

## (3) Irrigable Area

Unit : ha

Province	Land Development Scheme		Village Irrigation Scheme		Total	
	Present	Plan	Present	Plan	Present	Plan
North Sumatra	39	143	340	417	379	560
South Sulawesi	47	70	637	1,002	684	1,072
NTB	5	120	425	474	430	594
<b>Total</b>	<b>91</b>	<b>333</b>	<b>1,402</b>	<b>1,893</b>	<b>1,493</b>	<b>2,226</b>

## (4) Planned Irrigation Area and Planned Land Development Area

Unit : ha

Province	Planned Irrigation Area	Planned Land Development Area					Total
		Upland	Plantation	Grass	Forest	Swamp	
North Sumatra	560	25	87	1	18	8	139
South Sulawesi	1,072	210	46	22	1	0	279
NTB	594	27	117	0	0	0	144
<b>Total</b>	<b>2,226</b>	<b>262</b>	<b>250</b>	<b>23</b>	<b>19</b>	<b>8</b>	<b>562</b>

## 5) Water Source Discharge and Intake Discharge

Water source discharges and intake discharges of evaluated thirty(30) schemes are defined as follows:

Unit : m<sup>3</sup>/sec

Item	North Sumatra	South Sulawesi	NTB
Water Source Discharge (Wet Season)	> 0.11	> 0.09	> 0.13
Water Source Discharge (Dry Season)	> 0.17	> 0.02	> 0.01
Maximum Intake Discharge	0.17	0.30	0.16

Note : The values of each scheme is shown in Appendix Chapter 2.4.

#### (6) Gross Water Requirement

In the case when the gross water requirement is required, the following values are applied by referring to the results of inventory survey covering the whole schemes.

Province	Max. Gross Water Requirement during Wet Season	Max. Gross Water Requirement during Dry Season
North Sumatra	1.2 l/s/ha	1.5 l/s/ha
South Sulawesi	1.2 l/s/ha	1.5 l/s/ha
NTB	1.3 l/s/ha	1.5 l/s/ha

#### (7) Potential Planting Plan of Paddy

The potential planting plan is made as follows based on the study of water source discharges and gross water requirement of each scheme.

Province	Land Development Scheme			Village Irrigation Scheme		
	Wet Season	Dry Season	Ratio	Wet Season	Dry Season	Ratio
North Sumatra	128 ha	66 ha	52 %	376 ha	357 ha	95 %
South Sulawesi	63	54	86	902	645	72
NTB	108	108	100	435	165	38
Average	100	76	76	571	389	68

#### (8) Facility Plan

- a. Land development schemes include reclamation, construction and rehabilitation of tertiary canals, and construction of quaternary canals. The remaining land development schemes confront technical problems. For this reason, partial rehabilitation and improvement for secondary canals are required.
- b. In village irrigation schemes, construction and rehabilitation of intake facilities, distribution canals, secondary canals, maintenance roads, etc. are made. In addition, reclamation is performed if room for development is left.

c. Rehabilitation of intake facility and canal related structures

The water source facilities of thirty(30) representative schemes are classified into twenty seven(27) headworks, two(2) pumping stations, and one(1) spring. Judging from their current conditions, they are divided into three(3) divisions: facility with good condition, facility to be rehabilitated, and facility to be renewed. The principal construction volumes of the representative schemes are described in Section 5.5.4.

Table 5-5-1 WORK VOLUME FOR 30 REPRESENTATIVE SCHEMES

No.	Name of Schemes	INTAKE FACILITY				TERT. CANAL		DELIVERY CANAL		FIELD CANAL		O & M ROAD STRUCTURE		CANAL STRUCTURE	
		LD ha	NEW nos	REPLACE nos	REHAB. nos	NEW m	REHAB. m	NEW m	REHAB. m	NEW m	REHAB. m	NEW m	REHAB. m	NEW nos	REHAB. nos
<b>NORTH SUMATRA</b>															
1	Sumbari	42				200									2
2	Rauning (B)	47						500	1000	2800			300		2
3	Sumbul Berampu		1					200	1000	2900					2
4	Sidomukti									2000			750		6
5	Aek Palia			1				500	800	200					2
6	Pangambatan (B)				1				400	2150			800		2
7	Aek Siparbut				1				400	100			200		1
8	Kutamale				1				600	400			200		6
9	Asahan VIII Pengajian				1				600	1200					4
10	Aek Sihim		1						600	400			800		4
	SUB TOTAL	139	2	2	3	200	0	1800	5000	11350		0	3050		25
<b>SOUTH SULAWESI</b>															
1	Kalu	23				500				1100			400		2
2	Pajjenge				1				1000	2500			1400		6
3	Kadleng	53							4000	2700			2000		8
4	Kaindi	57							600	2700					3
5	Lembang Bata		1					900	600	200					5
6	Penrita	10							400	100			300		1
7	Marjo I-II-III	7			1			400	800	400			400		4
8	Pakelli II	35							600	1600			400		1
9	Padasio	61		2				3000	400	4500					1
10	Malimbu		1					100	400	500			550		1
11	Salu Akung	29						1500	600	600					30
12	Mariri	279		7		500		5900	9500	13700		0	5060		30
	SUB TOTAL		3	7	2	0	500	9500	13700	0	0	0	5060		30
<b>WEST NUSA TENGGARA</b>															
1	Danar Jengkang	115			1	2000	400			5000			1100		6
2	Mada Manini		1						1000	400			2000		1
3	Uma Lebang	21			1			150	500	1000					2
4	Lokok Tripas				1			100	600	500			500		4
5	Lengkok Dudu	2			1				600	100			100		2
6	Kelokos Uidang	6			1				650	300			450		6
7	Raba Sangga							400	400	2300			350		2
8	Montong Sapah/Puri	144		3		2000	400	650	4100	9000		0	4500		25
	SUB TOTAL		1	3	3	2000	400	650	4100	9000		0	4500		25
	TOTAL	562	6	12	8	2200	900	8350	18800	34050		0	12600		80

## 5.5.2 Agricultural Development

The expansion target of rice production will be achieved by means of extension of irrigated paddy field, improvement of irrigation facilities and also improvement of farming practices. In this section, the strategies of agricultural development in the representative schemes.

### (1) Improvement of Cropping Pattern

The standard cropping pattern in the irrigated paddy field is single or double cropping of paddy combined, sometimes combined with after crops such as palawija crops, vegetables and early maturing cash crops. The cropping intensity of those crops is primarily depend upon water availability in the dry season. The kinds of combined crops are determined by natural and social factors of the site. The present and future cropping pattern of the schemes are described in APPENDIX-VI.

The average cropping intensity of the representative schemes is planned to increase form 155 % to 184% in North Sumatra, from 147 % to 172 % in South Sulawesi and from 134 % to 150 % in West Nusa Tenggara. Since the schemes in West Nusa Tenggara has often scarce rainfall except during short rainy season, cropping intensity in the province remains lower than the others.

The crops, which planted after harvest of paddy, is preferred to be selected from the presently popular crops in the area. The introduction of unfamiliar crops around the area is not profitable because of difficulties of marketability and supporting system. The major after crops in the study schemes are presently maize and legume, and the minors crops are chili, tobacco and vegetables.

### (2) Improvement of Farming Method

At present, seeds of annual crops such as paddy are prepared from harvests by farmers themselves and local varieties are dominant. The local varieties has generally positive features of good taste and high price, and negative features of long maturity period and low productivity. In line with target of increasing paddy production, high yielding varieties planned to be introduced in the scheme areas. The high yielding varieties of paddy have about 110 days of

maturing period and about 5 ton/ha of yield potential. The recommended varieties are IR46 and IR64 in North Sumatra, IR36, IR42, IR46, IR48 and Cisadane in South Sulawesi, and IR36 in West Nusa Tenggara.

The standard method of paddy cultivation is planned as shown in Table 5-5-2. The cropping calendar and amounts of implements may fluctuate due to characteristics of variety, climate and other factors.

Table 5-5-2 STANDARD FARMING METHOD OF PADDY

Management	Days	Amounts of Implements
Preparation of Nursery		
Seed selection	- 3	Salt solution, 2 kg NaCl/10lit.
Seed disinfection	- 3	Benlate-T (6-12 hours)
Seed soaking	- 2	36 hours
Hastening of germination	- 2	24 hours
Application of fertilizer	- 1	Urea 4 kg/400m <sup>2</sup> , TSP 2 kg/400m <sup>2</sup>
Sowing	0	Acreage 400 m <sup>2</sup> /ha, seed 25 kg
Control of diseases/insect	15	Diazinon 200 ml/400m <sup>2</sup>
Preparation of Paddy Field		
Basal fertilizing	- 5	Urea 95-105 kg/ha, TSP 100-125 kg/ha, KCl 75-100 kg/ha
Transplanting	0	Spacing 20x20 cm, 3-4 seedlings per hill
Weeding	10	Hand rotary weeding
Control of insect damage	13	Diazinon 1 lit/ha
Application of fertilizer	15	Urea 85-95 kg/ha
Weeding	30	Hand rotary weeding
Control of insect damage	40	Sumithion 0.5 lit/ha
Application of fertilizer	50	Urea 70-75 kg/ha
Control of insect damage	65	Diazinon 0.5 lit/ha
Harvesting	110	Use of sickle

Introduction of high yielding varieties requires larger amounts of farming materials and labor. Table 5-5-3 illustrates present and planned amounts of materials and labour inputs for paddy cultivation during one cropping season. The future input plan derives from a target of Package-D on Insus program and general characteristics of soils.

Table 5-5-3 INPUTS OF MATERIALS AND LABOR FOR PADDY CULTIVATION

	N.Sumatra		S.Sulawesi		W.Nusa Tenggara	
	Pr	Fu	Pr	Fu	Pr	Fu
Seed(kg)	52	30	44	30	44	30
Fertilizer(kg)						
Urea	132	250	146	250	163	275
TSP	99	125	52	100	62	100
KCl	39	100	27	75	35	75
Agro-chemical(lit)	1.6	2.0	1.6	2.0	1.0	2.0
Rodenticide(kg)	0.0	2.0	0.0	2.0	0.0	2.0
Labor(md)	142	170	131	160	142	170
Draft Animal(ad)	12	17	11	16	16	20

Note; Pr = Present, Fu = Future.

### (3) Improvement of Agricultural Supporting Service

The scheme areas will be thoroughly introduced by Insus program out of the several intensification programs by the Government. The Insus program is determined to be preferable to the site conditions on the Project area, because most of the schemes are located in hilly and mountainous area. Insus program has already introduced to many schemes and even Supra Insus program has introduced to some schemes, but those programs does not often serve to farmers of the site. For the effective promotion of the intensification programs, therefore, the extension services and field extension workers (PPLs) should be qualified. For that, many PPLs and key farmers should be trained at the Field Extension Centers (BPPs) or other training centers.

Improvement of the marketing channels is essential due to high input rate of production materials. Main trading channels of the materials are Village Unit Cooperatives (KUDs) and their branches so called as Kios in the scheme areas. The number of KUDs and Kios is growing in the country, and Ministry of Cooperatives strongly supports to strengthen those functions. In the agricultural development, KUD's marketing service should be further strengthened in order to supply the materials to farmers in the scheme areas.

In addition, KUD plays important roll as marketing channel of agricultural products. KUD has a function of marketing route of crops. KUD trades farm products from farmers to National Logistics Agency (Bulog) at the fixed price by the Government. According to the field survey, there are many cases, for example, farmers send their products directly to rural market, and traders

come and purchase to the farm households. In the development plan, the organized marketing system through KUDs is recommendable because of stability. The system should be further strengthened in the area.



### 5.5.3 Operation and Maintenance

Based on the analysis of present O&M conditions, basic approach has been formulated to improve present O&M conditions which are detailed in Section 6.4 hereof. The general improvement plan in line with the above basic approach is explained below :

#### (1) Promotion of Authorized P3A Organization

P3A is not widely organized in the representative schemes, especially schemes in South Sulawesi Province. It is essential to promote authorized P3A organization in line with the Government's policy on irrigation through existing channel of rural extension service(PPL).

#### (2) Giving Solid Financial Background to P3A Organization

About 50 % of the representative schemes have not started to collect any type of water charge yet. Accordingly, it is difficult for those schemes to operate and maintain their irrigation systems properly without any financial sources. It is necessary to give a solid financial background to those schemes through introduction of reasonable water charge.

#### (3) Extension of Written O&M Regulations for P3A Organization,

Most of the representative schemes operate and maintain their systems without written O&M rules/regulations but mainly with not-written traditional rules/customs at present. It is necessary to keep written O&M regulations at a minimum level which include organization structures and respective functions, water charge and manpower contribution.

#### (4) Extension of Improved Operation/Water Management

Preparation of irrigation schedule, rotational irrigation, gate control during floods and record keeping are not made widely in the representative schemes. The above minimum operation should be made in the schemes as a first step.

#### (5) Extension of Improved Maintenance

Periodic minimum maintenance works such as tree/grass cutting or canal re-shaping/desilting are made in most of

the schemes, however, periodic minimum structure repairs are hardly done at present mainly due to O&M budget shortage. With an introduction of reasonable water charge, farmers would carry out simple structure repair works by themselves. It is, however, necessary for provincial governments to give technical supports to farmers in normal maintenance works.

6) Improvement of Rural Extension Systems for O&M

It is essential to extend the above improvement items to the farmers through rural extension workers(PPL) in collaboration with Provincial Irrigation Services(PRIS & PUD), and it is also required for Provincial Agricultural Services(PRAS) to train PPLs.

#### 5.5.4 Construction Works of Representative Schemes

The construction works of the thirty(30) representative schemes consist of irrigation and drainage schemes which cover water sources works, construction and rehabilitation works of conveyance canals, construction of distribution canals, construction of structures pertaining to canals, construction of roads for O&M, etc., and land development schemes of 562 ha.

Land development schemes consist of clearing and uprooting works, leveling works, and paddy field formation works. Work volumes of irrigation and drainage works for thirty(30) representative schemes are shown in the following table.

Because the work volume of one scheme is small, construction works shall be completed within one year.

Province	Weir	nos.	Conveyance Canal		Dist. Canal	O&M Road	St- rct.	Other
			New	Reha- bili- tation	Earth	Earth/Maso-Gravel	Struc- nry ture	
N.Sum (10)	Vol.	5	2,000	5,400	11,150	3,050	25	Pump
	Vol./ sch.	0.5	200	540	1,115	305	2.5	Sta. x 1
S.Sul (12)	Vol.	11	5,900	10,000	13,700	7,050	30	Pump
	Vol./ sch.	0.9	492	833	1,142	588	2.5	Sta. x 2
NTB (8)	Vol.	7	2,750	3,380	9,094	3,900	23	
	Vol./ sch.	0.9	344	423	1,137	488	2.9	
Total (30)	Vol.	23	10,650	18,780	33,944	14,000	78	Pump
	Vol./ sch.	0.8	355	626	1,131	467	2.6	Sta. x 3

Note: Lower column shows unit work quantities per number of schemes by each province and per total 30 representative schemes.

## 5.6 Construction Cost Estimate

### (1) Conditions

Construction cost required the development plan for the representative schemes is estimated under the following conditions.

- 1) Exchange rate used in the estimate is;

Yen 1.0 = Rp.15.5 (March 1992)

US\$ 1.0 = Rp.2,000 = Yen 129 (March 1992)

- 2) Civil engineering works are to be carried out on the contract basis using contractor's own heavy construction machinery and equipment taking farmers' participation into construction.
- 3) The local currency portion is calculated by the actual cost/prices in North Sumatra Province, South Sulawesi Province and West Nusa Tenggara Province in September 1989 which are collected from on-going projects in the three provinces.
- 4) Prices/cost of basic material and labors used in the estimate are shown in below.

unit: Rp.

ITEM	UNIT	M.SUM	S.SUL	W.N.TEN
Labor	m.day	4,200	2,000	2,300
Portland Cement	sack	6,400	5,800	7,100
Reinforcement Bar	kg	1,400	1,400	1,017

### (2) Estimate

The construction cost of representative 30 schemes is estimated 1.62 million US\$, and the total cost of 30 schemes is estimated 2.55 million US\$, which comprises 1.29 million US\$ in foreign portion and 1.26 million US\$ in local portion. The summary of the cost estimate is shown in Table 5-6-1.

Farmers' participation cost is calculated about 14 % of construction cost which is labor cost for farm formation, canal rehabilitation, in-field canal work and O&M road construction. The summary is shown in Table 5-6-2.

Table 5-6-1 SUMMARY OF PROJECT COST FOR REPRESENTATIVE 30 SCHEMES

US\$ 1.0= 2,000 Rp

Code	Project Name	Type	Irri. Area		Project Area	Construction (1000 Rp)	Project Cost		(1,000Rp) Total
			Present	Plan			L/C	F/C	
	[NIB]		ha	ha	ha				
45010	Danar Jenggang	A4	5	120	227	411,885	288,621	270,177	558,798
32013	Mada Manini	C2	70	70	98	85,021	72,091	72,506	144,597
33050	Uma Lebang	B1	68	89	96	98,536	86,085	86,212	172,297
34004	Lokok Tripas	C1	34	34	57	50,861	42,245	39,167	81,412
35035	Lengkok Dudu	B1	24	26	45	79,982	49,679	62,489	112,168
35045	Kelokos Udang	B5	105	111	128	66,855	67,371	79,836	147,207
36016	Raba Sangga	C1	111	111	125	58,038	61,478	75,077	136,555
37003	Montong Sapah/Puri	C1	13	33	37	36,070	31,125	32,198	63,323
	SUB-TOTAL		430	594	813	887,248	698,695	717,662	1,416,357
	[SULAWESI SELATAN]								
20003	Kalu	A3	47	70	101	66,101	50,033	43,573	93,606
10055	Pajjenge	C1	100	143	160	99,114	94,891	110,435	205,326
10099	Kadieng	B1	171	224	270	342,922	276,691	271,590	548,281
10115	kaindi	B4	67	124	195	133,862	117,024	118,894	235,918
10140	Lembang Bata	B5	72	76	175	104,898	65,909	70,897	136,806
10168	Panrita	B2	55	65	78	24,419	29,024	39,388	68,412
10182	Mario I-II-III	B4	50	57	74	68,139	56,224	58,745	114,969
10201	Pakelli II	B5	19	54	168	117,479	86,905	87,315	174,220
10227	Padaelo	B3	77	138	161	283,806	207,954	210,162	418,116
10287	Malimbu	C2	0	32	44	46,823	33,067	42,279	75,346
10332	Salu Akung	C1	26	26	30	50,625	35,472	41,239	76,711
10354	Mariri	B1	0	63	151	133,118	98,392	94,646	193,038
	SUB-TOTAL		684	1,072	1,607	1,471,306	1,151,586	1,189,163	2,340,749
	[NORTH SMATERA]								
60011	Sumbari	A4	34	77	163	112,830	85,801	75,619	161,420
60038	Rauning B	A2	5	66	99	137,250	104,396	89,509	193,905
50025	Sumbul Berampu	C1	124	124	234	101,994	93,418	104,010	197,428
50057	Sidomukuti	B1	12	27	68	48,745	38,093	36,057	74,150
50091	Aek Palia	B1	34	38	64	57,284	46,698	45,240	91,938
50129	Pangambatan (B)	B2	30	48	56	85,673	63,453	66,535	129,988
50141	Aek Siparbu	B4	23	26	37	51,993	38,885	39,478	78,363
50218	Kutamale	B4	32	40	69	55,443	45,805	45,108	90,913
50240	Asahan VIII	B3	45	66	100	136,985	100,072	102,222	202,294
50256	Aek Sihim	B5	40	48	103	77,339	61,589	60,558	122,147
	SUB-TOTAL		379	560	993	865,536	678,210	664,336	1,342,546
	(1,000 Rp)		1,493	2,226	3,413	3,224,090	2,528,491	2,571,161	5,099,652
	TOTAL (1,000 US\$)					1,612	1,264	1,286	2,550
	( US\$/Ha)					724			1,145

Table 5-6-2 Farmers' Participation in Representative Schemes

CODE	Irrigation Scheme	Gr. Irri. Area Plan (ha)	Construction (1000 Rp)	Farmers' Participation (%)	Participation (1,000Rp)	
[NTB]						
45010	Danar Jenggang	A4	120	411,885	15%	60,910
32013	Mada Manini	C2	70	85,021	12%	10,303
33050	Uma Lebang	B1	89	98,536	18%	17,325
34004	Lokok Tripas	C1	34	50,861	8%	4,078
35035	Lengkok Dudu	B1	26	79,982	6%	4,541
35045	Kelokos Udang	B5	111	66,855	14%	9,241
36016	Raba Sangga	C1	111	58,038	6%	3,494
37003	Montong Sapah/Puri	C1	33	36,070	11%	3,790
SUB-TOTAL			594	887,248	13%	113,682
[SULAWESI SELATAN]						
20003	Kalu	A3	70	66,101	23%	15,531
10055	Pajjenge	C1	143	99,114	9%	9,076
10099	Kadieng	B1	224	342,922	17%	58,549
10115	kaindi	B4	124	133,862	25%	33,148
10140	Lembang Bata	B5	76	104,898	5%	4,991
10168	Panrita	B2	65	24,419	12%	2,998
10182	Mario I-II-III	B4	57	68,139	11%	7,817
10201	Pakelli II	B5	54	117,479	19%	22,154
10227	Padaelo	B3	138	283,806	11%	30,801
10287	Malimbu	C2	32	46,823	4%	2,013
10332	Salu Akung	C1	26	50,625	6%	3,096
10354	Mariri	B1	63	133,118	14%	18,420
SUB-TOTAL			1,072	1,471,306	14%	208,594
[NORTH SMATERA]						
60011	Sumbari	A4	77	112,830	21%	23,751
60038	Rauning B	A2	66	137,250	20%	27,946
50025	Sumbul Berampu	C1	124	101,994	16%	15,955
50057	Sidomukti	B1	27	48,745	11%	5,332
50091	Aek Palia	B1	38	57,284	20%	11,408
50129	Pangambatan (B)	B2	48	85,673	7%	5,602
50141	Aek Siparbu	B4	26	51,993	15%	7,959
50218	Kutamale	B4	40	55,443	20%	11,327
50240	Asahan VIII	B3	66	136,985	13%	17,399
50256	Aek Sihim	B5	48	77,339	16%	12,656
SUB-TOTAL			560	855,536	16%	139,335
LD Projects			333	728,066	18%	128,138
TOTAL VI Projects			1,893	2,496,024	13%	333,473
Total			2,226	3,224,090	14%	461,611

Remarks : Farmers' participation consists of normal labor cost for farm formation, canal rehabilitation, in-field canal work and O&M road construction.

## 5.7 Evaluation of Schemes

In assessing representative 30 schemes of the project, traditional measures of the economic internal rate of return (EIRR) and the benefit cost ratio (B/C) were calculated for evaluating economic efficiency, while budget impact on typical size farms was analyzed for estimating financial viability.

### 5.7.1 Economic Evaluation

#### (1) Assumptions

The analysis of economic viability of the Project applies the traditional method of project evaluation that follows partial equilibrium framework. The calculation of EIRRs and B/Cs is made on the basis of the following assumptions.

- i) The economic useful life of every individual scheme is 30 years.
- ii) All prices are given as those of 1992 constant price.
- iii) An exchange rate of Rp.2,000=US\$ 1.0 is used.
- iv) Transfer payments such as contract tax, duty, value added tax and subsidy are excluded in valuing the project costs and benefits.
- v) All the goods and services are expressed in "efficiency price" which represents resource endowment of the economy. Traded component is given in import/export parity price while non-traded component is adjusted the distortion by multiplying Conversion Factors(CFs).
- vi) The following CFs are used for converting construction cost(World Bank 1990):

a) Designs of irrigation works, land clearance and development, agricultural extension and preparation for O&M	---	1.0
b) Construction of irrigation civil works, land development and annual O&M	-	0.9
c) All other goods (Standard Conversion Factor)	---	0.8

vii) Unskilled labor is priced at 65% of actual rate for Lombok Island of West Nusa Tenggara and at 80% in North Sumatra, South Sulawesi and Sumbawa Island of West Nusa Tenggara.

viii) In evaluating individual irrigation schemes, only the tangible direct benefit to be accrued from increased agricultural products was counted. Indirect and intangible benefits will be discussed in overall project assessment given in Chapter VIII.

## (2) Pricing of Agricultural Commodities

Agricultural products which are to be affected by the project include paddy, soybeans, groundnut, mungbeans and others. Paddy is the first and foremost crop in the project and most of the benefit will accrue from its production increase. In this assessment, the economic prices of traded commodities were derived from the projection of world price by the World Bank. Adjustment of processing, transportation, handling and other charges were made for border prices to represent prices at farm-gate level. The palawija crops are represented by the one with the largest harvest area for each of three provinces, i.e., by soybeans for North Sumatra and West Nusa Tenggara and by groundnut for South Sulawesi for simplicity. Supply demand balance and representative value years are set as follows:

The economic prices are valued as averages of import and export parity bases for paddy/rice and groundnut and as an import parity base for soybeans. As for agricultural inputs, urea is valued as export parity price and TSP and KCL as import parity price. As for the year of price forecast, the average of years from 1993 to 2005 is used. The derivation of economic commodity price is given in Appendix-IX.

## (3) Economic Benefits

The tangible direct benefits will accrue from increased agricultural production which is attributable to an improvement of irrigation water supply and farm input application. Benefits are estimated as the difference of annual net revenues in economic price under future with and without project conditions. The annual net revenues were calculated from value of products and the production costs which can be derived from unit yield and applied input amount.



The irrigation benefits are assumed to reach the expected level by the third year after facility development. 50% and 75% of yearly benefit are assumed to accrue in the first and second years, respectively.

#### (4) Economic Costs

The financial cost estimates given in Appendix-VIII were converted to economic costs by using aforementioned CFs. The cost for land acquisition/crop compensation is excluded since it has already counted in the with-without difference of production value. The costs are divided into those to occur in the first year of implementation and those in the second year. Costs for operation and maintenance are converted in the same way as initial project cost.

#### (5) Evaluation Results

Under the pricing and cost assumptions above, economic cost and benefit flows are made. The EIRRs and B/Ss generated by the 30 representative schemes are tabulated in Table 5-7-1. These indices range between 11.0% and 35.2% and between 1.09 and 3.59, respectively, with cost weighted averages of 20.5% and 1.99.

All of the EIRRs pass the test of the ten percent opportunity cost of capital figure commonly applied when evaluating projects. No notable difference was observed in EIRRs by project type groups. Cost benefit flows are given in Appendix-IX.

#### 5.7.2 Financial Analysis

In assessing a project, budgetary and financial impacts on economic bodies involved in it are to be analyzed. The bodies affected by the project will include individual farms, farmers' organizations and the project executing agency. In the case of this project, the cost of initial investment will be burdened by the government expect for the portion of farmers' participation which is estimated at about 14% of direct construction cost. The budgetary expense is regarded as a subsidy by farmers or farmers' organization. Since most of the benefits attributed to a production increase will be reserved by farmers, obviously the project will bring a favorable impact on farm budget and thus on management of farmers' organization. In this section, farm incomes of the future with-project condition and the existing without-project condition are discussed.

The "farm model" set for each province in this analysis is that with a average size of all the representative schemes inclusive in the province. These models are, however, not a "representative" farm in the schemes or the provinces because the farm type varies much by regions and even within a scheme. Another model with relatively larger farm was designed additionally referring an analysis made for the Small Scale Irrigation Improvement Project (Erickson 1991). The analysis thus gives a showcase of the farm income impact rather than a typical one. The farming cost used are based on the crop budgets in financial price. The table below summarizes the farm income analysis and shows an incremental income generated by the project.

Estimated Net Farm Income

		Existing Without Project	Future With Project	Incremental Gain
Average Size	SUMUT	Rp.381,000	Rp.575,000	Rp.194,000
	SULSEL	Rp.476,000	Rp.743,000	Rp.267,000
	NTB	Rp.371,000	Rp.489,000	Rp.118,000
Larger Size	SUMUT	Rp.923,000	Rp.1,509,000	Rp.586,000
	SULSEL	Rp.963,000	Rp.1,383,000	Rp.420,000
	NTB	Rp.1,118,000	Rp.1,598,000	Rp.481,000

Since the project schemes are generally dominated by small holders the project will benefit the poor, which shows an effect of this project in terms of "poverty alleviation."

The envisioned income increase is expected to cover the increase in operation and maintenance cost burdened by farmers. An increase of Rp.10,000/ha of O&M cost estimated in Appendix-VII is well less than a third of the above income increase estimates.

Table 5-7-1 RESULTS OF ECONOMIC EVALUATION FOR 30 SCHEMES

Code	Name of Scheme	Group	Economic Project Cost Rp. 1,000 (a)	Economic Annual Benefit Rp. 1,000 (b)	(b)/(a)	EIRR %	B/C (10%)
<u>North Sumatra Province</u>							
60011	Sumbari	LD A4	140,374	20,128	0.14	11.9%	1.10
60038	Rauning	LD A2	168,734	30,949	0.18	14.3%	1.41
50025	Sumbul Berampu	VI C1	176,034	48,666	0.28	22.3%	2.14
50057	Sidomukti	VI B1	64,638	13,255	0.21	17.2%	1.65
50091	Aek Palia	VI B1	80,160	18,618	0.23	19.2%	1.85
50129	Pangambatan B	VI B2	113,552	26,485	0.23	19.4%	1.86
50141	Aek Siparbue	VI B4	68,466	10,024	0.15	12.2%	1.19
50218	Kutamale	VI B4	79,285	19,962	0.25	20.6%	1.97
50240	Asahan III Pengajian	VI B3	176,784	43,493	0.25	19.8%	1.84
50256	Aek Sihim	VI B5	106,563	20,875	0.20	16.3%	1.55
<u>South Sulawesi Province</u>							
20003	Kalu	LD A3	81,487	14,564	0.18	14.4%	1.36
10055	Pajjenge	VI C1	179,153	66,873	0.37	29.7%	3.06
10099	Kadieng	VI B1	477,888	172,131	0.36	29.1%	2.94
10115	Kaindi	VI B4	205,057	55,943	0.27	21.6%	2.02
10140	Lembang Bata	VI B5	118,539	32,332	0.27	22.1%	2.12
10168	Panrita	VI B2	59,934	11,926	0.20	15.1%	1.41
10182	Mario I-II-III	VI B4	100,028	15,912	0.16	12.8%	1.23
10201	Pakelli II	VI B5	151,845	23,655	0.16	12.5%	1.21
10227	Padaelo	VI B3	365,267	101,321	0.28	12.8%	1.13
10287	Malimbu	VI C2	65,853	23,013	0.35	28.1%	2.80
10332	Salu Akung	VI C1	66,922	9,573	0.14	11.8%	1.15
10354	Mariri	VI B1	165,310	63,179	0.38	30.3%	2.99
<u>West Nusa Tenggara Province</u>							
45010	Danar Jengkang	LD A4	485,417	157,523	0.32	26.4%	2.56
32013	Mada Manini	VI C2	125,757	24,876	0.20	16.4%	1.57
33050	Uma Lebang	VI B1	149,855	23,964	0.16	12.7%	1.22
34004	Lokok Tripas	VI C1	70,825	12,737	0.18	15.0%	1.44
35035	Lengkok Dudu	VI B1	98,314	12,947	0.13	11.0%	1.09
35045	Kelokos Udang	VI B5	128,325	37,593	0.29	23.1%	2.20
36016	Raba Sangga	VI C1	119,424	31,959	0.27	21.2%	2.01
37003	Montong Sapah/Puri	VI C1	54,890	25,076	0.46	35.2%	3.59

## VI. THE PROJECT

### 6.1 Selection of Priority Scheme for Implementation

#### 6.1.1 Screening Criteria and Priority

The screening criteria on priority of land development and village irrigation schemes are shown in Table 6-1-1, and 6-1-2. Priority is decided on each scheme basis by using the results of F/S survey and inventory survey. The screening items consist of economical, technical, implementation and social aspects. In land development schemes, especially, the item on extension of area is considered, and the item on increase in planting ratio by introducing rehabilitation and improvement is considered in village irrigation schemes. The availability of water source is decided by analyzing hydrological data which are derived from inventory survey. In addition, operation and maintenance, and water management organizations are evaluated by considering management condition. On the other hand, screening item reflecting annual income is judged by Gross Development Product(GDP) because of indistinct survey data.

#### 6.1.2 Selection Method of Priority Scheme

The F/S schemes surveyed are classified into the following three(3) ranks; A, B, and C, and are evaluated in district level.

- Rank A: The schemes to be object of the Study.
- Rank B: The schemes to be implemented in future.
- Rank C: The remaining schemes or non-potential schemes.

#### Screening Criteria for Rank A:

1. Evaluation marks on water source availability or on soil is to be more than one point.
2. B/C ratio is to be more than 1.0. However, in the case when annual income is less than 80% of provincial average, B/C is to be more than 0.7, and preventive measures are to be taken for eradication of poverty.
3. The marks obtained by evaluation are to be more than 50 points.
4. The rank obtained by evaluation is to be higher than 10 in district level from comprehensive view point of management.
5. The scheme with high point is to be selected in order in each district, considering the above 1-4 items.

Screening Criteria for Rank B:

1. Evaluation marks on water source availability or on soil is to be more than one point.
2. B/C ratio is to be more than 1.0. However, in the case when annual income is less than 80% of provincial average, B/C is to be more than 0.7, and preventive measures are to be taken for eradication of poverty.
3. The marks obtained by evaluation are to be more than 50 points.

Screening Criteria for Rank C:

1. Evaluation mark on water source availability or on soil is to be zero.
2. In the case when B/C ratio is less than 1.0, and the annual income is more than 80% of provincial average.
3. In the case when development potential is null according to the survey conducted by the province.
4. Others.

In West Nusa Tenggara Province, Provincial Agricultural Service compiled the survey on possibility of paddy field development in irrigation schemes which were under control of Ministry of Public Works in January, 1992. According to the result of the survey, there exist less potential of paddy field development to be conducted by Ministry of Public Works. The following reasons are mentioned :

- Water source discharge is insufficient.
- Kind of crop is changed in many places.
- Soil is high permeable.
- Several schemes are excluded from the survey because they have already been constructed or planned.
- Water is scarce, and canal is not fully provided despite the fact that paddy field has already been developed.
- The scheme is located in higher land.
- The scheme is situated in protective forest.

In the above mentioned survey, the schemes (especially, land development schemes in West Nusa Tenggara Province) which have been reported to be problem in development potential and belonged to the lowest group in implementation order are to be excluded from the development area.

Table 6-1-1 SELECTION CRITERIA FOR IMPLEMENTATION OF  
LAND DEVELOPMENT SCHEME

EVALUATION ITEM	
A. Economic evaluation	
1. B/C	
a. more than 2.0	25
b. 1.5 - 2.0	20
c. 1.0 - 1.5	15
d. less than 1.0	0
2. Availability for expansion of paddy field (Question 41)	
a. more than 50 %	15
b. 25 - 50 %	10
c. less than 25 %	5
B. View from Technology	
1. Water availability (Question 244 & Analysis)	15
2. Soil texture for paddy cultivation (Question 46)	
a. Most suitable	5
b. Suitable	3
c. Not suitable	0
C. View from Implementation & Operation	
1. Condition of O&M, Water Users' association (Question 61 & Analysis)	15
2. Condition of present land use and boundaries of property land (Question 58)	
a. The status and boundaries are clear.	5
b. The status and boundaries are unclear.	2
3. Condition of roads and bridge to intake site for irrigation water (Question 13)	
a. Access road which can join with public road exit.	5
b. No road or damaged	3
D. View from Social condition	
1. Land ownership (Question 563)	
a. Land-owning farmers live in the district.	5
b. Land-owning farmers live outskirts of the district.	2
2. Land status (Question 571)	
a. Private property land is more than 60 %	5
b. Private property land is less than 59 %	2
3. Average income per capita per year	
a. less than 80 % of provincial average	5
b. 81 - 120 % of provincial average	3
c. more than 121 % of provincial average	1

Table 6-1-2 SELECTION CRITERIA FOR IMPLEMENTATION OF  
VILLAGE IRRIGATION SCHEME

EVALUATION ITEM	
A. Economic evaluation	
1. B/C	
a. more than 2.0	25
b. 1.5 - 2.0	20
c. 1.0 - 1.5	15
d. less than 1.0	0
2. Availability for increase of crop intensity (Question 44)	
a. more than 50 %	15
b. 25 - 50 %	10
c. less than 25 %	5
B. View from Technology	
1. Water availability (Question 244 & Analysis)	
	15
2. Soil texture for paddy cultivation (Question 46)	
a. Most suitable	5
b. Suitable	3
c. Not suitable	0
C. View from Implementation & Operation	
1. Condition of O&M, Water Users' association (Question 61 & Analysis)	
	15
2. Condition of present land use and boundaries of property land (Question 58)	
a. The status and boundaries are clear.	5
b. The status and boundaries are unclear.	2
3. Condition of roads and bridge to intake site for irrigation water (Question 13)	
a. Access road which can join with public road exit.	5
b. No road or damaged	3
D. View from Social condition	
1. Land ownership (Question 563)	
a. Land-owning farmers live in the district.	5
b. Land-owning farmers live outskirts of the district.	2
2. Land status (Question 571)	
a. Private property land is more than 60 %	5
b. Private property land is less than 59 %	2
3. Average income per capita per year	
a. less than 80 % of provincial average	5
b. 81 - 120 % of provincial average	3
c. more than 121 % of provincial average	1

### 6.1.3 Selection Results of F/S Schemes

Summary of the result of priority grouping is shown in the following table for the F/S 795 Schemes. The distribution of the marks obtained of Schemes is shown in Table 6-1-4.

Table 6-1-3 Number of Schemes by Ranking

Division	Rank	North Sumatra	South Sulawesi	NTB	Total
Land Development Schemes	A	23	5	2	30
	B	-	-	-	-
	C	9	5	18	32
Subtotal		32	10	20	62
Village Irrigation Schemes	A	90	160	60	310
	B	118	151	44	313
	C	39	38	33	110
Subtotal		247	349	137	733
Total		279	359	157	795

Note; The marks obtained of each scheme is attached to the end of this volume.

### 6.1.4 Proposed Schemes

As results of the above evaluation, 340 schemes of ranking-A are proposed for the Project implementation. The name of selected schemes (Ranking A) and the marks obtained are shown in Table 6-1-5.

North Sumatra Province	: LD Scheme,	23 nos
	VI Scheme,	90 nos
South Sulawesi Province:	LD Scheme,	5 nos
	VI Scheme,	160 nos
West Nusa Tenggara Province	: LD Scheme,	2 nos
	VI Scheme,	60 nos
Total	: LD Scheme,	30 nos
	VI Scheme,	310 nos

Grand total	:	340 nos
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Table 6-1-4

## Distribution of Score Evaluated

SCORE	LD SCHEME			VI SCHEME		
	North Sumatra	South Sulawesi	NTB	North Sumatra	South Sulawesi	NTB
	nos	nos	nos	nos	nos	nos
0-1	9	5	18	0	0	0
6-10	0	0	0	0	0	0
11-15	0	0	0	0	0	0
16-20	0	0	0	0	0	0
21-25	0	0	0	0	0	0
26-30	0	0	0	0	0	0
31-35	0	0	0	0	1	0
36-40	0	0	0	0	3	0
41-45	0	0	0	1	11	0
46-49	0	0	0	2	24	3
+++++						
50	0	0	0	2	17	0
51-55	0	0	0	7	43	13
56-60	0	1	0	14	48	16
61-65	0	0	1	21	24	10
66-70	1	0	0	37	45	15
71-75	0	0	0	57	49	35
76-80	4	2	0	36	39	31
81-85	10	1	1	37	31	12
86-90	6	1	0	31	10	2
91-95	2	0	0	3	4	0
96-100	0	0	0	0	0	0
Total	32	10	20	247	349	137
Grand total						795

Table 6-1-5 LIST OF SELECTED SCHEMES AND SCORE (1/4)

North Sumatra-Land Development					
No	CODE	L. D. Scheme	Rank	Regency	Total
IRR			REG		
1	60012	Lac Rakkom	A	Dairi	82
2	60002	Kuta Gambir	A	Dairi	88
3	60013	Lac Pinagar	A	Dairi	76
4	60004	Gapaulako-Galian Pancur nandi	A	Dairi	76
5	60014	Paniki I	A	Dairi	88
6	60006	Kabau Tengah	A	Dairi	89
7	60010	Lac Pangaroan	A	Dairi	86
8	60003	Siarung Arung	A	Dairi	81
9	60020	Mungkur	A	Dairi	92
10	60008	Amborgang	A	Dairi	83
11	60005	Parikki II	A	Dairi	81
12	*60011	Sumbari	A	Dairi	82
13	60037	Silingom-Linggom	A	Japanuli Selatan	89
14	60023	Sinar Toba Simangala	A	Labuhan Batu	83
15	60025	Ulu Mahuan	A	Labuhan Batu	83
16	60021	Paluh Paki	A	Langkat	82
17	60041	tahalak Rauning A	A	Tapanuli Selatan	92
18	60042	Aek Subat	A	Tapanuli Selatan	87
19	*60038	Rauning B	A	Tapanuli Selatan	77
20	60029	Aek Baja	A	Tapanuli Tengah	77
21	60028	Mandailing	A	Tapanuli Tengah	69
22	60034	Sisuhar-Subar	A	Tapanuli Utara	83
23	60033	Parlunggan	A	Tapanuli Utara	81
Total					1907
Average					82.9

South Sulawesi LD					
No	CODE	L. D. Scheme	Rank	Regency	Total
IRR			REG		
1	20004	Leko Ballo	A	Bone	80
2	*20003	Kalu	A	Bone	79
3	20008	Jinetalasa	A	Gowa	57
4	20009	Belong	A	Jenepono	83
5	20393	Sumamillan	A	Polmas	87
Total					386
Average					77.2

NTB LD					
No	CODE	L. D. Scheme	Rank	Regency	Total
IRR			REG		
1	*45010	DENAR JERKANG	A	LOMBOK TIMUR	85
2	43004	MARENTEH	A	SEMBAWA	64
Total					149
Average					74.5

Table 6-1-5 LIST OF SELECTED SCHEMES AND SCORE (2/4)

North Sumatra VI												
No	CODE	Irrigation Scheme	Rank	Regency	Total	No	CODE	Irrigation Scheme	Rank	Regency	Total	
		IRR	REG				IRR		REG			
1	*50240	Asahan VIII Pengajian	A	Asahan	88	81	50154	Aek Simokbok	A	Tapanuli Utara	89	
2	50225	Marjanji Aceh	A	Asahan	76	82	50164	Waduk Hairi Gorat	A	Tapanuli Utara	89	
3	50228	Siantipa/Siou	A	Asahan	67	83	50186	Aek Sigilang	A	Tapanuli Utara	88	
4	50245	Pulorejo	A	Asahan	66	84	50153	Danau Toba	A	Tapanuli Utara	87	
5	50226	Desa Gajah	A	Asahan	65	85	50162	Aek Sitete	A	Tapanuli Utara	87	
6	50042	Jumapetak	A	Dairi	93	86	50170	Parmansian	A	Tapanuli Utara	86	
7	*50625	Sumbul Berampu	A	Dairi	90	87	50167	Aek Sijambe	A	Tapanuli Utara	85	
8	50023	Sibora-bora	A	Dairi	87	88	50187	Aek Sia Tunggal	A	Tapanuli Utara	84	
9	50033	Sopogadong	A	Dairi	87	89	50134	Aek Silambu	A	Tapanuli Utara	84	
10	50026	Lac Tinokkap	A	Dairi	87	90	*50141	Aek Siparbue	A	Tapanuli Utara	84	
11	50032	Sitalmak	A	Dairi	87	Total				7,314		
12	50028	Lac Situlan	A	Dairi	87	Average				81.3		
13	50007	Bantuan Kerbo	A	Dairi	87							
14	50006	Lac Panginuman	A	Dairi	87							
15	50004	Ulu Merah	A	Dairi	87							
16	50029	Hutamanir	A	Dairi	87							
17	50296	Sungai Kerapuh	A	Deli Serdang	86							
18	50289	Sei Blumci	A	Deli Serdang	84							
19	50299	Paluh Kemiri	A	Deli Serdang	79							
20	50293	Sungai Rambung	A	Deli Serdang	76							
21	50303	Sungai Belutu	A	Deli Serdang	75							
22	50302	Lau Keramat	A	Deli Serdang	72							
23	50294	Bukit Cermin	A	Deli Serdang	72							
24	50288	Sei Rejo	A	Deli Serdang	65							
25	50283	Dusun X, XI, XII	A	Deli Serdang	61							
26	*50218	Kutamale	A	Karo	88							
27	50192	Parit Rumah Gugung	A	Karo	86							
28	50197	Sabah Berneh/Lau Jandi	A	Karo	86							
29	50216	Barong Kersap	A	Karo	84							
30	50195	Serdang	A	Karo	84							
31	50203	Pergendangen	A	Karo	84							
32	50200	Sabah Pinto	A	Karo	84							
33	50190	Mandah	A	Karo	83							
34	50208	Sabah Dekel	A	Karo	83							
35	50189	Lau Rambung	A	Karo	82							
36	50194	Lau Lenting	A	Karo	82							
37	50082	Sinar Pagi/Sibara-bara II	A	Labuhan Batu	83							
38	50070	Kp. Lalang II	A	Labuhan Batu	81							
39	50076	Sihosur	A	Labuhan Batu	74							
40	50080	Aek Paing	A	Labuhan Batu	74							
41	50085	Sibuaya	A	Labuhan Batu	74							
42	*50091	Aek Palia/Tegal Legok	A	Labuhan Batu	73							
43	50086	Kampung Lalang I	A	Labuhan Batu	73							
44	50087	Kampung Lalang III	A	Labuhan Batu	72							
45	50079	Aek Halubi	A	Labuhan Batu	72							
46	50088	Cinta Makmur	A	Labuhan Batu	72							
47	50062	Sei Sirit	A	Langkat	87							
48	50063	Sei Tungksakti	A	Langkat	86							
49	50046	Bukit Mas/Pantai Buaya	A	Langkat	83							
50	50061	Paya Salit	A	Langkat	83							
51	50053	Selemak/Sejagat	A	Langkat	80							
52	50066	Bekancan	A	Langkat	78							
53	*50057	Sidomukti	A	Langkat	77							
54	50052	Bandar Bunga	A	Langkat	77							
55	50045	Bangun Mulia	A	Langkat	75							
56	50056	Sei Tumkan Jaya	A	Langkat	74							
57	50058	Perpulungan	A	Langkat	74							
58	*50256	Aek Sihim	A	Tapanuli Selatan	91							
59	50309	Saba Hutadangka	A	Tapanuli Selatan	90							
60	50251	Aek Harsik	A	Tapanuli Selatan	89							
61	50276	Panyanggar Julu	A	Tapanuli Selatan	89							
62	50306	Sipanguapan	A	Tapanuli Selatan	86							
63	50279	Sabaipar	A	Tapanuli Selatan	86							
64	50249	Bondar Dolak Tamiang	A	Tapanuli Selatan	85							
65	50310	Siranap	A	Tapanuli Selatan	85							
66	50308	Sinapolan	A	Tapanuli Selatan	85							
67	50255	Aek Mahual	A	Tapanuli Selatan	84							
68	50260	Tano Tiris I	A	Tapanuli Selatan	82							
69	50099	Purbatua	A	Tapanuli Tengah	84							
70	50104	Hutaimbaru	A	Tapanuli Tengah	83							
71	50124	Desa Lumut A	A	Tapanuli Tengah	81							
72	50096	Labutua	A	Tapanuli Tengah	79							
73	50108	Napitupalu/Hutaimbaru	A	Tapanuli Tengah	79							
74	50100	Sipange/Baratan	A	Tapanuli Tengah	78							
75	50095	Purbatua	A	Tapanuli Tengah	77							
76	50131	Sigambo-Gambo	A	Tapanuli Tengah	75							
77	50121	Sibintang	A	Tapanuli Tengah	75							
78	*50129	Pangambatan (B)	A	Tapanuli Tengah	75							
79	50112	Barambang	A	Tapanuli Tengah	75							
80	50143	Aek Sampean	A	Tapanuli Utara	92							

Table 6-1-5 LIST OF SELECTED SCHEMES AND SCORE (3/4)

SOUTH SULAWESI VI											
No	CODE	Irrigation Scheme	Rank	Regency	Total	No	CODE	Irrigation Scheme	Rank	Regency	Total
IRR						IRR					
REG						REG					
1	10010	Bulu sumang	A	Bantaeng	64	81	10296	WALU-WALU	A	Luwu	68
2	10004	Batu Kanre	A	Bantaeng	60	82	10295	SALULAIYA	A	Luwu	68
3	10009	Parangpangi	A	Bantaeng	56	83	10386	BONDEPUTE	A	MAMUJU	86
4	10005	Bungloe	A	Bantaeng	53	84	10390	KALUKKU	A	MAMUJU	83
5	*10055	Tompo	A	Barru	79	85	10382	T A O S A	A	MAMUJU	82
6	10060	Bunewe	A	Barru	67	86	10380	B U R I N G	A	MAMUJU	81
7	10051	Batu Marajac	A	Barru	60	87	10379	S F S F	A	MAMUJU	74
8	10050	Alakkang	A	Barru	58	88	10392	PURE I	A	MAMUJU	73
9	10052	Matajang	A	Barru	55	89	10388	BATU PAPAN	A	MAMUJU	71
10	10057	Waepubbu	A	Barru	51	90	10381	BALIHANANG/WAI TUMBUR	A	MAMUJU	70
11	10029	Balsiru	A	Bone	85	91	10389	PURE II	A	MAMUJU	68
12	10033	Lappa Talle	A	Bone	85	92	10385	KARANAMU	A	MAMUJU	60
13	10028	Tubung	A	Bone	84	93	10383	MARURINDING	A	MAMUJU	55
14	10043	Lappa Karong	A	Bone	82	94	10193	Malempong	A	Maros	86
15	10037	Ulu Bubung	A	Bone	81	95	10183	Matajang I	A	Maros	82
16	10034	Toddang Jompi	A	Bone	80	96	10189	Matanre	A	Maros	82
17	10024	Elle (Tondon)	A	Bone	80	97	10191	Makdenge & Ujung	A	Maros	82
18	10023	Tondon Buah (Tondon)	A	Bone	77	98	10185	Sawaru	A	Maros	82
19	10030	Ajakkang	A	Bone	77	99	*10182	Mario I-II-III	A	Maros	79
20	10036	Salo Pokki	A	Bone	76	100	10176	Samanggi	A	Maros	79
21	10032	Padang Lampe	A	Bone	76	101	10187	Panagi	A	Maros	77
22	10046	S.Lita	A	Bone	76	102	10184	Mahaka	A	Maros	77
23	10074	Pakombong II	A	Bulukumba	93	103	10177	Puca	A	Maros	77
24	10079	Polehali	A	Bulukumba	87	104	10178	Tombolo	A	Maros	76
25	10070	Paocani	A	Bulukumba	85	105	10194	Wanuawaru	A	Maros	72
26	10064	Balumbung	A	Bulukumba	83	106	10236	Salo-Bulo	A	Pare-pare	71
27	10073	Pakombong I	A	Bulukumba	82	107	10238	Lameri	A	Pare-pare	70
28	10100	Tinurung	A	Bulukumba	81	108	10353	BATU ALANG	A	POLMAS	88
29	10077	Marame I	A	Bulukumba	79	109	10340	TAYANG PAMMASE	A	POLMAS	80
30	10068	Jammu	A	Bulukumba	78	110	10373	MAKARIA	A	POLMAS	77
31	10069	Sarajoko	A	Bulukumba	77	111	10372	BAMBANANGKA	A	POLMAS	74
32	10072	Bongkarae	A	Bulukumba	77	112	10343	TANDAKAN	A	POLMAS	73
33	10090	Barana II	A	Bulukumba	76	113	*10354	S. MARIRI	A	POLMAS	73
34	*10099	Kadieng	A	Bulukumba	75	114	10347	PAPANDANGAN	A	POLMAS	73
35	10078	Marame II	A	Bulukumba	74	115	10342	AMOLA	A	POLMAS	71
36	10138	Salu Kalama	A	Enrekang	79	116	10352	TANDUNG	A	POLMAS	65
37	*10115	Karindi	A	Enrekang	78	117	10358	L O K O	A	POLMAS	59
38	10134	Salu Dara	A	Enrekang	78	118	10348	K U N Y I	A	POLMAS	58
39	10135	Sarassang	A	Enrekang	77	119	10365	OSANGO	A	POLMAS	58
40	10109	Kaloiang	A	Enrekang	72	120	10345	BUTTU LAMBA	A	POLMAS	57
41	10103	Bassarau	A	Enrekang	71	121	10205	Kabba	A	Sinjai	84
42	10106	Kalo Baru	A	Enrekang	70	122	10206	Lebba	A	Sinjai	81
43	10128	Karrang	A	Enrekang	70	123	10207	Laiya	A	Sinjai	81
44	10105	Lalantedong	A	Enrekang	69	124	10196	Bangkeng laboro	A	Sinjai	74
45	10107	Kalo Kieba	A	Enrekang	66	125	10202	Kalibong	A	Sinjai	71
46	10104	Hiba	A	Enrekang	66	126	10198	Rumpala	A	Sinjai	71
47	10129	S. Durian	A	Enrekang	64	127	10204	Ciping	A	Sinjai	70
48	10131	Salu Gwang	A	Enrekang	62	128	10208	Galungtoa	A	Sinjai	68
49	*10140	Lembong Batang	A	Gowa	94	129	*10201	Pakelli II	A	Sinjai	66
50	10139	Lembang Panai	A	Gowa	88	130	10203	Kanrung	A	Sinjai	58
51	10141	Gantarang	A	Gowa	88	131	10199	Buke I & II	A	Sinjai	57
52	10144	Paburuang	A	Gowa	84	132	10215	Galung Langi	A	Soppeng	72
53	10142	Panaikang	A	Gowa	83	133	10210	Seppae	A	Soppeng	62
54	10148	Pantling	A	Gowa	81	134	10209	Kajade	A	Soppeng	60
55	10145	Kampania	A	Gowa	68	135	10213	Ladope	A	Soppeng	60
56	10149	Jenebatu	A	Gowa	66	136	10249	Lamalampe	A	Soppeng	52
57	10150	Nyulu	A	Gowa	66	137	10322	BURASEA	A	TANA TORAJA	91
58	10146	Patalasang	A	Gowa	60	138	10321	BELALANG	A	TANA TORAJA	83
59	10147	AereJembang	A	Gowa	58	139	10315	TO' BATU	A	TANA TORAJA	79
60	10172	Kompasa	A	Jeneponto	91	140	10316	BUTU TONGKON	A	TANA TORAJA	79
61	10156	Birangloe	A	Jeneponto	88	141	10324	S. PUTTI	A	TANA TORAJA	78
62	10163	Tabuakang	A	Jeneponto	88	142	10311	S A P A N	A	TANA TORAJA	78
63	10169	Passaukang	A	Jeneponto	87	143	10303	TOLIKU	A	TANA TORAJA	73
64	10154	Pitape	A	Jeneponto	87	144	10319	MATASALU	A	TANA TORAJA	71
65	10159	Kalampeto	A	Jeneponto	84	145	10302	K A L U A	A	TANA TORAJA	71
66	10170	Bontonompo	A	Jeneponto	83	146	*10332	SALU A' KUNG	A	TANA TORAJA	69
67	10160	Tangkaluka	A	Jeneponto	82	147	10312	BOMBO WAY	A	TANA TORAJA	68
68	10166	Pattiro	A	Jeneponto	82	148	10335	PA' BASEAN DUA	A	TANA TORAJA	68
69	10162	Barobbo	A	Jeneponto	81	149	10328	K A N A K A	A	TANA TORAJA	68
70	*10168	Panrita	A	Jeneponto	73	150	10235	Tanlung	A	Wajo	84
71	10279	KAIYANG/TOMPO	A	LUWU	78	151	10230	tarampakkae /Tokkoe	A	Wajo	81
72	*10287	MALIMBU	A	LUWU	76	152	10229	danau lalapak /Saramae	A	Wajo	79
73	10292	BAEBUNTA	A	LUWU	73	153	10234	Labong (Piampo)	A	Wajo	79
74	10291	POTANTTU	A	LUWU	73	154	10219	Peneki	A	Wajo	69
75	10280	TIROMUNDA	A	LUWU	73	155	*10227	Linipua /lampulung	A	Wajo	75
76	10276	TOASYIK	A	LUWU	73	156	10218	Cenranae IV/Maffabentae	A	Wajo	74
77	10272	SAMPANO	A	LUWU	72	157	10228	Pao-Pao	A	Wajo	72
78	10294	BEBESUK	A	LUWU	71	158	10233	Pilallang	A	Wajo	72
79	10301	PATILLA I	A	LUWU	71	159	10220	Lokading/Salumpare	A	Wajo	72
80	10288	PARARA MALALING	A	LUWU	70	160	10226	Mualia /Cingki /Kcecie	A	Wajo	70

Total 11,862  
Average 74.1

Table 6-1-5 LIST OF SELECTED SCHEMES AND SCORE (4/4)

NTB VI				
No	CODE	Irrigation Scheme	Rank Regency	Total
		IRR	REG	
1 *	36016	RABA SANGGA	A BIMA	79
2	36019	PANDE	A BIMA	78
3	136007	OYI FANDA	A BIMA	78
4	136005	SORI TOLO LERE	A BIMA	78
5	136003	DAM BOJA	A BIMA	77
6	136006	SONCO KATIPU	A BIMA	77
7	136002	TOLOTUY	A BIMA	77
8	136004	DAM DIWU MPINGA	A BIMA	77
9	36014	DAM BROJONG	A BIMA	75
10	36009	MONTA	A BIMA	74
11	36018	DAM NGERU	A BIMA	71
12	32008	KALATE KOCU	A DOMPU	81
13 *	32013	MADA MANINI	A DOMPU	72
14	32007	KOCABO WAWO	A DOMPU	71
15	32003	DORO KORE	A DOMPU	71
16	32002	AMARAD	A DOMPU	70
17	32020	WORO I	A DOMPU	68
18	32004	KARANG BURA	A DOMPU	68
19	34022	TELAGA SEGOAR	A LOMBOK BARAT	86
20	34025	LABUHAN POH	A LOMBOK BARAT	82
21	34003	LOKOK PELOK	A LOMBOK BARAT	82
22	34016	BANGKET BAYAN	A LOMBOK BARAT	81
23	34006	LEKOK	A LOMBOK BARAT	77
24	34013	MANGGALA	A LOMBOK BARAT	76
25	34005	LENGGORONG	A LOMBOK BARAT	75
26 *	34004	LOKOK TRIPAS	A LOMBOK BARAT	74
27	34012	BURUAN	A LOMBOK BARAT	74
28	34010	SESAOT II (SURANADI)	A LOMBOK BARAT	73
29	37001	JURANG JEMBOK	A LOMBOK TENGAH	90
30	37006	SUKA RAJA	A LOMBOK TENGAH	83
31	31010	MELEP	A LOMBOK TENGAH	82
32	37004	NANGKER	A LOMBOK TENGAH	82
33	37005	TIBU PETUNG	A LOMBOK TENGAH	78
34	37002	EYAT KUBUR KELANJUR	A LOMBOK TENGAH	76
35	31008	SIDEMEN	A LOMBOK TENGAH	76
36 *	37003	MONTONG SAPAH I	A LOMBOK TENGAH	76
37	31009	EYAT TEREP	A LOMBOK TENGAH	76
38	31005	REBAN BARU	A LOMBOK TENGAH	74
39	35020	GOGÉ	A LOMBOK TIMUR	84
40 *	35045	KELOKOI UDANG	A LOMBOK TIMUR	83
41	35009	PLANTING	A LOMBOK TIMUR	82
42	35019	DURIAN	A LOMBOK TIMUR	79
43	35011	TERENG BENGKOK	A LOMBOK TIMUR	79
44	35010	OTAK REBAN	A LOMBOK TIMUR	78
45	35002	PEROPOK	A LOMBOK TIMUR	78
46	35004	MADANG	A LOMBOK TIMUR	78
47	35001	MELONG	A LOMBOK TIMUR	78
48	35015	MENCERIP	A LOMBOK TIMUR	78
49 *	35035	LINGKOK DUDU	A LOMBOK TIMUR	72
50	33045	TARUJUM	A SUMBAWA	82
51	33025	SABURUNG ATAS	A SUMBAWA	82
52	33006	TANONG/ABUHAN	A SUMBAWA	82
53	33044	AI SELALO	A SUMBAWA	80
54	33043	AI NUNUNG	A SUMBAWA	80
55	33007	BANETE	A SUMBAWA	79
56	33047	AI MALIN	A SUMBAWA	79
57	33036	PAKAT	A SUMBAWA	79
58	33055	P E L A T	A SUMBAWA	77
59	33015	ORONG LENGAS	A SUMBAWA	76
60 *	33050	UMA LEBANG	A SUMBAWA	72
Total				4,648
Average				77.5

## 6.2 LAND DEVELOPMENT PLAN

### (1) List of Scheme Area for the Project

The list of F/S scheme area and paddy field area by province, and scheme based on the inventory survey are shown in Table 6-2-1, which is the areas of 795 schemes.

The areas of 340 schemes are the schemes to be developed which are incorporated in the current project. The average area of the existing paddy fields in three provinces is estimated at 140 ha/scheme in Land Development Schemes(LD), and at 50 ha/scheme in Village Irrigation Scheme(VI).

The paddy field areas of 340 schemes belonging to the schemes to be developed are shown in Table 6-2-2.

Table 6-2-3 shows the number of development schemes by province, the present and planned paddy field areas, and the planned areas to be reclaimed.

### (2) Rehabilitation Plan of Intake Facilities

Based on the results of inventory survey, and the detailed survey on the representative schemes, the intake facilities are classified into the facilities with good condition, the facilities to be rehabilitated partly, and the facilities to be rehabilitated, judging from the inventory data and present condition of the structures. The intake facilities are defined on the present condition basis as follows:

(Refer to Table 6-2-4.)

- a) Schemes with good condition : 20%
- b) Schemes required for partial rehabilitation : 40%
- c) Schemes required for rehabilitation : 40%

### (3) Number of Schemes by Group

The group of 340 schemes is shown in Table 6-2-5. The schemes relying on the headworks as water source is 193 schemes in VI, which occupies 57% of three provinces. The schemes depending on free intakes is 60 schemes, that is 18%. On the other hand, the schemes irrigated by pump, and others are 57 schemes corresponding to 17%.

Table 6-2-1 LIST OF F/S SCHEME AREA (795 SCHEMES)

PROVINCE	DEVELOP. STAGE	DIVISION	NO. OF SCHEME	COMMAND AREA (Estimated)	PRESENT		PLANNING		REMARK	
					PADDY	RAINFED	PADDY	RAINFED		
			nos	ha	ha	ha	ha	ha		
NORTH SUMATRA	1st.	LD	23	3,886	1,341	284	3,269	35	Evaluation A rank	
	1st.	VI	90	9,305	4,345	2,606	7,785	234		
	FUTURE	LD	-	-	-	-	-	-	B rank	
	FUTURE	VI	127	15,316	7,297	2,624	11,525	602		
	EXCLUDE	LD	9	1,425	1,110	218	-	-	C rank	
	EXCLUDE	VI	30	2,963	1,193	399	-	-		
	SUB TOTAL	LD	32	5,311	2,451	502	3,269	35		
		VI	247	27,584	12,835	5,629	19,310	836		
	SOUTH SULAWESI	1st.	LD	5	890	204	148	465	35	A rank
		1st.	VI	160	32,215	8,524	10,209	14,263	5,103	
FUTURE		LD	-	-	-	-	-	-	B rank	
FUTURE		VI	151	33,431	9,169	6,342	11,837	4,285		
EXCLUDE		LD	5	2,605	983	669	-	-	C rank	
EXCLUDE		VI	38	11,341	2,093	1,368	-	-		
SUB TOTAL		LD	10	3,495	1,187	817	465	35		
		VI	349	76,987	19,786	17,919	26,100	9,388		
NTB		1st.	LD	2	490	238	0	383	0	A rank
		1st.	VI	60	25,314	4,116	2,375	6,011	911	
	FUTURE	LD	-	-	-	-	-	-	B rank	
	FUTURE	VI	44	-	-	-	-	-		
	EXCLUDE	LD	18	15,338	4,801	1,955	-	-	C rank	
	EXCLUDE	VI	33	-	-	-	-	-		
	SUB TOTAL	LD	20	15,828	5,039	1,955	383	0		
		VI	137	25,314	4,116	2,375	6,011	911		
	TOTAL		LD	62	24,634	8,677	3,274	4,117	70	
			VI	733	129,885	36,737	25,923	51,421	11,135	
AVERAGE		LD	ha/nos	397	140	53	66	1		
		VI	ha/nos	177	50	35	70	15		

Table 6-2-2 LIST OF PROJECT SCHEME AREA (340 SCHEMES)

PROVINCE	DEVELOP. STAGE	DIVISION	NO. OF SCHEME	COMMAND AREA (Estimated)	PRESENT		PLANNING		REMARK
					PADDY	RAINFED	PADDY	RAINFED	
			nos	ha	ha	ha	ha	ha	
NORTH	1st.	LD	23	3,886	1,341	284	3,269	35	
SUMATRA	1st.	VI	90	9,305	4,345	2,606	7,785	234	
SOUTH	1st.	LD	5	890	204	148	465	35	
SULAWESI	1st.	VI	160	32,215	8,524	10,209	14,263	5,103	
NTB	1st.	LD	2	490	238	0	383	0	
	1st.	VI	60	25,314	4,116	2,375	6,011	911	
TOTAL		LD	30	5,266	1,783	432	4,117	70	
		VI	310	66,834	16,985	15,190	28,059	6,248	
AVERAGE		LD	ha/nos	176	59	14	137	2	
		VI	ha/nos	216	55	49	91	20	



Table 6-2-3 LIST OF PROJECT SCHEME AREA BY DISTRICT  
(340 SCHEMES)

PROVINCE	REGENCY	DIVISION	NO. OF SCHEME	COMMAND AREA (Estimated)	PRESENT PADDY	PLANNING LD	PLANNING PADDY	
			nos	ha	ha	ha	ha	
NORTH SUMATRA	Dairi	LD	12	1,491	608	797	1,405	
	LabuBatu	LD	2	126	0	67	67	
	Langkat	LD	1	560	286	210	496	
	TapSel	LD	4	746	127	489	616	
	TapTen	LD	2	399	7	190	197	
	TapUt	LD	2	564	313	175	488	
	SUB TOTAL		23	3,886	1,341	1,928	3,269	
	Asahan	VI	5	891	465	47	801	
	Dairi	VI	11	1,061	839	56	951	
	Deli S.	VI	9	1,268	933	35	1,255	
	Karo	VI	11	570	295	57	446	
	LabuBatu	VI	10	1,040	388	406	896	
	Langkat	VI	11	645	183	31	540	
	TapSel	VI	11	1,044	341	264	840	
	TapTen	VI	11	1,371	531	99	1,159	
	TapUt	VI	11	1,414	370	70	897	
	SUB TOTAL		90	9,305	4,345	1,065	7,785	
	TOTAL		113	13,191	5,686	2,993	11,054	
	SOUTH SULAWESI	Bone	LD	2	330	134	58	192
		Gowa	LD	1	140	0	140	140
Jenepono		LD	1	385	70	35	105	
Polmas		LD	1	35	0	28	28	
SUB TOTAL			5	890	204	261	465	
Bantaeng		VI	4	608	112	50	176	
Barru		VI	6	4,363	279	145	625	
Bone		VI	12	8,082	578	0	1,442	
Bulkumba		VI	13	1,919	517	92	981	
Enrekang		VI	13	2,266	1,063	57	1,196	
Gowa		VI	11	2,104	881	4	1,196	
Jenepono		VI	11	1,621	599	10	1,269	
Luwu		VI	12	1,224	1,065	0	1,177	
Mamuju		VI	11	1,194	593	0	872	
Maros		VI	12	1,278	278	7	852	
Polmas		VI	13	1,152	825	29	956	
Parepare		VI	2	280	56	0	175	
Sinjai		VI	11	2,273	364	50	743	
Soppeng		VI	5	731	315	56	490	
Tator		VI	13	987	628	0	875	
Wajo	VI	11	2,134	372	61	1,238		
SUB TOTAL		160	32,215	8,524	561	14,263		
TOTAL		165	33,105	8,728	822	14,728		
NTB	LonTim	LD	1	227	5	115	120	
	Sumbawa	LD	1	263	233	30	263	
	SUB TOTAL		2	490	238	145	383	
	LonBar	VI	10	8,527	1,105	14	1,311	
	LonTen	VI	10	8,056	707	0	1,552	
	LonTim	VI	11	6,283	694	214	1,060	
	Sumbawa	VI	11	743	430	53	703	
	Bima	VI	11	1,168	820	70	981	
	Dompu	VI	7	537	299	49	404	
	SUB TOTAL		60	25,314	4,116	400	6,011	
TOTAL		62	25,804	4,354	545	6,394		
TOTAL	LD		30	5,266	1,783	2,334	4,117	
	VI		310	66,834	16,985	2,026	28,059	

The number of land development schemes is 9% of 340 schemes. The average area of 30 land development schemes is only 64 ha, being small. It may be said that the area has been left undeveloped from the view point of difficulty of construction. The average of VI schemes is 30 ha/scheme, and the number of schemes in three provinces are 68 schemes.

Table 6-2-4 IMPROVEMENT PLAN OF INTAKE FACILITIES FOR THE PROJECT

Province	Division	Intake Condition Good		Needed Rehabilitation		Needed Replace		Total nos
		nos	%	nos	%	nos	%	
North Sumatra	LD	-	-	-	-	-	-	23
	VI	26	28.9	37	41.1	27	30.0	90
South Sulawesi	LD	-	-	-	-	-	-	5
	VI	29	18.1	57	35.6	74	46.3	160
NTB	LD	-	-	-	-	-	-	5
	VI	11	18.3	25	41.7	24	40.0	60
Total	LD	-	-	-	-	-	-	33
	VI	66	21.3	119	38.4	125	40.3	310

Table 6-2-5 NUMBER OF PROJECT SCHEME BY A1 TO B3 GROUP

Group	Change of Ground		Clearing	Intake Facility	North	South	NTB	Total
	Paddy	Slope			Sumatra	Sulawesi		
					nos	nos	nos	nos
A1	Increase	S<5 %	none		1	2	1	4
A2	"	S<5 %	need		9	1	-	10
A3	"	S>=5%	none		2	2	-	4
A4	"	S>=5%	need		11	-	1	12
B1	"	S<5 %		Weir	32	22	14	68
B2	"	S<5 %		Free intake	3	3	2	8
B3	"	S<5 %		others	11	15	1	27
B4	"	S>=5%		Weir	23	36	11	70
B5	"	S>=5%		Free intake	6	21	7	34
B6	"	S>=5%		others	4	16	1	21
C1	Constant	-		Weir	10	28	17	55
C2	"	-		Free intake	-	13	5	18
C3	"	-		others	1	6	2	9
Total					13	165	62	340

(4) Principal Features of the Project

The tentative feature formulated for the land development project is summarized as below;

a. Objective Province	: North Sumatra	South Sulawesi	NTB	Total
b. Objective District	: 9 nos	16 nos	6 nos	31 nos
	Asahan Dairi Deli Serdan Karo Labuhan Batu Langkat Tapanuli Sel. Tapanuli Tengah Tapanuli Utara	Bantaeng Barru Bone Bulkumba Enrekang Gowa Jeneponto Luwu Mamuju Maros Polmas Pare-pare Sinjai Soppeng Tana Toraja Wajo	Lombok Barat Lombok Tengah Lombok Timur Sumbawa Bima Dompu	
c. Project Components	<ol style="list-style-type: none"> <li>1. Land development</li> <li>2. Village irrigation development</li> <li>3. Institutional strengthening</li> <li>4. Strength of coordination and monitoring</li> </ol>			
d. Number of Scheme	nos	nos	nos	nos
LD Scheme	: 23	5	2	30
VI Scheme	: 90	160	60	310
Total	: 113	165	62	340
e. Covering Area	ha	ha	ha	ha
LD Scheme	: 3,900	900	500	5,300
VI Scheme	: 9,300	32,200	25,300	66,800
Total	: 13,200	33,100	25,800	72,100
f. Beneficiaries	household : 17,400	19,100	12,300	48,800
g. Gross Paddy Field	ha	ha	ha	ha
Present Paddy	: 4,400	8,500	4,100	17,000
Future Paddy	: 9,700	14,500	6,200	30,400

Objective	Province : North Sumatra	South Sulawesi	NTB	Total
h. Net Paddy Field				
	ha	ha	ha	ha
Present Paddy	: 3,900	7,700	3,700	15,300
Future Paddy	: 8,700	13,100	5,500	27,300
i. Increase of Paddy Field				
	ha	ha	ha	ha
Gross Paddy	: 5,300	6,000	2,100	13,400
Net Paddy	: 4,800	5,400	1,800	12,000
j. Reclamation of New Paddy Field				
LD Scheme	: 1,928	261	145	2,334
VI Scheme	: 1,065	561	400	2,026
Total	2,993	822	545	4,360
k. Rainfed Paddy				
Present	: 2,900	10,300	2,400	15,600
Future	: 200	5,100	900	6,200
l. Palawija				
Present	: 1,100	5,900	6,600	13,600
Future	: 500	5,300	6,300	12,100
m. Orchard/Plantation				
Present	: 400	1,900	1,400	3,700
Future	: 300	1,900	1,400	3,600
n. Yield of Paddy				
	t/ha	t/ha	t/ha	
Present	: 2.87	3.33	3.38	
Future	: 3.88	4.29	4.33	
o. Production of Paddy				
	ton	ton	ton	ton
Present Paddy	: 22,400	61,500	21,800	105,700
Future Paddy	: 55,700	100,900	35,900	192,500
Increase	: 33,300	39,400	14,100	86,800
p. Construction Cost :			39,318 million Rp.	
Ha Cost :			647 us\$/ha	
Burden of Farmers :			5,504 million Rp.	
q. Construction Period:			7 years	
r. Project Cost :			79,648 million Rp.	
Ha Cost :			1,310 US\$/ha	
s. EIRR :			16.5 %	
t. B/C :			1.55	

### 6.3 Agricultural Development Plan

The Project will achieve farm extension, improvement of irrigation facilities, and, at the same time, modernization of farming. Regarding to the Government policies on supporting self-sufficiency of rice, improvement of irrigated paddy field is related to Extension and modernization of cropping methods is related to Intensification. So, the Project should be in line with those two central policies to support self-sufficiency of rice. In this section, agricultural development plan within the Project is described.

#### (1) Extension and Transformation of Farm Land

The area of irrigated paddy field in the Project area will increase after the Project implementation. It will be derived from extension works of paddy field and transformation of land use. Total area of irrigated paddy field is planned to increase from about 19,000 ha to 32,000 ha in the recommended 340 schemes. On the other hand, rainfed paddy area will extremely decrease and other dryland and plantation area will also decrease. Since the most schemes which are recommended to be implemented belong to village irrigation schemes, irrigated paddy field will increase mainly by means of transformation from rainfed paddy fields. The change of farm land areas is shown in Table 6-3-1.

Table 6-3-1 AREA OF FARM LAND OF THE RECOMMENDED PROJECT  
Unit:ha

	N.Sumatra		S.Sulawesi		W.Nusa Tenggara	
	LD	VI	LD	VI	LD	VI
Present						
Irrigated Paddy	1364	4345	193	8524	244	4116
Rainfed Paddy	301	2602	218	10209	70	2375
Dryland	382	682	350	5594	170	6423
Plantation	126	321	0	1899	0	1374
Future						
Irrigated Paddy	3608	7778	439	14190	344	5971
Rainfed Paddy	35	234	70	5103	0	911
Dryland	4	473	140	5176	140	6196
Plantation	7	326	140	1826	0	1359

Notes; LD = Land Development, VI = Village Irrigation.  
Those areas are calculated as 70 % of the inventory data.

Such land transforming pattern will not change cropping system and kind of crops in the area drastically. Therefore, main point of agricultural aspects is introduction of new irrigation farming of paddy.

## (2) Cropping Pattern

The Government of Indonesia promotes continuous growth of paddy production to support increasing domestic demand. In addition, verification of crops is promoted for the sake of improvement of nutrition consumption among the nation. To plant palawija crops after harvest of paddy is recommended in paddy field. Preferential crops for that are maize and soybean in general, and planted area of them is growing in the last several years.

In the Project area, multi cropping of paddy and after crops is also promoted. Upper limit of paddy planting times should be two times per year, because triple cropping of paddy will cause diseases and insect damage of paddy plant and decrease of soil fertility in paddy field. The kind of after crops should be basically selected from popular crops in the area in consideration of natural and social conditions. Legume crops such as soybean are suitable for combined crops with paddy because of their function of nitrogen fixation. Green pea, which requires small amount of moisture, is also suitable especially in dry area such as eastern part of West Nusa Tenggara. Maize is also recommendable for after crops of paddy in the scheme

area. (3) Introduction of New Variety

Presently, local varieties of paddy are dominant in the small scale paddy fields in the Project. Those local varieties is preferred among farmers due to good taste and high unit price. However, they generally have negative features of low productivity and long maturity period. The agricultural development of the Project plans to introduce high yielding varieties of paddy in line with intensification programs by the Government.

(4) Fertilizer and Agro-chemical

The new fertilizing methods should be extended into the Project area, high yielding varieties of paddy require larger application of fertilizer to achieve high yield. In addition, effective control of diseases and pest is necessary because of uniformity of a variety and low tolerance itself. In the present farming methods in the scheme areas, farmers apply small amount of Urea and little of other kinds of fertilizer and agro-chemicals. In the development plan, target amounts of them are set in consideration of the application level in Package D of Insus program. Labor input level is also expected to increase in the new farming methods. The standards of inputs and practices are as explained in prior Section 5.5.2.

(5) Agricultural Extension Service

Introduction of improved farming method needs effective agricultural extension services to explain to farmers. In that meaning, Field Extension Centers (BPPs) should enlighten farmers by spreading of poster and booklet or direct guidance to farmers. Moreover, training courses should be held for Field Extension Workers (PPLs) and key farmers.

The kabupaten and kecamatan officers in charge of agriculture should do field guidance and research at the scattered schemes in the region. But unfortunately agriculture offices of kabupatens have not enough transportation means such as motorcycles for frequent field visit. Therefore motorcycles are recommended to be installed to agriculture offices in kabupatens.

(6) Marketing

The agricultural development plan includes improvement marketing system for agricultural materials and farm products. Marketing channel of farm inputs is planned to remain Village Unit Cooperatives (KUDs). But it is necessary to improve its activity in order to supply increasing farm inputs to farmers. In addition, transportation means are preferred to be improved.

Some KUDs have established post-harvest facilities such as dry and milling facilities for organized and effective works. Further, marketing system of agricultural products is improved in the rural area.



## 6.4 Operation and Maintenance Plan

### 6.4.1 Basic Plan in O&M at Farm Level

The proposed goal of O&M at farm level is that beneficiary farmers in the proposed schemes will be able to operate and maintain their irrigation and drainage systems technically as well as financially by themselves in line with the Government's laws/regulations and Presidential Instructions related to O&M.

In order to achieve the above goal, following basic approach has been formulated to improve present O&M conditions, however, generally O&M situations depend upon site specific conditions on which an irrigation scheme is located.

- i) Promotion/encouragement of authorized P3A organization,
- ii) Giving solid financial background to P3A organization to be promoted through introduction of reasonable water charge,
- iii) Extension of written O&M regulations to P3A organization,
- iv) Extension of improved operation/water management including irrigation schedule, rotational irrigation and record keeping,
- v) Extension of improved maintenance including structure repair works and record keeping,
- vi) Improvement of rural extension system for O&M and training of rural extension workers(PPL).

On the basis of the above basic approach, respective improvement/strengthening plans have been formulated and are explained below :

### 6.4.2 Improvement of O&M Organization

#### (1) Farmer's O&M Organization

Present conditions of existing farmer's O&M groups are quite various location by location. Accordingly, it is proposed to improve the groups step by step. In the final O&M organization:

P3A, it is recommended to have an organization structure given in Fig. 4-7-1. The proposed step-by-step development to the authorized O&M group:P3A is as follows :

Development of Farmer's O&M Group

Step No	Present Group	Next Step
Step-1	No-group	General Working Group or Traditional O&M Group
Step-2	General Working Group	Traditional O&M Group or Authorized O&M G:P3A
Step-3	Traditional O&M Group	Authorized O&M G:P3A

Authorized P3A and not-authorized traditional O&M groups have been developed in both North Sumatra and West Nusa Tenggara Province. Accordingly, it is recommended that the above Step-2 or Step-3 be taken in order to increase number of P3A in these two provinces. In South Sulawesi Province P3A development has been delayed though farmer's general working groups have been widely organized. Therefore, it is recommended that the above Step-2 be initiated as a first step in the province in order to increase O&M groups. If there is not any farmer's group at present, it is recommended to start from the above Step-1.

In addition to the above organization development, it is necessary to enforce O&M activities of the group members/farmers, for most of the existing groups operate and maintain their systems without written O&M rules/regulations at present. It is proposed to introduce certain written O&M regulations at a minimum level to farmer's O&M groups as an initial step in order to establish firm groups.

(2) Government's Supporting Organization

It is essential to extend improved O&M to the farmers through rural extension workers(PPL) in collaboration with Provincial Irrigation Services at Kabupaten level(PUD) as well as Bupati's offices, and it is also required for Provincial Agricultural Services(PRAS) to train PPLs. General organization and coordination is shown in Fig.6-4-1.

Phase II field investigation results revealed that most of representative schemes(73 %) have a channel to rural extension services though PPL. On the other hand, less schemes(13 %) have a channel to PRIS at present, since most of village irrigation schemes are managed by beneficiary farmers under village administrations at present. Furthermore, small Government control irrigation systems which irrigation area is less than 500 ha will be turned over to beneficiary farmers in accordance with recent Government's strategy in O&M. Present major PPL's activities are technical extension of farming practices, fertilizer application, crop protection, cropping systems and so on. Generally O&M techniques including water management are extended in the part of the "cropping systems" or "water management" as an independent item by PPLs.(See Fig. 6-4-2)

Taken the above present situations into consideration, it is proposed that O&M after construction of systems will be improved mainly by PPLs in collaboration with PUD and Bupati & Camat office. Accordingly, it is essential to strengthen present rural extension system of PRAS for O&M improvement and, it is proposed to train PPLs in the proposed schemes and provide necessary equipment for them.

### (3) Proposed O&M Equipment

O&M of the facilities are to be made basically by beneficiary farmer's O&M groups. Government's direct involvement in the long term will be minimized for O&M, but PRAS's extension services for O&M improvement are indispensable at present until the groups reach a certain level in O&M. Required O&M equipment for this purpose is listed in Table 6-4-1 and its total cost is estimated at 2,017 million Rp as given below :

#### Cost for O&M Equipment

Province	Cost
	(Million Rp)
1. North Sumatra	672.24
2. South Sulawesi	732.51
3. West Nusa Tenggara	612.15
Total	2,016.90

### 6.4.3 Improvement of O&M of the System

#### (1) Proposed Operation/Water Management

Preparation of irrigation schedule, rotational irrigation, gate control during floods and record keeping are not made widely in the proposed schemes at present. Following minimum system operation with supports of PPL should be made by farmer's O&M groups in the schemes as a first step :

- i) Seasonal irrigation schedules with irrigation blocks should be prepared through discussions in regular general meetings, and the schedule must be informed to every group members.
- ii) When irrigation water runs short, it is proposed to apply rotational irrigation. Rotation order and irrigation time of respective blocks should be decided through discussions in irregular meetings.
- iii) When it rains heavily, it is proposed to minimize damages of the systems by gate control of an intake weir and so on.
- iv) The above operation/water management activities should be recorded in order to improve these activities.

#### (2) Proposed Maintenance

Periodic minimum maintenance works such as tree/grass cutting or canal re-shaping/desilting are made in most of the schemes, however, periodic structure repairs with purchased materials and timely emergency repairs are hardly done at present. Following minimum system maintenance with supports of PPL should be made by farmer's O&M groups in the schemes as a first step :

- i) Periodic system maintenance schedules should be prepared through discussions in regular general meetings, and the schedule must be informed to every group members.
- ii) When special maintenance works such as concrete works and gate replacement are required, it is proposed to open a general meeting to discuss and decide required material, its procurement/repair method, its budgetary

preparation and repair schedule.

- iii) When emergency repair is required in case of floods and so on, it is proposed that the group leader or irrigator conduct the repair and the repair be completed within a right period by available group members in order to minimize the system damages.
- iv) The above maintenance activities should be recorded in order to improve these activities.

#### 6.4.4 Farmer's Contribution to O&M

About 60 % of the investigated schemes have not started to collect any type of water charge yet. Accordingly, it is difficult for those schemes to operate and maintain their irrigation systems properly without any financial sources.

On the other hand, the remaining 40 % of the schemes collect water charge as a form of organization fee and the charged rate is 17,600 Rp/ha/year on average. Many damaged systems, however, have been observed in the course of the field investigations. Accordingly, it is proposed to add another 12,400 Rp to present transportation and material cost provisionally. Furthermore, it is recommended that the proposed water charge of 30,000 Rp in total will be initiated as a trial and an adjustment for the charge will be made later.

In addition to the above water charge, farmers generally spend 7.6 working days in a year on average for system maintenance, especially for grass/tree cutting and re-shaping/desilting of canals. Structure maintenance is seldom made in most cases at present. Accordingly, it is proposed to add another 2.4 days for structure repair provisionally. Furthermore, it is recommended that the proposed 10 working days will be initiated as a trial and an adjustment will be made later.

Table 6-4-1 LIST PROPOSED O&amp;M EQUIPMENT

Unit : 1,000 Rp.

No	Item of Equipment	Required Number	Unit Price	Total Price	Remarks
I NORTH SUMATRA PROVINCE[9 Kabupaten]					
1	4WD Vehicle	4	60,000	240,000	
2	Truck (Load 1.5-2.0 ton)	3	35,000	105,000	
3	Vehicle (Kijang Class)	6	30,000	180,000	
4	Motor Cycle (100-125cc Class)	22	4,000	88,000	2*
5	Type Writer	11	725	7,975	1*
6	Calculator	28	150	4,200	2*
7	Filing Cabinet	11	400	4,400	1*
8	Computer Set	1	8,000	8,000	
9	Measuring Tape (L:50 m)	13	80	1,040	1*
10	Measuring Tape (L:100 m)	13	150	1,950	1*
11	Convex Tape (L:3-5m)	13	75	975	1*
12	Theodolite Set	2	6,000	12,000	
13	Auto Level Set	2	2,500	5,000	
14	Current Meter	2	4,900	9,800	
15	Camera	13	300	3,900	1*
				(Sub-total 672,240)	
II SOUTH SELAWESI PROVINCE[18 Kabupaten]					
1	4WD Vehicle	4	60,000	240,000	
2	Truck (Load 1.5-2.0 ton)	3	35,000	105,000	
3	Vehicle (Kijang Class)	5	30,000	150,000	
4	Motor Cycle (100-125cc Class)	40	4,000	160,000	2*
5	Type Writer	20	725	14,500	1*
6	Calculator	46	150	6,900	2*
7	Filing Cabinet	20	400	8,000	1*
8	Computer Set	1	8,000	8,000	
9	Measuring Tape (L:50 m)	22	80	1,760	1*
10	Measuring Tape (L:100 m)	22	150	3,300	1*
11	Convex Tape (L:3-5m)	22	75	1,650	1*
12	Theodolite Set	2	6,000	12,000	
13	Auto Level Set	2	2,500	5,000	
14	Current Meter	2	4,900	9,800	
15	Camera	22	300	6,600	1*
				(Sub-total 732,510)	
III WEST NUSA TENGGARA PROVINCE[6 Kabupaten]					
1	4WD Vehicle	4	60,000	240,000	
2	Truck (Load 1.5-2.0 ton)	3	35,000	105,000	
3	Vehicle (Kijang Class)	5	30,000	150,000	
4	Motor Cycle (100-125cc Class)	16	4,000	64,000	2*
5	Type Writer	8	725	5,800	1*
6	Calculator	22	150	3,300	2*
7	Filing Cabinet	8	400	3,200	1*
8	Computer Set	1	8,000	8,000	
9	Measuring Tape (L:50 m)	10	80	800	1*
10	Measuring Tape (L:100 m)	10	150	1,500	1*
11	Convex Tape (L:3-5m)	10	75	750	1*
12	Theodolite Set	2	6,000	12,000	
13	Auto Level Set	2	2,500	5,000	
14	Current Meter	2	4,900	9,800	
15	Camera	10	300	3,000	1*
				(Sub-total 612,150)	
TOTAL COST:				2,016,900	

Note; \*:Numbers of Equipment in Each Kabupaten

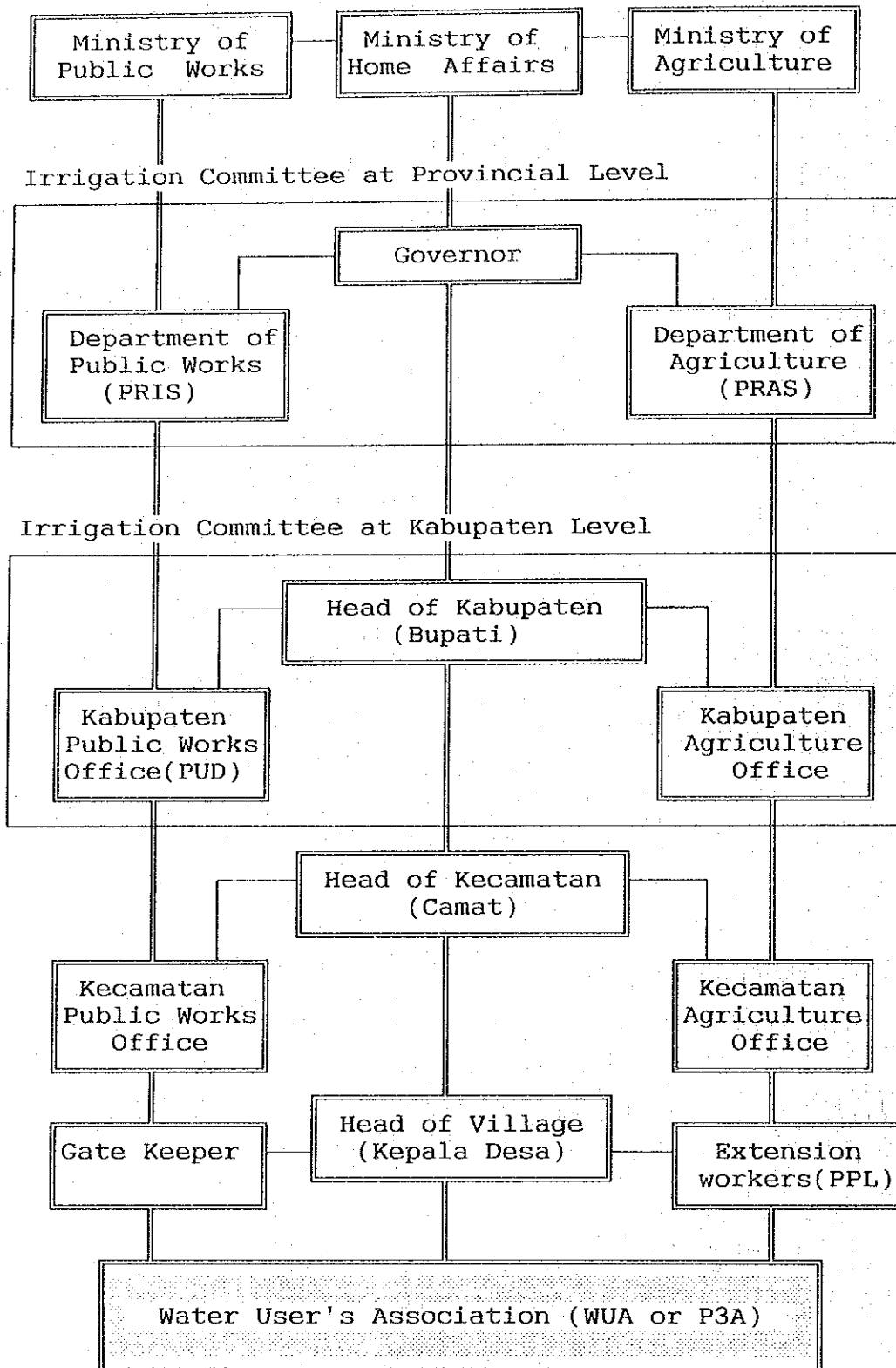


Fig. 6-4-1 O&M ORGANIZATION FOR IRRIGATION DEVELOPMENT PROJECTS

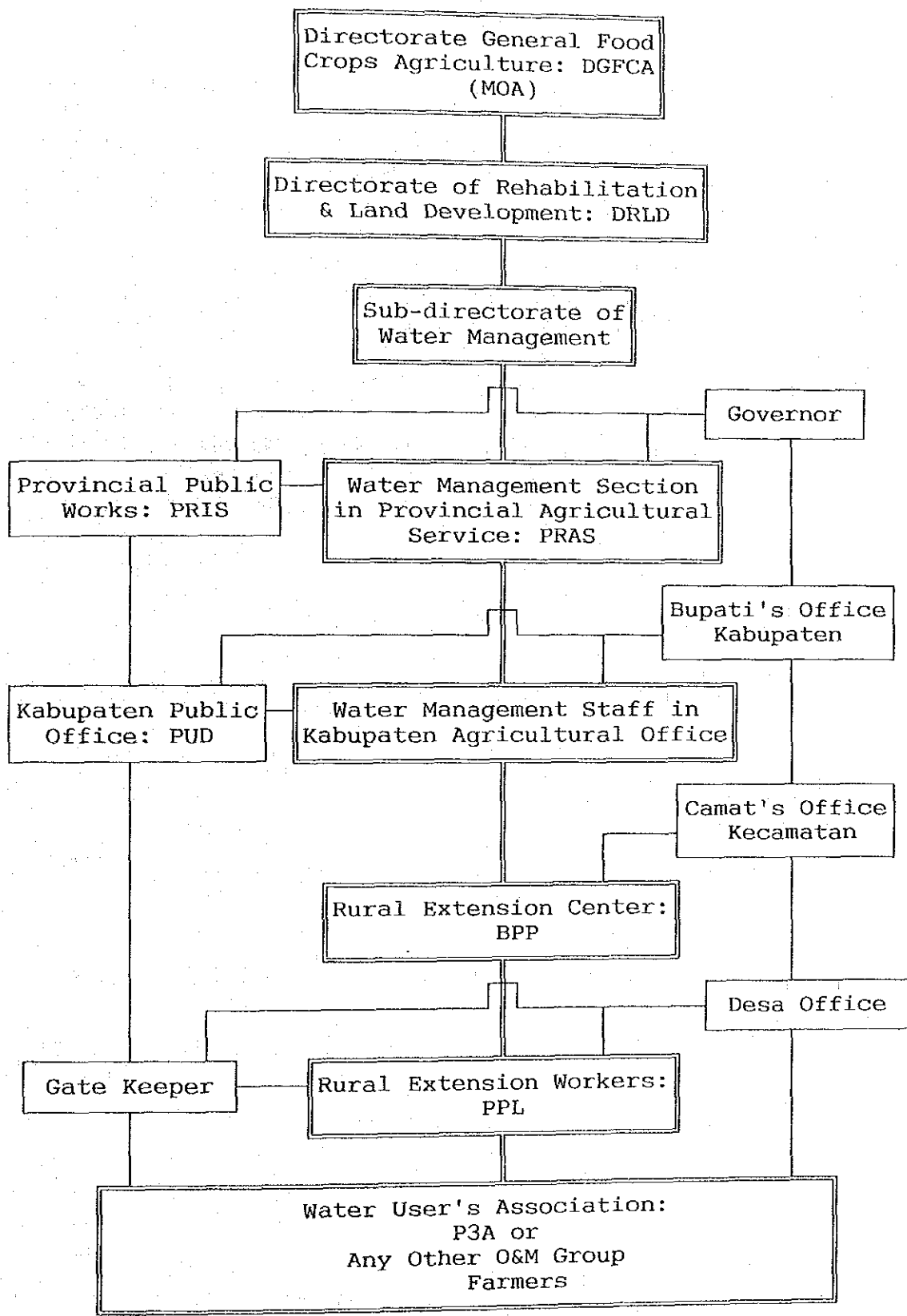


Fig. 6-4-2 PROPOSED ORGANIZATION FOR O&M IMPROVEMENT (At Farm Level)



## 6.5 Training Plan

### (1) Background

It may be surmised that most of the districts in the objective schemes do not hold enough staff or technique required for implementation of the Project according to the result of the field survey. To realize the Project, it is necessary to hold staff required of agricultural service office of district, and to level up technical management on irrigation and drainage facilities, agricultural technique and facility management, and management ability for member of water management association, agricultural extension workers, and farmers. The Project is to rehabilitate the irrigation and drainage facilities in villages, and close and mutual understanding between the government and villages are required in order to carry out the Project. For this purpose, training of facilitator who arrange the view of the both parties should be made.

### (2) Training Items and Related Offices

Training Item	Province	District	Sub-District	Village
O&M	0	0	0	0
Facilitator			0	0
Farming technology				0
Facility plan	0	0		

### (3) Number of Trainee Required

		person
a. Participant of Provincial Agricultural Service	3 prov. x 2 person =	6
b. District Agricultural Service	32 district	64
c. Sub-District Office	340 scheme	340
d. Village Level	340 scheme	
-WUA		340
-PPL/Facilitator		340
-Key Farmer		340
	Total	1,430

(4) Operation of Training

- a. Lecture itself will be carried out at each municipality and present training facility of provincial agricultural office are utilized as much as possible. However training special equipments and furniture is prepared by the Project.
- b. Trainee is selected among related personnel to the provincial agriculture services. Education level of trainee is primary school, middle or high school graduated, and key farmers.
- c. Instructor is scheduled from senior staff of Ministry of Agriculture, University and Consulting firms.
- d. Major training equipments are transportation equipments, overhead projector, slide projector, microphone speaker and etc.
- e. As to the training period, around one week per person is scheduled. Acceptance of trainee corresponds to the time of construction of each scheme. Whole training period is four(4) years.
- f. As a series of training for farmers, demonstration farming is also proposed.

## 6.6 Consulting Services

Consulting services will be required in carrying out the Project with regard to:

- 1) assisting and advising: (i) DGFCAs with procurement, planning, detailed design, construction supervision, on-farm water management and extension and training program; and (ii) DGWRDs with procurement, planning, detailed design and construction supervision,
- 2) preparation of Agro-institutional Profiles (AIPs) for DGFCAs, and
- 3) assisting: (i) DGFCAs with Project coordination and monitoring; and (ii) BAPPEDAs with strengthening coordination and monitoring at provincial and district levels.
- 4) assisting Contracts for: survey, mapping, geo-technical investigation and others.
- 5) other studies: environmental study, monitoring of constructed schemes, special study on Phase II schemes and preparation of Phase II implementation.

The consultants will be engaged by the Executing Agencies for their respective components. The consulting firms to work for the aforementioned services will be selected and engaged under international competitive selection procedures in accordance with the guidelines of the lending agency. The international consulting firms will be encouraged to associate with local consulting firms. Local consulting firms to provide the aforementioned services at province level will be selected from qualified firms in accordance with the Government standard competitive procedures acceptable to the lending agency.

## VII. IMPLEMENTATION PROGRAM (Draft)

### 7.1 Basic Concepts of the Project Implementation

#### 7.1.1 Objective of the Project

The project aims at accelerating agricultural development at farm level in Indonesia.

Details of the objective are as follows:

- (1) To fully develop and rehabilitate on-farm facilities which are left behind in the existing irrigation schemes and village irrigation areas;
- (2) To achieve the potential benefits from irrigated agriculture development contributing to the sustainability of self-sufficiency of food crops,
- (3) To create new employment opportunities, and
- (4) To contribute to alleviation of poverty for the rural population in the project area.

The project is considered to support "to strengthen stable self-sufficient of food crops, provide opportunity of employment in local areas and achieve balanced regional development" as the development strategy of the current agricultural sector in the Government of Indonesia.

#### 7.1.2 Scope of the Project

Scope of the project includes:

- (1) To fully develop the existing irrigation, drainage and other infrastructure facilities at farm level to complete the land development work in existing irrigation schemes.
- (2) To thoroughly develop potential irrigation areas by upgrading and expanding existing irrigation, drainage and other infrastructure facilities in village irrigation areas.
- (3) To strengthen the institutional capabilities of relevant agencies for management and coordination of the development. The agencies include those at provincial, district and sub-district levels, Water

User's Association (P3A) and Rural Extension Centers(BPP).

### 7.1.3 Components of the Project

The project consists of four (4) major components including the land development, the village irrigation development, institutional strengthening and strength of coordination and monitoring. The contents of these items are as follows. The former two items relate to the development of physical infrastructure and the latter two items to the management and control of the project.

#### (1) Land Development

This component of the Project intends to complete the land development work left undone in existing irrigation schemes managed by DGWRD. Rehabilitation and improvement of existing facilities in tertiary systems related to these land development works are also included. For smooth implementation of the land development, surveying, mapping, planning and detailed designs should be carried out in prior to commencement of the Project work.

#### (2) Village Irrigation Development

This component intends to promote the expansion of stably irrigated agricultural land. Existing facilities in the village irrigation schemes are to be rehabilitated and/or upgraded. The scope of the work includes surveying, mapping, planning and detailed design followed by implementation of civil works for land development and facility rehabilitation/upgrading.

#### (3) Institutional Strengthening

Details of Strength of the organization include:

- 1) To increase number of staff of the Field Extension Center and another organizations relating to the works area, when required,
- 2) To train the agricultural support service staff at province, district or county level to control the work effectively,
- 3) To train main farmers in province or district, or of the field extension workers or the works areas for farm technique including water control, improvement of

- rice growing, farming or fruit growing,
- 4) To supply facilities or materials necessary for the training,
- 5) To establish and strengthen the water control organization and support to organize the farmer's group, and
- 6) To train water keeper for maintenance and control of the tertiary system and the terminal irrigation and drainage facilities.

#### (4) Strength of Coordination and Monitoring to Implement Work

BAPPEDA I and BAPPEDA II are suggested as the organizations to coordinate and monitor to implement the work at province and district level. This item supports coordination and monitoring activities by securing the space for a conference or preparing the equipments or vehicles.

#### 7.1.4 Aims of Work Scale

##### (1) Land Development Areas

Though the Ministry of Agriculture aims at the development of farm land (paddy field) of approximately 375,000 ha during the period of REPELITA V, the areas considered to be scheduled to develop at that time are changed to another cash crops or include the lands which seem to have difficulty in developing for the lack of water. The results of the land development work such as cutting and reclamation and land leveling construction shows that though approximately 175,600 ha of areas have been developed by January 1992, approximately 200,000 ha been undeveloped. This means that the farm land proposed for development should tend to be decreased. In this investigation, the potential farm lands to reclaim are three (3) provinces (North Sumatra, South Sulawesi and West Nusa Tenggara) including the village irrigation areas, approximately 240 among 795 areas, approximately 10,000 ha. This is the largest developable area among the proposed investigation.

Meanwhile, the number of farm land to reclaim selected from the existing irrigation work areas of the Directorate of Public Work is approximately 62 areas, only 3,500 ha. Therefore, all the areas corresponding to selective criteria could be the project works. However the above 62 areas will decrease to around 30 schemes, about 2,300 ha due to the results of another current provincial investigation.

(2) Village Irrigation Areas

Project Scale of Rehabilitation and Improvement for Village Irrigation is approximately estimated as follows;

- a. The long term plan aims at twenty-seven (27) provinces as the objective areas. In accordance with the area data from the Directorate General of Water Resource Development, the area by development stage is classified into the followings.

Three (3) objective provinces: 204,000 ha  
(first development)

Five (5) provinces surveyed : 138,000 ha (secondary  
by Indonesian side development)

Another nineteen (19) : 694,000 ha (the later  
provinces development area)

Total Twenty-seven (27) : 1,036,000 ha  
provinces

- b. The project area of village irrigation areas in three provinces (North Sumatra, South Sulawesi and NTB), in accordance with reference data on the village irrigation schemes of each Provincial Agricultural Offices, are as follows.

Province	No. of Schemes	Potential Paddy Field Area	Present Irrigation Area
	nos.	ha	ha
North Sumatra	845	122,000	57,200 *
South Sulawesi	962	149,000	67,300
N T B	328	35,000	29,800
Total	2,135	306,000	154,300

Note) \* : Estimated value from the inventory data.

- c. Considering the guideline to implement the inventory survey, among the above 2,135 schemes, followings are the areas to survey.

Province	Village Irrigation Schemes to Implement Inventory Survey	Potential Paddy Field Area	Present Irrigation Area
	nos	ha	ha
North Sumatra	308	46,800	27,600
South Sulawesi	374	45,800	30,200
N T B	189	20,700	16,700
<b>Total</b>	<b>871</b>	<b>113,300</b>	<b>74,500</b>

- d. As the results of the examination of the inventory survey data for the above 871 schemes, 733 are adopted as the objective schemes for village irrigation.

Province	No. of Areas Schemes	Area of Schemes	Potential Paddy Field Area	Present Paddy Field Area
	nos.	ha	ha	ha
North Sumatra	247	25,700	21,400	12,700
South Sulawesi	349	75,400	29,000	19,600
N T B	137	37,400	11,200	8,600
<b>Total</b>	<b>733</b>	<b>138,500</b>	<b>61,600</b>	<b>40,900</b>
<b>Average</b>		<b>189</b>	<b>84</b>	<b>56</b>

Note 1 : Each area indicates evaluated value (70 % ).

Note 2 : Area includes rain-fed, farmland, orchard, grass land, forest, or flood plain and excludes unknown value.

- e. Objectives of Work Scale (Village Irrigation Areas)

The Central Government, by analyzing the Table 2-3-8, have invested in 125 village irrigation areas of 19 provinces, for the period of three years from 1989/90 - 1991/92.

The result shows that the Government has invested in 2.2 places per one province in a year. It could be said to be 2.2 places per one district per year. To manage the work smoothly, the relationship between the central - province - district - subdistrict - village are essential must be coordinated. It is difficult to construct entire target area at once. As the first step, based on five year preparation and construction



period, yearly two (2) schemes per district are adopted as the scheduled construction volume. However, the number of staff must be increased at the central and provincial level.

#### Objectives of Work Scale

Province District	Objective Inventory Scheme			Target of the Project		Remaining	
	Scheme nos	Poten- tial Area nos	ha	Scheme nos	Poten- tial Area ha	Scheme nos	Poten- tial Area ha
North Sumatra	9	247	21,400	90	7,800	157	13,600
South Sulawesi	16	349	29,200	160	14,200	189	15,000
NTB	6	137	11,200	60	6,000	77	5,200
<b>Total</b>	<b>31</b>	<b>733</b>	<b>61,600</b>	<b>310</b>	<b>28,100</b>	<b>423</b>	<b>33,500</b>

Note 1 : Potential area is estimated by using the average area.

North Sumatra : 86.6 ha/scheme,

South Sulawesi : 83.1 ha/scheme,

N T B : 90.5 ha/scheme

Note 2 : Examining from economical and technical viewpoints, the above remaining area becomes to be the value of the future plan.

## 7.2 Implementation Schedule

### (1) Sequence of Implementation Scheme

The commencement time of implementation of three provinces is scheduled at the same period. In principle the implementation of each scheme will be carried out according to the order of higher score of evaluation points. However the order should be considered as district level. Because from the provincial level, the higher score schemes are apt to concentrate to the same district. At present construction sequence of 340 schemes has no order, then annual construction plan is scheduled using average size of scheme area and average number of schemes. the order of construction would be desired to decide in the coordination committee before the implementation of each scheme.

### (2) Work Quantity and Construction Period

#### a. Work Quantity

The work quantity of the Project is planned as follows;

##### 1. Land Development Project

Number of Schemes	:	30 nos.
Paddy field reclamation	:	2,334 ha
Tertiary System & Land consolidation	:	2,334 ha

##### 2. Village Irrigation Project

Number of Schemes	:	310 nos.
Planning paddy area	:	28,100 ha
Upgrading of Irrigation/ drainage facilities	:	310 schemes

#### b. Construction Period

Preparatory period	:	1 year
Construction Period	:	4 year
Monitoring & evaluation period	:	2 year
Total	:	7 year

#### c. Handling Agency

Main Agency	:	Directorate of Food Crops Agriculture, Ministry of Agriculture
Sub Agency	:	Directorate of Irrigation-I, Directorate General of Water Resources Development, Ministry of Public Works

(3) Annual Construction Plan

Annual construction plan by each year is shown in the following tables. As to the LD schemes, the construction period is estimated to be 1 to 4 years in accordance with the number of schemes in each province. On the other hand, the construction period of village irrigation schemes needs 4 years for rehabilitation and improvements works.

1) LD Schemes

a. Number of Schemes

Unit : nos

Province/Year	2nd	3rd	4th	5th	Total
North Sumatra	5	6	6	6	23
South Sulawesi	2	2	1		5
NTB	2				2
Total	9	8	7	6	30

Note; Preparatory work is scheduled in 1st year.

b. Planning Area for Land development

Unit : ha

Province/Year	2nd	3rd	4th	5th	Total
North Sumatra	680	315	487	446	1,928
South Sulawesi	51	70	140		261
NTB	145				145
Total	876	385	627	446	2,334
Accumulated Paddy field	-	876	1,261	1,888	2,334

2) VI Schemes

a. Number of Schemes

Unit : nos

Province/Year	2nd	3rd	4th	5th	Total
North Sumatra	22	23	22	23	90
South Sulawesi	40	40	40	40	160
NTB	15	15	15	15	60
<b>Total</b>	<b>77</b>	<b>78</b>	<b>77</b>	<b>78</b>	<b>310</b>

b. Planning Area for Village irrigation schemes  
(Gross Paddy Area)

Unit : ha

Province/Year	2nd	3rd	4th	5th	Total
North Sumatra	1,900	1,900	1,990	1,995	7,785
South Sulawesi	3,560	3,570	3,560	3,573	14,263
NTB	1,500	1,500	1,500	1,511	6,011
<b>Total</b>	<b>6,960</b>	<b>6,970</b>	<b>7,050</b>	<b>7,079</b>	<b>28,059</b>

Note; Area of each year are assumed to be average amount.  
The figure of above area is including expansion of land development in village irrigation schemes.

c. Present Area for village irrigation schemes  
(Gross Paddy Area)

Unit : ha

Province/Year	2nd	3rd	4th	5th	Total
North Sumatra	1,080	1,080	1,090	1,095	4,345
South Sulawesi	2,130	2,130	2,130	2,134	8,524
NTB	1,030	1,030	1,030	1,026	4,116
<b>Total</b>	<b>4,240</b>	<b>4,240</b>	<b>4,250</b>	<b>4,255</b>	<b>16,985</b>

Note; Area of each year are assumed to be average amount.

d. Expansion of paddy area for village irrigation  
(Gross Paddy Area)

Unit : ha

Province/Year	2nd	3rd	4th	5th	Total
North Sumatra	260	270	270	265	1,065
South Sulawesi	140	140	140	141	561
NTB	100	140	140	140	400
Total	500	550	550	546	2,026

3) Total Schemes (LD+VI)

a. Number of Schemes

Unit : nos

Province/Year	2nd	3rd	4th	5th	Total
North Sumatra	27	29	28	29	113
South Sulawesi	42	42	41	40	165
NTB	17	15	15	15	62
Total	86	86	84	84	340

b. Total area of Future Irrigation Paddy  
(Gross Paddy Area)

Unit : ha

Province/Year	2nd	3rd	4th	5th	Total
	ha	ha	ha	ha	ha
North Sumatra	2,580	2,215	2,477	2,441	9,713
South Sulawesi	3,611	3,640	3,700	3,573	14,524
NTB	1,645	1,500	1,500	1,511	6,156
Total	7,836	7,355	7,677	7,525	30,393

Fig. 7-2-1 IMPLEMENTATION SCHEDULE FOR THE PROJECT

I T E M	(QUANTITY)	1992	1993	1994	1995	1996	1997	1998	1999	2000
Loan Period										
I. Preparation										
1.1 Preparation of I/P		—								
1.2 Appraisal		—								
1.3 Loan Agreement			△							
1.4 Selection of Consultants			—							
1.5 Project Coordination			—							
II. Project Works										
2.1 Preparatory Works										
(1) Office arrangements	Central & Provinces									
(2) Survey and Investigation	30,400 ha									
2.2 Civil Works (North Sumatra, South Sulawesi, NTB Province)										
(1) Land Development	2,300 ha									
a. Assembling of farmer's groups	30 Groups									
b. Detailed design	30 Schemes									
c. Rehabilitation & Extension of facilities	2,300 ha									
d. Land clearing / levelling	2,300 ha									
e. Formatting, etc.	2,300 ha									
(2) Village Irrigation Development	28,100 ha									
a. Assembling of farmer groups	310 Groups									
b. Detailed design	310 Schemes									
c. Rehabilitation & Extension of on-farm facilities	28,100 ha									
d. Land clearing / levelling	2,000 ha									
e. Formatting, etc.	2,000 ha									
2.3 Training	3 L.S									
2.4 Post Evaluation	340 Schemes									

### 7.3 Project Cost Estimate

#### (1) Conditions

Project cost required for the development plan for the 340 schemes is estimated under the following conditions.

1) Exchange rate used in the estimate is;

Yen 1.0 = Rp.15.5 (March 1992)

US\$ 1.0 = Rp.2,000 (March 1992)

= Yen 129

2) Civil engineering works are to be carried out on the contract basis using contractor's own heavy construction machinery and equipment taking farmers' participation into construction.

3) The local currency portion in construction cost is calculated by the actual cost/prices in North Sumatra Province, South Sulawesi Province and West Nusa Tenggara Province in September 1989 which are collected from on-going projects in the three provinces.

4) The physical contingency which is included in total cost is given around 5 % of the direct costs. And the price contingency in total cost for the foreign currency portion is calculated 0 % per annum and for the local currency portion 8 % per annum.

## (2) Project Cost

The project cost is estimated at 40 million US\$, which comprise 16 million US\$ equivalent of foreign currency and 23 million US\$ equivalent of local currency. Summary of the project cost is shown bellows;

### SUMMARY OF PROJECT COST

Unit;Million Rp.

Division	F/C	Total	
		L/C	Total
1. Preparatory Works	1,550	1,033	2,583
2. Civil Works	19,659	19,659	39,318
3. Training and Demonstration	145	827	972
4. Institutional Strengthening	298	128	426
5. O & M Equipment	1,833	203	2,036
6. Land Acquisition	0	426	426
7. Administration	0	1,966	1,966
8. Consulting Services	7,819	1,956	9,775
Sub Total (1-8)	31,304	26,198	57,502
9. Physical Contingency	1,565	1,310	2,875
Total	32,869	27,508	60,377
10. Value Added Tax		5,799	5,799
11. Price Escalation		13,472	13,472
<b>GRAND TOTAL</b>	<b>32,869</b>	<b>46,779</b>	<b>79,648</b>
Million US\$	16	23	40

Remarks ; 1 US\$ = Rp. 2,000 = YEN 129.0  
Price Index (Year 1992 = 100)

Note ; Farmers' participation cost is estimated about 14 % of civil works cost.

## (3) Annual Disbursement Schedule

The annual disbursement schedule is worked out based on the implementation schedule. The annual disbursement schedule is shown in Table 7-3-1.



Table 7-3-1 ANNUAL DISBURSEMENT SCHEDULE OF FINANCIAL COST

AD-T

[Unit: Million Rp.]

Item	Total cost		1993		1994		1995		1996		1997		1998		1999		2000	
	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C
1. Preparatory Works	1,550	1,033	2,583		620	413	238	159	238	159	233	155	78	52	72	48	72	48
2. Civil Works	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1 Land Development	3,806	3,007	6,013		0	0	1,202	1,203	451	451	752	752	601	601	0	0	0	0
2.2 Intake & Canal Structure	16,653	16,652	33,305		0	0	4,426	4,426	3,888	3,888	4,163	4,163	4,076	4,076	0	0	0	0
3. Training & Demonstration	145	827	972		9	51	29	165	36	204	36	204	29	165	7	38	0	0
4. Institutional Strengthening	298	128	426		62	27	61	26	61	26	58	25	31	13	14	6	14	6
5. O & M Equipment	1,833	203	2,036		0	0	395	44	360	40	374	41	367	41	338	38	0	0
6. Land Acquisition	0	426	426		0	111	0	103	0	107	0	105	0	0	0	0	0	0
7. Administration	0	1,966	1,966		0	393	0	410	0	410	0	295	0	295	0	81	0	81
8. Consulting services	7,819	1,956	9,775		1,624	406	1,564	391	1,564	391	1,564	391	782	196	361	90	361	90
Sub Total (1-8)	31,304	26,198	57,502		2,315	1,402	7,915	6,827	6,697	5,776	7,179	6,131	5,953	5,438	791	301	446	225
9. Physical Contingency	1,565	1,310	2,875		116	70	396	346	335	289	359	307	298	272	40	15	22	11
Total	32,869	27,508	60,377		2,430	1,472	8,311	7,273	7,032	6,064	7,538	6,437	6,261	5,710	831	316	469	236
10. Valu Added Tax		5,799	5,799		0	340	0	1,507	0	1,258	0	1,358	0	1,168	0	107	0	62
11. Price Escalation	0	13,472	13,472		0	301	0	2,280	0	2,640	0	3,658	0	4,036	0	301	0	254
Grand Total	32,869	46,779	79,648		2,430	2,113	8,311	11,061	7,032	9,962	7,538	11,453	6,261	10,914	831	724	469	553

Price index ( 1992 =100)

Remarks: 1US\$=Rp2,000=¥129.0

Table 7-3-2 ANNUAL DISBURSEMENT SCHEDULE FOR LD SCHEMES

AD-LD

[Unit: Million Rp.]

Item	Total cost		1993		1994		1995		1996		1997		1998		1999		2000	
	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C
1. Preparatory Works	115	79	198		48	32	24	16	24	16	18	12	6	4	0	0	0	0
2. Civil Works					0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1 Land Development	1,589	1,690	3,379		0	0	676	676	253	254	422	423	338	338	0	0	0	0
2.2 Intake & Canal Structure	1,751	1,750	3,501		0	0	700	700	263	263	438	438	350	350	0	0	0	0
3. Training & Demonstration	11	64	75		2	13	2	13	2	13	2	13	2	13	0	0	0	0
4. Institutional Strengthening	23	10	33		7	3	6	3	6	3	3	2	3	2	0	0	0	0
5. O & M Equipment	141	15	156		0	0	56	6	21	2	35	4	28	3	0	0	0	0
6. Land Acquisition	33	33	33		0	13	0	5	0	8	0	7	0	0	0	0	0	0
7. Administration	344	344	344		0	69	0	86	0	86	0	52	0	52	0	0	0	0
8. Consulting services	600	151	751		180	45	120	30	120	30	120	30	60	15	0	0	0	0
Sub Total (1-8)	4,334	4,136	8,470		237	175	1,584	1,534	689	674	1,039	978	788	776	0	0	0	0
9. Physical Contingency	216	207	423		12	9	79	77	34	34	52	49	39	39	0	0	0	0
Total	4,550	4,343	8,893		249	183	1,663	1,611	723	707	1,091	1,027	827	815	0	0	0	0
10. Valu Added Tax		852	852		0	35	0	318	0	134	0	206	0	159	0	0	0	0
11. Price Escalation	0	1,991	1,991		0	36	0	501	0	303	0	579	0	571	0	0	0	0
Grand Total	4,550	7,186	11,736		249	255	1,663	2,430	723	1,144	1,091	1,812	827	1,545	0	0	0	0

Price index(1992 =100)

Remarks: 1US\$=Rp2,000=¥129.0

1.000 1.080 1.000 1.166 1.000 1.260 1.000 1.360 1.000 1.469 1.000 1.587 1.000 1.714 1.000 1.851

Table 7-3-3 ANNUAL DISBURSEMENT SCHEDULE FOR VI SCHEMES

Item	Total cost		1993		1994		1995		1996		1997		1998		1999		2000	
	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C
1. Preparatory Works	1,431	954	572	382	215	143	215	143	215	143	215	143	72	48	72	48	72	48
2. Civil Works																		
2.1 Land Development	1,317	1,317	0	0	527	527	198	198	329	329	329	329	263	263	0	0	0	0
2.2 Intake & Canal Structure	14,902	14,902	0	0	3,726	3,726	3,726	3,726	3,726	3,726	3,726	3,726	3,726	3,726	0	0	0	0
3. Training & Demonstration	134	763	7	38	27	153	34	191	34	191	34	191	27	153	7	38	0	0
4. Institutional Strengthening	275	118	55	24	55	24	55	24	55	24	55	24	28	12	14	6	14	6
5. O & M Equipment	1,692	188	0	0	338	38	338	38	338	38	338	38	338	38	338	38	0	0
6. Land Acquisition	393	393	0	98	0	98	0	98	0	98	0	98	0	0	0	0	0	0
7. Administration	1,622	1,622	0	324	0	324	0	324	0	324	0	243	0	243	0	81	0	81
8. Consulting services	7,219	1,805	1,444	361	1,444	361	1,444	361	1,444	361	1,444	361	722	181	361	90	361	90
Sub Total(1-8)	26,970	22,062	2,078	1,227	6,331	5,393	6,008	5,102	6,140	5,152	5,175	4,662	791	301	446	225	446	225
9. Physical Contingency	1,349	1,103	104	61	317	270	300	255	307	258	258	233	258	233	40	15	22	11
Total	28,319	23,165	2,182	1,288	6,647	5,662	6,309	5,357	6,447	5,410	5,410	4,896	831	316	469	236	469	236
10. Valu Added Tax				305		1,189		1,124		1,124		1,152		1,009		107		62
11. Price Escalation				0	265	0	1,779	0	2,336	0	3,080	0	3,465	0	301	0	254	0
Grand Total	28,319	39,583	2,182	1,858	6,647	8,631	6,309	8,818	6,447	9,641	5,434	9,369	831	724	489	553	489	553

Price index (1992 =100)

1.000 1.080 1.000 1.166 1.000 1.260 1.000 1.360 1.000 1.469 1.000 1.587 1.000 1.714 1.000 1.851

Remarks: 1US\$=Rp2.000=¥129.0

## 7.4 Organization and Management

### (1) General

The institutional framework for project implementation is examined on both national and provincial levels. Since the Project consists of a large number of schemes scattered in each province, an implementation must be controlled substantially by provincial agencies. Central governmental agencies will be in charge of comprehensive management and coordination.

### (2) National Level Organization and Management

The principal executing agency of the Project is the Directorate General of Food Crops Agriculture (DGFCFA) under the Ministry of Agriculture. DGFCFA will be responsible for the project implementation and manage the most part of the Project budget. DGFCFA is the only governmental agent that is in charge of land development and village irrigation projects and have experienced their implementation. The followings also serve as sub-executing agencies.

#### The Ministry of Public Works

- The Directorate General of Water Resources Development (DGWRD)

#### The Ministry of Home Affairs

- The Directorate General of Regional Development (DGRD)
- The Directorate General of Rural Development (BANDA)
- The Directorate General of Public Administration and Regional Autonomy (DGPARA)

In practical implementation stage, however, much of the responsibility needs to be developed to the provincial services of above mentioned agencies. The role of the agencies of central government will be limited mainly to issues of total management and coordination.

#### This includes:

- planning,
- coordination and technical control
- technical guidance
- procurement of equipment and materials
- selection and engagement of the consultants
- loan disbursement
- liaison with the loan lending agency and other

- government agencies.

The proposed organizational structure for the Project is shown in Fig.7-4-1.

BAPPENAS will serve as a chair-agency of a working group for project coordination at national level which consists of DGFCFA, DGWRD, BANGDES, BANGDA, DGPARA and other agencies concerned. The chair-agency will undertake inter-agency coordination and monitoring of the implementation works, being assisted by DGFCFA, the principal executing agency.

For the purpose of coordinating and monitoring technical and practical issues of the Project, two Project Coordination and Monitoring Units(PCMUs) will be established, one in DGFCFA and the other in DGWRD.

### (3) Provincial Level Organization and Management

Actual implementation of the Project will practically be undertaken by provincial agencies concerned. The technical agencies such as agricultural service and irrigation service are responsible for implementation of relevant components. Provincial and district BAPPEDAs will serve as agencies in charge of planning, coordination and monitoring under a guidance from technical agencies. The proposed work and responsibility demarkation for land development and village irrigation at provincial level is shown in Table 7-4-1. Organizational arrangement for each component of the Project is explained below.

Table 7-4-1 DEMARKATION OF WORK AND RESPONSIBILITY

Works	Village Irrigation Scheme (Non-Public Works Project)		Land Development Scheme (Mainly in Public Works Project)	
	Intake and Canal System	On-farm Facilities	Tertiary System	On-farm Facilities
Survey, Investigation and Design (S.I.D)	Provincial Government	Agriculture Office	Public Works Office /Provincial Government	Agriculture Office
Construction	Provincial Government /Farmers	Farmers	Public Works Office /Provincial Government /Farmers	Agriculture Office /Farmers
O & M	Farmers	Farmers	Farmers	Farmers

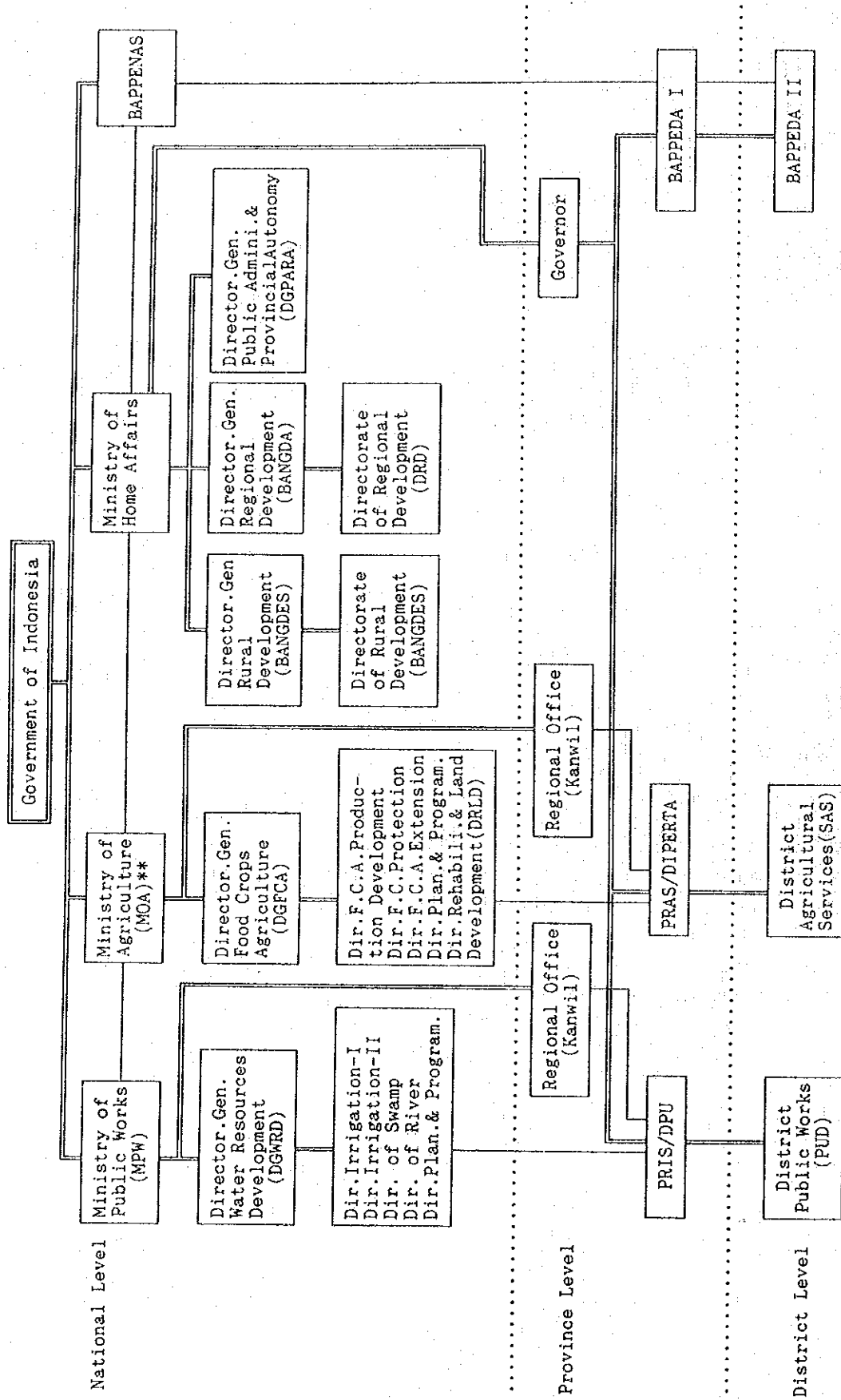
For the rehabilitation/upgrading and additional works of the tertiary system in the land development scheme, the PRIS (provincial irrigation service) surveys and investigates. The Public Work Offices at province and sub-district levels control construction and also take charge in contact between the farmers and the Public Work Office.

Meanwhile, for the rehabilitation/upgrading and additional works of the village irrigation scheme, the Public Work Office takes charge in main irrigation and drainage structures such as rehabilitation and/or replacement of intake weir and so on.

For the reclamation to paddy field, the Agricultural offices and the farmers take responsibility.

Fig. 7-4-1

PROPOSED ORGANIZATION AND COORDINATION



Remarks; \*\*: Leading Agency, =====: Normal Connection, -----: Coordination

## 7.5 Women in Development

In Indonesia, PKK (Women/Family Education Program at Village Level) has been widely organized throughout the country in accordance with Government's policy, and its organization members are village housewives of respective families.

LKMD (Village Development Committee) is also organized in each village to discuss their village development under village administration. The chief of PKK is one of the member of this committee: LKMD as a representative of women group. In principle, village housewives have a channel to village development officially.

With the implementation of proposed schemes family income will be increased and housewives' purchasing power will be improved, which will finally lead to nutrition/health improvement of farm family in rural area.

## 7.6 Environmental Aspect

Based on the Act No.4 of 1982 concerning the Basic Provisions for Management of Living Environment, several regulation/decrees have been enforced in Indonesia since 1986 by Ministry of Population and Environment and other ministries.

In 1989 Ministry of Public Works prepared a guidelines for environmental impact analysis management (AMDAL) procedure for projects including irrigation development projects in accordance with Government's Regulation No.29, 1986 concerning AMDAL. The guidelines stipulate followings:

- 1) The maintenance/rehabilitation of irrigation networks in Category 4 can be made without AMDAL, and
- 2) PIL (Presentation of Environmental Information) without AMDAL must be made in a new small scale irrigation scheme which development area is less than 2,000 ha.

The proposed schemes in this study belong to village irrigation scheme or small scale land development scheme which development area is far less than 2,000 ha. Generally, rehabilitation area or new land development area in each scheme is around 100 ha on average. Accordingly, much environmental impacts would not be expected with the implementation of the



proposed schemes. It is recommended, however, to take following actions prior to their construction:

- a) In village irrigation schemes, simple environmental checking will be made before their construction, and
- b) In land development schemes, environmental information with project implementation will be collected and evaluated before their construction.

## VIII. PROJECT EVALUATION

### 8.1 Economic Evaluation

#### (1) Objective and Methodology

Following the result of the project evaluation for 30 representative schemes, this chapter gives an estimation of B/Cs at 10% discount rate for all the inventoried schemes. Present and future crop production and project cost estimates presented in Appendices VI and VIII, respectively, are the basis of evaluation. As discussed in Chapter VI, estimated B/Cs will be used in scoring all schemes for prioritization.

Estimation of B/Cs are made through the following procedure under the assumptions given in 5-7-1.

- i) Financial project cost was converted to economic cost in the same method used for 30 schemes
- ii) Economic benefit to accrue annually was estimated as the difference in net production revenues in economic price between under with-project and without-project conditions. Economic commodity prices were differentiated only by provinces not by individual schemes.
- iii) Calculate the ratio of annual incremental benefit over initial project cost
- iv) An estimate of B/C for each scheme is obtained using a linear correlation formula between B/Cs and annual benefit-initial cost ratio estimated from those of 30 representative schemes.

The rationale of estimating B/Cs with a correlation model can be explained as follows:

B/C is calculated by the formula;

$$B/C = \frac{\sum_{t=0}^u B_t(1+r)^{-t}}{\sum_{t=0}^u C_t(1+r)^{-t}}$$

Where,  $B_t$  and  $C_t$  are benefit and cost at year  $t$ ,  $r$  is the discount rate and  $u$  is the economic useful life.

Now, under the condition that the cost occurs at once and annual benefit accrue at the same value amount, then

$$B/C = \frac{\int_0^u B_t e^{-rt} dt}{C_s(1+r)^{-s}} = \frac{B_t(r^{-1}e^{-ru} + r^{-1})}{C_s(1+r)^{-s}} = \frac{B_s}{C_s} \times \frac{(1+e^{-ru})r^{-1}}{(1+r)^{-s}}$$

Where, e is the natural logarithmic base and s is the year of cost accrument,  $B_t = B_s$  (constant).

Since the second part of the right hand side is a constant term, B/C is expressed by a linear formula of  $B_s/C_s$ . In the case of land development and village irrigation schemes, the construction of each scheme will be finished within a year, although some preparation works have to be made in the previous year. Benefits are assumed to accrue at the same amount after the third year. Thus, the assumption of linear correlation can almost be true.

The correlation equation estimated with the least square method is:

$$Y = -0.03678 + 7.98329X$$

$$r=0.996, F=3304.2, df=26$$

$$\text{Standard deviation of X coefficient}=0.139$$

where, Y is B/C and X is (annual benefit)/(initial cost)

The coefficient of correlation at 0.996 proves the strong correlation. Note that two pump irrigation schemes were excluded because the initial costs are relatively low and operation and replacement costs are higher in pump irrigation. The ratio of annual benefit over initial cost is thus larger than other schemes with the same B/C. The upward bias in B/C estimates will result from using the same equation for pump irrigation. B/C was calculated based on the cost benefit flow for each pump irrigation scheme. There are in total 17 pump irrigation schemes in the inventory list.

## (2) Results of B/C Estimation

The results of B/C estimation by the aforementioned method are summarized as below. The histograms of B/C distribution are depicted in Fig.8-1-1 and 8-1-2. The result shows that 70.5% of schemes clear the criteria of  $B/C \geq 1.0$  at 10% discount rate.

Distribution of B/Cs

Scheme	B/C<1.0	1.0≤B/C<1.5	1.5≤B/C<2.0	B/C≥2.0
Land Development	10	14	8	12
Village Irrigation	203	294	116	120
Total	213	308	124	132

Note: 18 land development schemes of which development area is less than 25ha were excluded from B/C estimation

### (3) Evaluation of Overall Project Package

Evaluation of the entire project package is made dealing the 340 schemes recommended to be implemented as one project. The same assumptions in the section 5.7.1 are applied again and the total of benefits of all schemes are used for that of the project. The implementation schedule given in Chapter VII of is followed in making cost benefit flow of the project.

Cost benefit stream tables are made as shown in Tables 8-1-1 to 8-1-3 under the assumption mentioned above. The project is expected to generate economic internal rates of return(EIRRs) of 12.0%, 17.2% and 16.5% for the land development scheme, the village irrigation scheme and overall project, respectively. At a 10 percent opportunity cost of capital, the project yields net present values(NPVs) of Rp. 1.0 billion from the land development scheme and Rp. 23.6 billion from the village irrigation scheme. B/Cs at the same discount rate are estimated respectively at 1.16 and 1.62 and for overall project at 1.55.

All the EIRRs pass the test of the 10 percent cost of capital figure that is commonly applied in evaluating projects.

### (4) Sensitivity Analysis

Sensitivity of project profitability is analyzed for the cases of cost increase and benefit decrease. 10 percent and 20 percent changes are assumed and the EIRRs are calculated as follows:

Increase in Cost	<u>Decrease in Benefit</u>		
	0%	10%	20%
0%	16.5%	14.8%	13.0%
10%	14.9%	13.3%	11.6%
20%	13.6%	12.1%	10.5%

The project still generates more than 10 percent of EIRR even in the worst case of 20 percent cost increase and benefits decrease. It is concluded that the project is economically sound against the unforeseen changes of the economy.

## 8.2 Financial Evaluation

The major economic units affected by the project implementation include individual farm, farmers' organizations and the project executing agency. The farm budget analysis in Section 2.2 shows that the project will well better off every farm. Since economic viability is the key factor in selecting schemes to be implemented, selected schemes are those with higher returns. Thus farm income is expected to be higher.

The farmers' organization will be responsible for operation and maintenance of the irrigation facilities with the service fees and labor dedication from farmers. The organizations, however, are not profit seeking bodies and then their budget stability highly depends on farmers' capacity to pay service fees. As discussed in the farm budget analysis, an increase in farm income can well exceed the additional payment for operation and maintenance. Thus the organization budget will keep a balance as far as they successfully collect charges from farmers. The activities of the organizations are described in detail at Appendix-VII.

The project will be implemented with a government development budget and no charges are collected from farmers nor farmers' organization. There is no use of having financial budget analysis of the executing agency. All the project costs form a subsidy to farmers for improvement their production facilities. The expense is already proved its high viability in terms of national economy, which at the same time means feasibility of the public investment.

### 8.3 Indirect and intangible Impacts

#### (1) Indirect Benefits

In addition to the direct benefit of an increase in agricultural production, the project will induce an expansion of supporting industries. These forward and backward linkages include input suppliers, processing industry, marketing sector and construction contractors. The linkage effects were analyzed briefly since detailed analysis requires a complicated general equilibrium approach.

##### i) Backward Linkage

The backward linkage is an inter-industrial effect of an increased demand in a certain sector. The project investments will mainly occur in the construction sector. The multiplier obtained from the Leontief inverse matrix  $(I-A)^{-1}$  of Indonesia for the construction sector is 2.1545 (Biro Pusat Statistik, Table Input-Output Indonesia 1985). Since total project cost is estimated at about Rp. 80 billion, the total indirect backward linkage effect is calculated as:

$$\text{Rp.}80,000,000,000 \times 2.1545 = \text{Rp.}172,000,000,000$$

##### ii) Foreword Linkage

The foreword linkage, on the other hand, is an effect of an increased output in one sector. The output increase to be generated by the project is that in agriculture sector, mostly an increased rice production. The "input multiplier" of rice sector 2.9670 is obtained from the Leontief inverse matrix  $(I-A)^{-1}$ , while that of "other food crop" is 2.0221. An increase of about 86,800 tons of paddy (59,000 tons in terms of polished rice) will result from the project. Using the recent market price of rice at Rp.500 per kg, the increase in value is about Rp.29.5 billion. Then the foreword linkage is:

$$\text{Rp.}29,500,000,000 \times 2.9670 = \text{Rp.}87,526,500,000$$

##### iii) Employment Opportunity

The project will contribute to an increase of employment in the agriculture sector in the rural area. This can alleviate the "push" factor in the expansion of urban population. The indirect linkage effect discussed above also expand the employment opportunities in the related industries. The initial construction works have an employment impact in the area, though only that of short-run period.

## (2) Intangibles

Intangible benefits of the project may also be important factors for decision making of project implementation. The following are several of the intangibles.

### i) Poverty Alleviation

"Poverty alleviation" is one of the main objectives of the government policies in Indonesia. The farmers involved in the project are mostly in remote area and of small scale. The project thus will better off these poor farmers rather than the riches. Higher incomes and consumption levels will imply better diets and health for the project population.

### ii) Institutional Building

The project includes an institutional training program for improved operation and maintenance. Farmers do benefit from the organizations such as Water User Association (P3A), extension-organized Kolompok Tani, and local cooperative (KUD). These institutions would be strengthened through the project, which will contribute to enhanced community welfare. Farmers' participation to such institutions induces "consciousness" in farm management and local activities and then be a vehicle for sustainable regional development.

### iii) Quality Improvement

It is expected that the quality of farm products will improve, though cannot be qualified. Crop damages are reduced through stable water supplies and maturing will be higher and more even. These will provide better marketability and higher prices for products from the project area.

Table 8-1-1 COST BENEFIT STREAM OF THE LAND DEVELOPMENT PROJECTS

Year	Costs			Benefit	Balance
	Capital	O&M	Total		
1	0	0	0	0	0
2	415	0	415	0	-415
3	3,124	0	3,124	124	-3,000
4	1,367	22	1,389	247	-1,142
5	2,020	42	2,062	464	-1,598
6	1,395	71	1,466	789	-678
7	0	94	94	1,036	942
8	0	106	106	1,175	1,069
9	0	112	112	1,237	1,125
10	0	112	112	1,237	1,125
11	0	112	112	1,237	1,125
12	0	112	112	1,237	1,125
13	0	112	112	1,237	1,125
14	0	58	170	1,237	1,067
15	0	22	134	1,237	1,103
16	0	36	148	1,237	1,089
17	0	29	141	1,237	1,096
18	0	112	112	1,237	1,125
19	0	112	112	1,237	1,125
20	0	112	112	1,237	1,125
21	0	112	112	1,237	1,125
22	0	112	112	1,237	1,125
23	0	112	112	1,237	1,125
24	0	58	170	1,237	1,067
25	0	22	134	1,237	1,103
26	0	36	148	1,237	1,089
27	0	29	141	1,237	1,096
28	0	112	112	1,237	1,125
29	0	112	112	1,237	1,125
30	0	112	112	1,237	1,125
31	0	112	112	1,237	1,125
32	0	112	112	1,237	1,125
33	0	112	112	1,237	1,125
34	0	58	170	1,237	1,067
35	0	-61	51	1,237	1,186

Table 8-1-2 COST BENEFIT STREAM OF THE VILLAGE IRRIGATION PROJECTS

Year	Costs			Benefit	Balance
	Capital	O&M	Total		
1	0	0	0	0	0
2	3,322	0	3,322	0	-3,322
3	11,745	0	11,745	0	-11,745
4	11,129	168	11,297	1,340	-9,957
5	11,305	315	11,620	3,350	-8,270
6	9,898	536	10,433	6,030	-4,403
7	1,133	704	1,837	8,711	6,874
8	320	798	1,118	10,051	8,932
9	0	840	840	10,721	9,881
10	0	840	840	10,721	9,881
11	0	840	840	10,721	9,881
12	0	840	840	10,721	9,881
13	0	483	840	10,721	9,397
14	0	483	840	10,721	9,397
15	0	483	840	10,721	9,397
16	0	483	840	10,721	9,397
17	0	840	840	10,721	9,881
18	0	840	840	10,721	9,881
19	0	840	840	10,721	9,881
20	0	840	840	10,721	9,881
21	0	840	840	10,721	9,881
22	0	840	840	10,721	9,881
23	0	385	840	10,721	9,495
24	0	385	840	10,721	9,495
25	0	385	840	10,721	9,495
26	0	385	840	10,721	9,495
27	0	840	840	10,721	9,881
28	0	840	840	10,721	9,881
29	0	840	840	10,721	9,881
30	0	840	840	10,721	9,881
31	0	840	840	10,721	9,881
32	0	840	840	10,721	9,881
33	0	483	840	10,721	9,397
34	0	483	840	10,721	9,397
35	0	-552	288	10,721	10,433

EIRR= 17.2%  
 NPV(10%)= 23,623  
 B/C(10%)= 1.62

Unit: Rp. million



Table 8-1-3 COST BENEFIT STREAM OF THE OVERALL PROJECT

		Costs			Benefit	Balance
Year		Capital Replacement	O&M	Total		
1	1993	0	0	0	0	0
2	1994	3,737	0	3,737	0	-3,737
3	1995	14,869	0	14,869	124	-14,745
4	1996	12,496	0	12,686	1,587	-11,099
5	1997	13,325	0	13,682	3,814	-9,868
6	1998	11,293	0	11,900	6,819	-5,081
7	1999	1,133	0	1,931	9,747	7,816
8	2000	320	0	1,225	11,226	10,001
9	2001	0	0	952	11,958	11,005
10	2002	0	0	952	11,958	11,005
11	2003	0	0	952	11,958	11,005
12	2004	0	0	952	11,958	11,005
13	2005	0	483	1,436	11,958	10,522
14	2006	0	541	1,493	11,958	10,464
15	2007	0	505	1,457	11,958	10,500
16	2008	0	520	1,472	11,958	10,486
17	2009	0	29	981	11,958	10,977
18	2010	0	0	952	11,958	11,005
19	2011	0	0	952	11,958	11,005
20	2012	0	0	952	11,958	11,005
21	2013	0	0	952	11,958	11,005
22	2014	0	0	952	11,958	11,005
23	2015	0	385	1,338	11,958	10,620
24	2016	0	443	1,395	11,958	10,562
25	2017	0	407	1,359	11,958	10,598
26	2018	0	422	1,374	11,958	10,584
27	2019	0	29	981	11,958	10,977
28	2020	0	0	952	11,958	11,005
29	2021	0	0	952	11,958	11,005
30	2022	0	0	952	11,958	11,005
31	2023	0	0	952	11,958	11,005
32	2024	0	0	952	11,958	11,005
33	2025	0	483	1,436	11,958	10,522
34	2026	0	541	1,493	11,958	10,464
35	2027	0	-614	339	11,958	11,619

Sensitivity of EIRR

Increase in Cost	Decrease in Benefit		
	0%	-10%	-20%
0%	16.5%	14.8%	13.0%
+10%	14.9%	13.3%	11.6%
+20%	13.6%	12.1%	10.5%

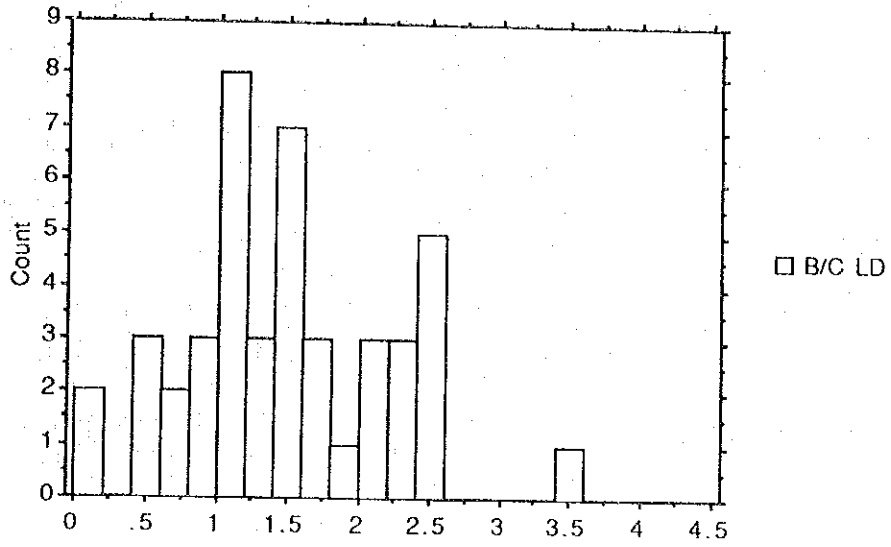


Fig. 8-1-1 HISTOGRAM OF B/C, LAND DEVELOPMENT SCHEMES

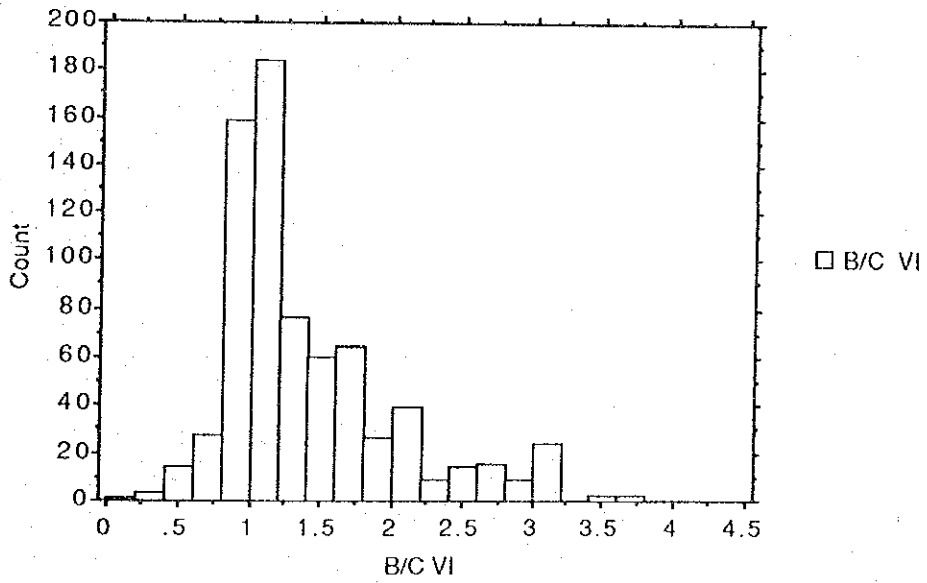


Fig. 8-1-2 HISTOGRAM OF B/C, VILLAGE IRRIGATION SCHEMES



## IX. PROPOSAL FOR LONG TERM PLAN

### 9.1 Guidelines for Typical Method of Survey & Planning

As shown in the Chapter III, Clause 3.1, the land development project is composed of land development schemes and village irrigation schemes. The objective of inventory survey is to catch hold of present conditions on irrigation and drainage facilities and development potential on agriculture for the both schemes, and also to apply the collected data as basic figure for the further study of project formulation in objective provinces. In accordance with the procedure in the Study, guidelines for typical method of further survey and planning is mentioned as below.

#### (1) Objective Province

Administrative area of Indonesia is divided into twenty seven (27) provinces including special administration districts. The draft implementation program has been formulated in three (3) provinces of North Sumatra, South Sulawesi and West Nusa Tenggara as the representative provinces in the Study. Further the Ministry of Agriculture carried out the same inventory survey in five (5) provinces, that is, Aceh, Lampung, South East Sulawesi, Central Sulawesi and East Nusa Tenggara. As to this five (5) provinces, implementation program should be formulated as the base of collected data in future. As to the remaining nineteen (19) provinces, the inventory survey and study is desirable to commence judging from the progress of the above eight (8) provinces

#### (2) Scheme Number of Inventory Survey

In three (3) provinces, the actual rate which the inventory survey was carried out using the selection criteria on inventory survey schemes shows about 40 % of total number of existing village irrigation schemes. Based on the experience, required number of inventory survey is proposed as following table for the five (5) and nineteen (19) provinces.

Unit : nos.

Province	Number of Present VI Scheme	Number of Potential Area of LD Scheme	Number of Already Surveyed Scheme	Additional Survey Required
Ache	598	126	139	100
Lampung	130	76	117	-
South East Sulawesi	263	53	59	50
Central Sulawesi	134	112	82	-
NTT	305	45	43	80
Total	1,430	412	440	230
Other 19 Provinces	19,300	N.A.	-	7,700

### (3) Survey Agency and Survey Period

From the experience of inventory survey in the five (5) provinces, the same agency, which is Directorate of Land Rehabilitation and Development (DLRD) in Jakarta should be continued to carry out overall arrangement of the inventory survey. As for the more detailed instruction to the provincial agriculture services, however, it is necessary that the inventory survey should carry out not only the village irrigation schemes but also the land development schemes.

Basic Plan for the Inventory Survey and Budgetary Arrangement	Directorate of Land Rehabilitation & Development, DGFCFA
Implementation of Inventory Survey	Provincial and Prefectural Agricultural Services
1st Check of Collected Data	Provincial and Prefectural Agricultural Services
Computer Treatment of Collected Data and Analysis	Directorate of Land Rehabilitation & Development, DGFCFA

Additional survey and data arrangement of the five (5) provinces should be carried out as soon as possible for the project implementation as second stage development and it is desirable to finish data analysis before the project implementation of three (3) provinces. As to the nineteen (19) provinces, such inventory survey is recommend to carry out in

order in accordance with progress of the project implementation in eight (8) provinces. Also the detailed instruction on the inventory survey is necessary to the each province.

(4) Guidelines for Typical Method of Survey & Planning

In principle the survey and planning methods which have been developed in the Study should be followed in further study. Flow od outline of the works up to the formulation of implementation program is shown in the below diagram. Typical method of survey and planning are shown in Table 9-1-1.

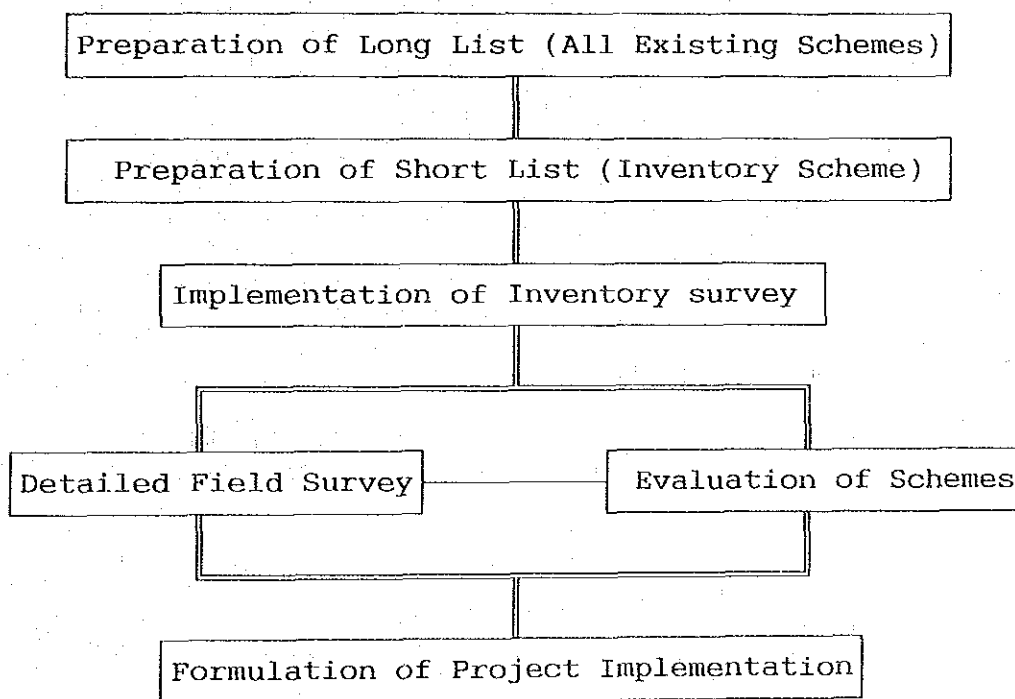


Table 9-1-1 GUIDELINES FOR TYPICAL METHOD OF SURVEY & PLANNING

Work Item	Guidelines and Special Attention
1. Preparation of long list	Arrangement of basic registration list for potential schemes of land developments and existing village irrigation schemes. Items of arrangement are name of scheme, location, present size of paddy field, potential area, present facilities conditions.
a. LD Scheme	The scheme is selected from the projects controlled under DPU. The number 13th column of the registered books of DPU irrigation & drainage projects shows all potential schemes as the LD list, but not including under construction schemes.
b. VI Scheme	The basic list is prepared using the recent record of PRAS in each province. Further the list of PRIS and Bangdes are combined for the village irrigation.
2. Preparation of short list	In accordance with the selection criteria for the inventory survey scheme, the survey area is selected from the above long list. The items of selection criteria are size of project area, schedule of construction, cooperation of foreign budget, facilities' condition and so on.
3. Preparation of questionnaire	The same survey form with the Study should be used, but some explanation on each question is added taking consideration present answer style into the account in case of not able to get uniformed answer.
4. Implementation of inventory survey	The survey is almost carried out by the staffs of prefecture agricultural service office. Detailed instruction is necessary before commencement of the survey works from each PRAS office.

Work Item	Guidelines and Special Attention
	<p>In case that if certain scheme is obviously not satisfy with selection criteria for inventory survey, the survey on that area should be stopped after adding the reason.</p> <p>It is important to check omission to answer column at the site. Especially filling in or out concerning on the selection criteria for implementation of schemes should be attended.</p> <p>From the formulation of project implementation, filling of answer on project scale, land use, water source availability, quantity of facilities, conditions of present facilities, required improvement work, etc. should be checked.</p> <p>Location map of schemes and past construction record such as construction period, name of executing agency, construction cost consumed, etc. should be collected as attachment data for additional explanation.</p>
<p>5. Computer treatment of collected data</p>	<p>The program for dBASE-IV which has been developed in the Study should be used for the purpose of data input, revision, output and data preservation. For the data analysis itself, conversion program to Lotus files is recommendable.</p>
<p>6. Examination of surveyed schemes</p>	<p>After the checking of data output, unusual or abnormal data should be re-surveyed, revised or avoided. Further at this time. the schemes which do not satisfy with the standard criteria of area size and/or have special local conditions should be treated as to be disqualified schemes.</p>
<p>7. Grouping of surveyed schemes</p>	<p>From the view of cost and benefit, surveyed schemes should be divided into each group which was decided in the Study.</p>



Work Item	Guidelines and Special Attention
8. Detailed field survey	In the Study, thirty (30) representative schemes were surveyed in actual fields considering its distribution of locations of all schemes. If the analyzed cost and benefit in these representative schemes are not utilized, supplemental field survey should be carried out in those area and after surveying on the required data, construction cost and benefit should be re-estimated.
9. Selection of priority scheme for project implementation	The same selection method with this Study should be applied about following items to be evaluated.
<b>A. Economic Evaluation</b>	
A1. B/C	Each project cost and annual benefit should be estimated and after the calculation of the ratio, B/C can be estimated using the correlation formula in the Study. should be calculated.
A2. Expansion of paddy field	Using the inventory survey results, increase of paddy field is estimated. The estimation method is referred in Appendix I, clause 5.5.
A3. Increase of crop intensity	Using the inventory survey results, availability of increase of paddy crop intensity is estimated.
<b>B. View from Technology</b>	
B1. Water availability	To be based upon the inventory survey results and field survey data.
B2. Soil texture	To be based upon the inventory survey results.
<b>C. View from Implementation &amp; Operation</b>	
C1. O&M and P3A	To be based upon the inventory survey results. Detailed point evaluation is referred in Appendix VII.
C2. Boundary of land	To be based upon the inventory survey results.
C3. Condition of accessibility	To be based upon the inventory survey results.

Work Item	Guidelines and Special Attention
D. View from Social Condition	
D1. Land ownership	To be based upon the inventory survey results.
D2. Land status	To be based upon the inventory survey results.
D3. Average farmers' income	GRDP per capita in each region is used for the estimation(in each kabupaten).
10. Ranking of evaluation	Screening criteria for each rank mentioned in chapter VI should be applied for selection of implementation schemes. In next, highest priority rank A, second candidates rank B and re-survey group C should be classified and then implementation plan for the rank A schemes should be formulated. However selection of implementation schemes should consider average number of schemes in each kabupaten.

## 9.2 Proposal for Long Term Plan

1. It is expected that the Project which has 340 schemes with 30,400 ha of gross paddy field area, is implemented in three (3) provinces where the feasibility study has been carried out, namely, North Sumatra, South Sulawesi and West Nusa Tenggara in the first stage. Then it is proposed that the project where the inventory survey was carried out by the Indonesian side, that is, Aceh, Lampung, South East Sulawesi, Central Sulawesi and East Nusa Tenggara is implemented in five (5) provinces as the second stage development.

2. At present, progress of inventory survey in five (5) provinces is 340 schemes with about 33,800 ha of present paddy fields in total. Actual implemented rate of inventory survey in three (3) provinces is about 40 % of existing number of village irrigation. On the other hand, the progress in five (5) provinces shows still low rate to be about 30 % as shown in the clause 9.1. For this five (5) provinces, it is desirable to do and continue the additional inventory survey and evaluation of the schemes. Especially number of present village irrigation schemes seems to be about 600 places, therefore additional inventory survey of about 100 schemes is proposed. As to the other provinces, it is desirable that 50 schemes in South East Sulawesi and 80 schemes in East Nusa Tenggara province are added continuously. Furthermore the inventory survey against the potential area of land development schemes is apt to short in the projects controlled under DPU.

3. As for the number of LD schemes in five (5) provinces, about 40 schemes and planning development paddy field of 5,200 ha could be scheduled by estimating 10 % of number of potential schemes judged from the experience of planning value in three (3) provinces. Number of VI schemes for improvement could be scheduled to be 320 schemes and about 28,800 ha of paddy field could be covered assuming two schemes per one kabupaten in each year. The total project cost in the five (5) provinces is roughly estimated to be 90 billion rupiah. An increase of about 97,000 tons of paddy will result from the project (about 66,000 tons in terms of polished rice).

4. Survey and undertaking as project for nineteen (19) provinces other than the above five (5) provinces would be implemented as the third stage development due to the view of required survey period, construction period and budgetary arrangement. As a series of public equal investment, the