from China. Amount purchased by this facility during the 1994/95 Maha season was 1,800 tons at prices of Rs 7.42/kg (equivalent to guaranteed price) and Rs 7.50 for red rice. Milling capacity at the facility is 1.5 t per annum, with 1 t of rice producing 680 kg of milled rice, 280 kg of chaff and 40 kg of bran. Bran is sold to private dealers for Rs 3/kg. Milling cost (Rs 0.75/kg) is more expensive than that at PMB facilities. In some instances, the MPCS facilities mill rice on behalf of PMB.

However, in conjunction with the national policy of promoting private sector participation in the rice distribution market, numerous private traders establish temporary collection points in rice production areas during the harvest season and aggressively engage in the purchase of paddy. In the case of Angunakolapelessa in Hambantota District, rice merchants purchase 30~50 t of paddy per day from farmers over a 1~1.5 month period. Purchase prices are Rs 7 kg/day for white rice (below the guaranteed price) and Rs 7.5~7.6 for red rice. After purchase, paddy is promptly hauled by medium class truck to private millers in Galle and Matara districts. These millers bear the cost for transport, purchasing white rice from the merchants at a cost of Rs 7.5/kg. Milled rice is then sold to rice retailers, who pass on the same to consumers at a cost of Rs 13~13.5/kg. Rice retained by the farmer for self consumption is generally stored as paddy, and when necessary is milled at small mills in the vicinity (usually around 5 such facilities in each Grama Niladhari division). Large amounts of rice are sold by farmers at the collection points in Angunakolapelessa, at a set price regardless of rice quality. In the case of purchase by MPCSs, in contrast, a strict quality inspection is carried out and rice purchase price varies reflecting quality. This phenomenon implies that at present the rice market is in a shifting period from quantity-oriented to quality-oriented.

Sri Lanka depends on imported rice to cover the deficit in supply and demand balance for domestic production, which is heavily constrained by climatic conditions. At present, rice is imported under a bonded warehouse system by eight licensed importers under contract with the Food Commissioner's Department. Under this system, bondsmen chosen by bidding take

responsibility for storage of imported rice while the commodity is still pending import procedures (in other words tariffs have not as yet been paid) and these stocks are therefore considered as buffer stocks of the country of origin. The contract with the Food Commissioner's Department specifies quality, quantity and cost sharing, and subsequent quality control requirements are strictly enforced by the Quality Control and Fumigation Section of the Food Commissioner's Department. Stocked amounts of rice are easily influenced by the status of domestic supply and demand, with a tendency to decrease during the harvest system and increase in the off-season. Release of stocked rice and replenishment of the same is done at the request of MPCSs and private wholesalers and with the approval of the Food Commissioner's Department and the Custom's Department. (see Fig. 4.2-1) At the time of such release or ex-bonding, the stocked rice is sold at the prevailing price to the MPCSs and the private wholesalers. Standards for quantity and quality of rice to be stocked are determined at the weekly Food Policy Meetings of the Ministry of Internal and External Trade, Commerce and Food (MIETCF), which is the agency responsible for supervision of the bondsmen.

The Food Commissioner's Department has as its main responsibilities tracking the status of food supply and demand island wide through the collection, collation and analysis of data pertaining to domestic food production, food imports, stocks at bonded warehouses and PMB storage facilities, status of consumption of food crops such as wheat, maize and root vegetables, prices of agricultural products, etc.

Imported rice in 1993 totaled 209 t (11.8% increase over the previous year) accounting for 1.2% of total import value (down from 1.9% in 1992). This drop in import amount is attributed to the increase in domestic paddy production from 2.34 million tons in 1992 to 2.564 million tons in 1993 (9.6% increase). C&F price of imported rice in 1993 dropped 4.9% over the previous year to Rs 11,426/t. (see App. 2.2-23)

b) Subsidiary Food Crops and Vegetables

Marketing route for subsidiary food crops comprises (i) purchase by the Co-operative Wholesale Establishment (CWE) and private traders, and (ii) marketing through "polas". Marketing of vegetables is primarily through the polas where large scale purchases are made by collectors and dealers.

CWE was established in 1949 and is the oldest public company in Sri Lanka. The company engages in the import/export, wholesale and retail of agricultural produce, and performs a role viewed with extreme importance by the Government. As of November 1994, CWE operated 38 wholesale outlets and 130 retail outlets (including supermarkets) island-wide, engaging in the procurement and supply of subsidiary food crops, minor food crops and essential food commodities. In earlier years, CWE had been given the exclusive right to import big onions, tur dhal, etc., but such exclusive import rights with the exception of that for wheat have been loosened at present.

Major agricultural products imported by CWE in 1993 were lentils, big onions, chillies, and garlic. Imports of lentils totaled 30,671 t, with a value of Rs 1,371.89 million, equivalent to 71.9% of total value of agricultural produce imported by CWE. Major items exported by CWE were betel, ekel, rubber, copra, cinnamon and black pepper. Exports of betel totaled 34,968 t, with a value of Rs 50.7 million, equivalent to 55.1% of total value of agricultural produce

exported by CWE. Proportion of total domestic purchase accounted for by each imported item were 52.8% for sugar, 31.4% for flour, 13.6% for rice, 1.9% for big onion, 0.2% for green gram, followed lastly by black pepper, cinnamon and cowpea.

Purchase of subsidiary food crops by CWE is done under the floor price scheme, which applied to the following nine items in 1994: maize, kurakkan, ground nut, soy beans, gingelly, cowpea, green gram, black gram and turdhal.

Floor prices for maize, soy bean and green gram which were at Rs 5.25/kg, Rs 7.30/kg, Rs 12.00/kg respectively in 1990 rose to Rs 6.00/kg (41.2% increase), Rs 14.00/kg (91.8% increase) and Rs 20.00/kg (66.7% increase) in 1994. Prices for the other commodities remained unchanged for the same period. (see App. 2.2-24) Retail prices for subsidiary food crops and vegetables are shown in App. 2.2-25 and App. 2.2-26.

CWE has wholesale outlets located in Kalutara, Galle, Matara and Hambantota districts, engaged in the purchase of subsidiary food crops. Items sold through the said outlets include food commodities (rice, pulses, red onions, dried chillies, wheat flour, powder milk, dried fish), daily necessities, clothing, etc, exclusive of agricultural production inputs (seeds, fertilizers, agro-chemicals).

CWE purchases rice in Hambantota District from private dealers and retails the same at Rs 12/kg for white rice and Rs 13/kg for red rice. Other crops purchased in the district include green gram, cowpea, dried chillies, and red onion. Retail prices for green gram and cowpea are Rs 42/kg and Rs 23/kg, respectively. Purchase amounts for these two commodities in 1994 were 100 t for green gram and 31 t for cowpea. Green gram and cowpea bought by CWE is transported to its warehouse in Colombo, while red onion and dried chillies are shipped to CWE's wholesale outlets in Kurunegala and Polonnaruwa districts in northern Sri Lanka.

Main crops purchased by CWE in the other 3 districts are cinnamon, black pepper, goraka and copra in Galle and Matara, and cinnamon, black pepper and copra in Kalutara. These items are largely shipped to consumer markets in Colombo. Purchase quotas for each district are passed on to each wholesale outlet from CWE's headquarters in Colombo, with an average single purchase involving the transfer of 0.5~1 t of produce. Purchases by CWE of subsidiary food crops are generally small, with the bulk of these being moved through private distribution channels (marketing agents, dealers, etc.).

"Polas" are scattered throughout rural and urban areas, and are open 1 or 2 times a week. In rural areas they play an important role as a source for consumers of cereals, pulses, vegetables and fruits, and in turn serving as a source of cash income for farmers. Polas are not only markets for agricultural and animal products, but also for clothing, daily necessities, and other miscellaneous products for household use, and when open these markets are crowded with shoppers. They are run by the Pradeshiya Sabhas, and stall operators pay a usage fee to the Pradeshiya Sabha. 1~3 polas are generally found in each D.S. Division.

c) Minor Food Crops

The major part of minor food crops are purchased from growers by private marketing agents and dealers, with CWE accounting for only a very small portion of such purchases. Minor

food crops purchased by CWE in Kalutara, Galle and Matara districts are cinnamon and black pepper. Hambantota District is a major producer of citronella, and the bulk of this crop is bought up by private marketing agents.

1993 auction prices for minor food crops showed a marked rise over 1990, with cardamon, coffee and cocoa showing respective increases of 124.2%, 30.4% and 24.7%. In contrast, prices for other items decreased for the same period, with mace in particular experiencing a 64.1% drop from Rs 249.62/kg in 1990 to Rs 89.68/kg in 1993. (see App. 2.2-27)

Exports for 1993 of minor food crops showed healthy growth, with pepper, nutmeg and mace showing significant increases compared to 1991. Pepper exports increased 3.8 fold to 7,829 t, accounting for 34.0% of total exports of minor food crops. (see App. 2.2-28)

(11) Marketing System of Agricultural Inputs

a) Seeds and Planting Materials

The paddy seed production and supply mechanism in Sri Lanka comprises seed farms directly under the Seeds and Planting Materials Division which produce seed paddy for high yielding varieties, which are then passed on to the farmer via the Agrarian Services Centres, Multi-purpose Co-operative Societies and farmer organizations.

Serving the Southern Province are 2 seed farms in Hambantota at Bata-ata and Middeniya. The former is engaged chiefly in seed paddy production while the latter exclusively produces seed for subsidiary food crops. In addition to improved varieties of seed paddy, Bata-ata also produces seed for subsidiary food crops (maize, green gram, black gram, cowpea) and vegetables (okura, snake gourd, bitter gourd), as well as planting materials for various fruits (mango, guava, lime, orange). (see App. 2.2-29) 1994/95 Maha season production target for seed paddy is around 670 tons. (see App. 2.2-30). Seed paddy cultivation is also contracted out to full time farm households and Multi-purpose Co-operative Societies. Under such contracts the seed farm extends technical guidance in registered seed paddy and cultivation and field management, while the contracted farmer or organization bears the cost for agricultural production inputs such as fertilizer and agro-chemicals. Surplus seed paddy over the contract amount can be freely marketed by the farmer or organization.

Target seed paddy production at the Ambalantota seed farm (under the management of the Bata-ata seed farm) for 1994/95 Maha season is about 60 t. Harvested seeds are delivered to the Bata-ata farm, which has 5 seed storages each with a 63 ton capacity). One storage is reserved for unprocessed paddy while the remaining 4 hold processed paddy.

The Middeniya seed farm engages exclusively in the cultivation of seed for subsidiary food crops. Target cropped area and seed production for the 1994/95 Maha season were 13 ha and 7 tons, respectively. (see App. 2.2-31) Rainfed cultivation is practiced at the farm due to lack of irrigation facilities. Accordingly, it is considered very difficult for the farm to achieve its target yields. Specific target yields for the 1994/95 Maha season are as shown in App. 2.2-32. Following harvest, vegetable seeds are shipped to the Kundasala Vegetable Seeds Processing Centre in Kandy District, while other crop seeds go to the Dambulla Pelwerhera Farm in Kurunegala District. As of the present, the farm does not supply seed to the Southern

Province. A similar seed farm is also located at Bombuwala in Kalutara District.

Food crop seed prices for 1994 are shown in App. 2.2-33 and 4.1.2-34. Seed paddy has three classifications: registered, certified, and commercial. Prices vary somewhat depending on the classification. Vegetable seed has three classifications as well: basic, standard and commercial.

The Department of Export Agriculture oversees the supply to registered farms of planting materials for minor export crops. The agency maintains branch offices at the district level, and distributes seedlings as well as providing fee-gratis technical services by extension officers. Within the Study region, branch offices are located in Galle, Matara and Tangalle districts. A central nursery, the only such facility for the Southern Province, is located at Mapalana in Matara District, and engages in the large scale cultivation of cocoa, coffee, cinnamon, pepper and clove. The production of planting materials is also contracted out to full time farms. As shown in App. 2.2-35, the numbers of such farms in 1993 ranged from a maximum of 40 in Galle to only one in Matara.

As indicated in App. 2.2-36 target productions of planting materials for 1995 cinnamon and pepper in the Southern Province were 71.9% and 16.4%, respectively, of the national total. Galle and Matara in particular account for 83.3% and 69.6%, respectively, of the total production of planting materials for cinnamon and pepper in the Southern Province. App. 2.2-37 indicates seed and planting material prices for minor export crops in 1993, and it can be seen that planting material prices for clove and nutmeg are higher than for the other perennial crops.

Under the Export Agricultural Crops Assistance Scheme as part of national policy to promote the cultivation of minor export crops, subsidies are extended to farmers who engage in this type of agriculture. Extension period for subsidies is 3.5 years, and are paid out in 4 installments. (see App. 2.2-38)

b) Chemical Fertilizers

Generally speaking, low prices for fertilizer combine with stable prices for agricultural products to provide production incentive to farmers, in turn spurring increased fertilizer consumption. In the case of Sri Lanka, however, high government subsidies for fertilizer became subject to the pressure for tightness of Government expenditure, and were eliminated in January 1990 in accordance with the Structural Adjustment Policy formulated by the World Bank and IMF. However, the sharp rise in fertilizer prices immediately after this induced a sharp drop in fertilizer consumption, with consumption finally returning to pre subsidy elimination levels in 1993.

In line with the Government's policy of privatization of the public sector, authorized wholesalers as of 1993 totaled 15 companies, of which 7 companies controlled roughly 95% of market distribution. Representative firms among these wholesalers are Ceylon Fertilizer Co., Ltd., Janatha Fertilizer Enterprises Ltd., Colombo Commercial Fertilizers Ltd. in the public company category, and A. Baur & Co., Ltd among the private companies. These firms engage in fertilizer purchase and resale to retailers (authorized agent and dealers, Multi-purpose Co-operative Societies, Agrarian Services Centres, and other government agencies). The National Fertilizer Secretariat (NFS) oversees the companies acting as authorized wholesalers of fertilizer. Distribution of fertilizer is thus under the jurisdiction of the NFS, passing from the

wholesalers to retailers and then on to the farmer. (see Fig. 4.2-2) A separate marketing route is via private marketing agents/dealers who sell primarily to poor farmers who do not qualify for bank credit.

In 1993, domestic supply of chemical fertilizers relied 94% on imports, with the remaining 6% being locally produced fertilizers (rock phosphate and dolomite). Reflecting the increase in fertilizer demand since 1990, a large quantity of fertilizer was imported in 1993 (464,929 tons, representing a 36.9% increase over the previous year). (see App. 2.2-14). Although fertilizers are in principal exempt from import duties and sales taxes, a portion of fertilizers classified as industrial products are subject to a 10% import duty and 20% sales tax. In 1990, public sector participation in the import of chemical fertilizers was 86%, which dropped to 50.5% in 1993. This is attributed to the on-going program of privatization of the public sector under the Structural Adjustment Policy. This has affected the Ceylon Fertilizer Co., Ltd, the largest public company marketing fertilizer, as well, with a number of agencies formerly under its umbrella already having been privatized.

Retail prices for fertilizers are as shown in App. 2.2-39. By 1994, prices had doubled the level prior to elimination of subsidies in 1990. The new administration has, in line with its political promise of making fertilizers more readily available to farmers, commenced subsidies to farmers as of the 1994/95 Maha season and subsequently inaugurated a new revised fertilizer subsidy scheme from April 4, 1995. Under this system, 40% subsidies are extended for urea and 10~20% subsidies for other fertilizers. (see App. 2.2-40) However, concerns persist that this program will decelerate efforts to reduce fiscal deficits, in light of the fact that annual government expenditure on fertilizer subsidies is Rs 1,700 million (or 1.1% of total government expenditure in 1994)

c) Agro-chemicals

Insecticides, fungicides, and weedicides are marketed through the private sector, Agrarian Services Centres and Multi-purpose Co-operative Societies. Most of these agro-chemicals are purchased from the Ceylon Petroleum Corporation, although some private traders also participate in supply. Retail prices as of March 1995 are shown in App. 2.2-41.

d) Agricultural Equipment and Machinery

Reflecting the steady advancement of agricultural mechanization in the country, imported tractors in 1993 were 7,002 nos., twice the number in 1990. At present, 2-wheel and 4-wheel tractors are leased to farmers through the Agrarian Services Centres, Multi-purpose Co-operative Societies and farmer organizations. 4-wheel tractors are deployed at each branch of the Multi-purpose Co-operative Societies and are rented to member farmers for Rs 1,200 per day. 4-wheel tractors are deployed as well at the Agrarian Services Centres as indicated on a center-wise basis in App. 2.2-42. Member farmers may use the equipment freely, however, annual dues of Rs 6/ac are paid to cover center administrative costs. The Agrarian Services Centres function to support development of farmer organizations, and extend credit to FO's for the purchase of tractors.

Tractor extension rate is particularly high in Hambantota District, where numerous British made 4-wheel tractors are in operation. Within the management area of the Agrarian Services Centre

at Ambalantota, around 33% of the farm households possess either 4-wheel or 2-wheel tractors. In addition to farm use during the cropping season, tractors also serves as an important means of travel and transport.

(12) Rural Credit

The Department of Rural Credit and the Central Bank of the Sri Lanka are the principal agencies which oversee the rural credit system, playing an important role as executing agencies in the case of various credit schemes funded by donor entities and targeted at the rural sector. The majority of such credit schemes have their source of funding as the World Bank, ADB, etc., which is characteristic of the credit system of the country. (see App. 2.2-43)

At present, the institutional structure responsible for extension of credit within the rural sector comprises both national and private banks. Large national banks (People's Bank and Bank of Ceylon) which operate throughout the country including both urban and rural areas extend financing to and manage savings deposits at farmer and small commercial banks. Actual extension of credit to the rural sector is performed by Bank of Ceylon sub-offices at Agrarian Services Centers, Co-operative Rural Banks, Regional Rural Development Banks, and Thrift and Credit Co-operative Societies, in effect acting as supplementary financial agents for the major national banks. The Co-operative Rural Banks are accommodated within the branch offices of the Multi-purpose Co-operative Societies, and actively engage in extending credit to cultivation funds of member farmers.

Numbers of offices and sub-offices for each bank as of 1994 are indicated in App. 2.2-44. Of the relevant districts Galle has the greatest number of banks, accounting for 6.5% of the nation's total, while Hambantota exhibits the smallest number. Service density (banks/km^2) is greatest for Matara district at 0.37/km^2. Nevertheless, in the case of all the districts, the extension ratios of Thrift and Credit Co-operative Societies which are co-operative financial organizations of member farmers are greater than those for major banks.

Under the New Comprehensive Rural Credit Scheme aimed at increasing agricultural productivity, cultivation loans (money for purchase of main farm inputs including seed, fertilizer, agro-chemicals, etc.) for paddy and subsidiary food crops are available from 7 banks both national and private. Cultivation loans for 1993 totalled Rs 957 million, showing a 10.6% increase over the previous year. Crop-wise loan proportions are 66.9% for paddy and 33.1% for subsidiary food crops. Previous years likewise show a higher rate of cultivation fund procurement for paddy (see App. 2.2-45). In contrast to this active extension of this type of credit to the smaller farmer, bank transactions have been mainly limited to the very small number of medium to large farmers holding collateral. The many small farmers who cannot meet the criteria for bank loans are thereby forced to rely on private financing which require repayment at a high rate of interest.

As indicated in App. 2.2-46, the loan recovery rate deteriorated from 94.5% in 1990 to 63.8% in 1993. As of 1993, the loan recovery rate in the case of subsidiary food crops (61.7%) was slightly lower than that for paddy (64.8%). According to the district-wise cultivation recovery statistics of the Bank of Ceylon in 1993 (see App. 2.2-47), rates were 92.5% for Kalutara, 82.7 for Galle, 78.8% for Hambantota, 76.1% for Matara. Amount per loan granted was greatest for Hambantota at around Rs 16,000 (a 74.6% increase over 1990).