

Table 4-1-2 AVERAGE MONTHLY RAINFALL BY REGION
IN SOUTH SULAWESI PROVINCE

Unit :mm

MONTH	LUWU	TANA TORAJA	ENREKANG	WAJO	MAROS	SOPPENG
January	253	178	333	240	660	333
February	92	309	183	54	672	66
March	376	221	146	25	308	126
April	254	291	224	144	400	132
May	95	213	99	221	91	246
June	308	313	141	284	116	169
July	255	265	90	277	87	243
August	138	128	35	94	38	48
September	140	66	136	78	24	76
October	126	184	179	58	247	72
November	95	174	166	55	320	51
December	129	248	67	141	452	175
Total	2261	2590	1799	1671	3415	1742
Average(1989)	188	216	150	139	285	145
Average(1988)	294	178	204	176	327	205
Average(1987)	200	168	165	101	270	89
Average(1986)	178	218	194	136	174	139

Source: DIPERTA South Sulawesi

(3) West Nusa Tenggara Province

This Province consists of the Lombok island and Sumbawa islands, and has different characteristics of the rainfall. The Lombok island has rainfall over 2,000 mm in the mountains with elevation of about 3,000 m in the center of the island, and the lower the elevation becomes, the less the rainfall becomes. The annual rainfall becomes less than 1,000 mm especially in the north-east coast. The wet season in the Lombok island is about 5 months centering December to January.

In the Sumbawa island, the rainfall over 3,000 mm is also found in the area centering the Tambora mountain, but the rainfall in the Sumbawa island is usually 1,000 to 1,500 mm and has the tendency to be come the less for the east. As in the Lombok island, the coastal area in the east has the rainfall less than 1,000 mm as shown in Fig. 4-1-3. The wet season in the Sumbawa is shorter and the rainfall concentrate for 3 to 4 months during the period from December to March, and in other months almost no rain is found as the dry season as shown in Table 4-1-3.

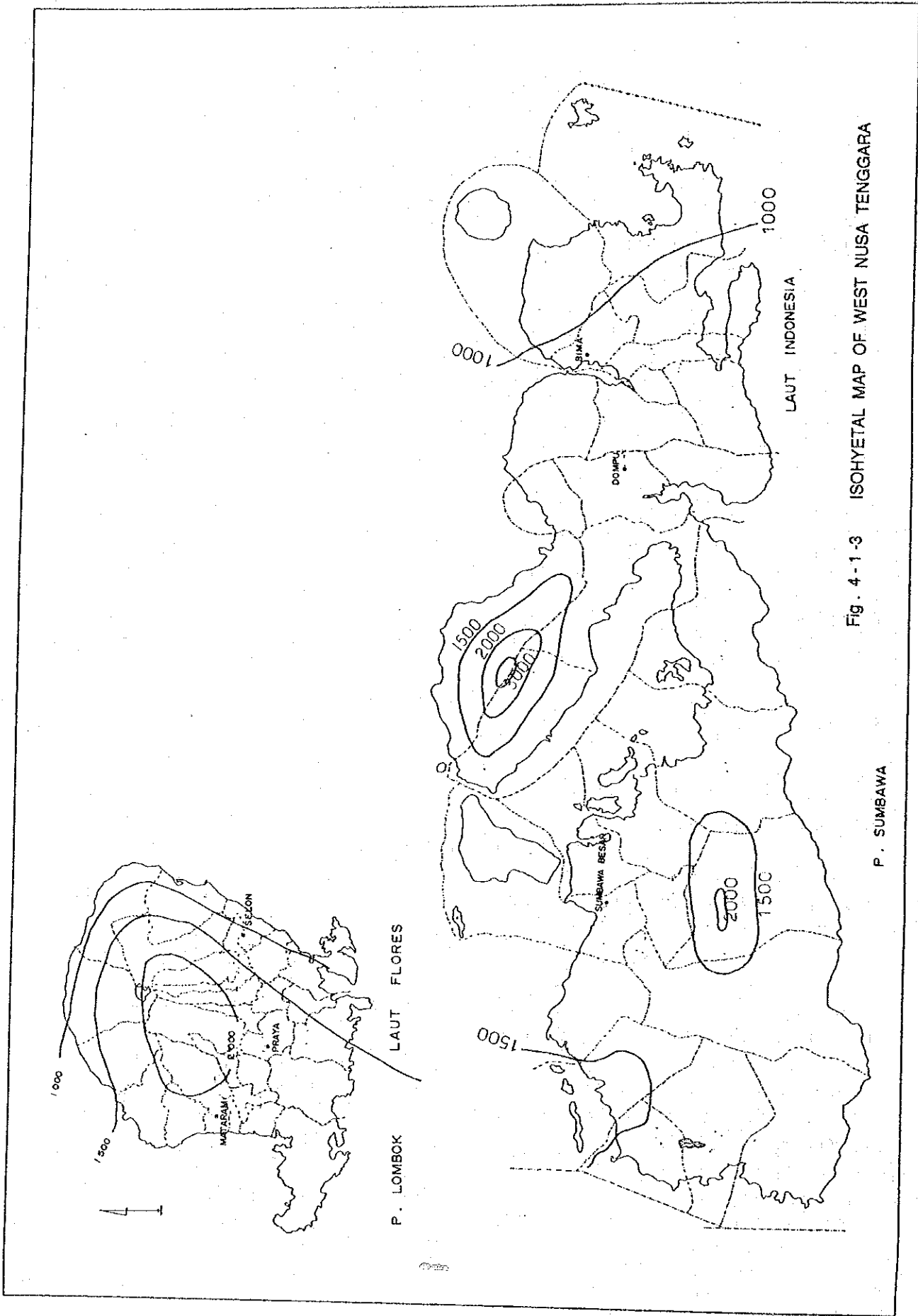


Fig. 4-1-3 ISOHYETAL MAP OF WEST NUSA TENGGARA

P. SUMBAWA

The average annual air temperature is 31.2°C at the maximum and 22.9°C at the minimum.

The average relative humidity is about 82%.

Table 4-1-3 AVERAGE MONTHLY RAINFALL BY REGION
IN WEST NUSA TENGGARA PROVINCE

Unit : mm

MONTH	LOMBOK BARAT	LOMBOK TENGAH	LOMBOK TIMUR	SUMBAWA	DOMPU	BIMA
January	337	383	315	367	206	248
February	322	290	334	230	201	224
March	278	236	215	166	210	177
April	141	74	103	184	44	115
May	59	63	50	34	3	17
June	104	158	182	92	44	76
July	50	53	19	30	0	40
August	60	89	65	21	32	16
September	4	1	1	4	0	1
October	126	42	50	61	22	12
November	173	104	31	92	54	52
December	312	317	210	258	142	174
Total	1966	1810	1575	1539	958	1152
Average(1990)	164	151	131	128	80	96
Average(1989)	140	152	101	105	104	173
Average(1988)	140	150	85	104	72	97
Average(1987)	145	174	131	118	85	73
Average(1986)	143	143	133	113	98	83

Source: DIPERTA West Nusa Tenggara

4.1.2 Hydrology

Water levels in the rivers in the Study area which are basic data for the hydrological study are observed by the Provincial Public Works (DPU). The following shows the number of water level observation stations by Province.

NUMBER OF WATER LEVEL OBSERVATION STATION BY PROVINCE

Province	Water Level Station
North Sumatera	44 places
South Sulawesi	56 "
West Nusa Tenggara	39 "

The rivers of which the water levels are observed, however, are comparatively bigger rivers and the on-firm irrigation systems resorting water sources in the bigger rivers, usually have enough diversion discharge even in the dry season and rather, the problem in the damage to the intake and diversion facilities at the time of flood.

The discharge in small rivers in the dry season in the North Sumatera and South Sulawesi provinces is comparatively stable because of higher rainfall, but the discharge in the rivers in the Sumbawa island in the west Nusa Tenggara Province is extremely small in the dry season and no discharge is expected in the dry season in many irrigation systems.

(1) Result of inventory survey for present condition of hydrology

The following table shows the summarized present condition of hydrology by province. the scheme of analysis is abstracted the inventory survey schemes which have a river water resource from the result of inventory survey.

Table 4-1-4 SUMMARIZED PRESENT CONDITION OF HYDROLOGY BY PROVINCE

Item	North Sumatra	South Sulawesi	N.T.B.
Average Wide of River	$0 < B \leq 5m$	$5 < B \leq 10m$	$10 < B \leq 15m$
Average Depth of River	$0 < H \leq 1m$	$0 < H \leq 1m$	$1 < H \leq 2m$
Discharge of River Dry Season	$0.25 < Q \leq 0.5m^3$	$0.1 < Q \leq 0.25m^3$	$0.1 < Q \leq 0.25m^3$
Discharge of River Wet Season	$0.5 < Q \leq 5m^3$	$1 < Q \leq 10m^3$	$0.5 < Q \leq 5m^3$
Flood Experience	76 %, none	81 %, none	81 %, none
Height of Flood water	$0 < h \leq 0.5m$	$0 < h \leq 0.5m$	$2 < h \leq 3m$
Draught Experience	82 %, none	60 %, none	83 %, none
Draught Period less than 1month	2 to 3months	1 to 2months	

(2) Specific Discharge

The collected data of the river discharge is used the review data by DGWRD on the Planning of Integrated Water Resources Development from the report of RePPPProT (Regional Physical Planning Project for Transmigration).

The specific discharge in dry season is estimated by minimum monthly average flow, and in wet season by annual average flow. The specific discharge of Sumbawa Island (West Nusa Tenggara Province) in wet season, however, is used monthly average flow during wet season.

The specific discharge by province is as follows;

SPECIFIC DISCHARGE BY PROVINCE

Location	Wet Season	Dry Season
	lit./sec	lit./sec
North Sumatra Province		
Zone I (Asahan, Dairi, Karo, Deli Serdang, Langkat)	43	31
Zone II (Tapanuli Utara, Tapanuli Tenggara, Tapanuli Selatan, Labuhan Batu)	27	12
South Sulawesi Province		
Zone I (Luwu, Polmas, Tator, Enrekang, Pinrang, Sidenreng)	64	27
Zone II (Barru, Soppeng, Pangkep, Wajo, Maros, Bone)	48	10
Zone III (Jeneponto, Bulukumba, Gowa, Sinjai)	63	13
West Nusa Tenggara Province		
Zone I (Lombok Island)	48	9
Zone II (Sumbawa Island)	44	3

4.2 Irrigation and Drainage

4.2.1 Current Condition of Village Irrigation System

Through the inventory survey and field survey, principle findings are as follows.

- a. Village irrigation has not only the necessity of rehabilitation and improvement but also considerable potential area of paddy field.
- b. Some of survey scheme still include the areas unaccepted as the definition of village irrigation scheme.
- c. One of the most important problems to make the land development delay, in most case, has been the shortage of water to candidate scheme for land development. Although there area cases which the candidate scheme with enough irrigation water has not been developed because of the big cost for land development due to such a topographic condition as in the swamp or dense forest, these cases are found to be rare.
- d. In the case of village irrigation, one of the important problems is that the life year of the irrigation system seems very short, perhaps around five years because of the simple and insufficient survey, investigation and design and the limited less investment.

4.2.2 Irrigation Area

The present irrigation area of the schemes mostly distributed range from 50 ha to 100 ha and the average present irrigation area of the inventory survey schemes is estimated at about 90 ha, and the potential area which can be extended from the inventory survey schemes is estimated at about 15,100 ha.

Present Irrigation Area in Objective Area

Province	No. of scheme	Present Irrigation Area	Potential Area for Extension
	nos	ha	ha
North Sumatra	279	21,700	8,500
South Sulawesi	359	29,700	3,500
NTB	157	19,500	3,100
Total	795	70,900	15,100
Average		89	63

Source: Inventory Survey

Note 1; Rainfed excluded in the above potential area for extension.

Distribution for Scale of Present Irrigation Area

Size of Area	North Sumatra	South Sulawesi	NTB	Total	%
	nos	nos	nos	nos	
less than 25ha	61	60	18	139	17.5
25- 50 ha	54	51	24	129	16.2
50-100 ha	78	124	48	250	31.4
100-150 ha	37	64	28	129	16.2
150-250 ha	38	50	23	111	14.0
250-500 ha	10	8	11	29	3.6
more than 500ha	1	2	5	8	1.0
Total	279	359	157	795	100

Source: Inventory Survey

4.2.3 Kind of Water Source

Rivers are mostly used as water source over about 80 % in all the province. Spring is also used to some extent, over ten, in the South Sulawesi and Nusa Tenggara Provinces. As to the spring, its irrigation scale is naturally small due to the limited amount of water source, therefore spring is often used with river water source in order to keep more stable irrigation water.

Kind of Water Source in Objective Area

Kind of Water Source	North Sumatra	South Sulawesi	NTB	Total	%
	nos	nos	nos	nos	
River	247	299	122	668	84.0
Ground water	4	1	5	10	1.3
Spring	19	45	25	89	11.2
Pond	6	0	0	6	0.8
Tidal water	1	1	0	2	0.2
Others	2	13	5	20	2.5
Total	279	359	157	795	100

Note; Others include combined type.
Source: Inventory Survey

Kind of Water Source in DPU Project

Kind of Water Source	North Sumatra	South Sulawesi	NTB	Total	%
	nos	nos	nos	nos	
River	563	197	256	1,016	85.2
Dam	13	2	39	54	4.5
Spring	40	18	46	104	8.7
Other	17	1	-	18	1.5
Total	633	218	341	1,192	100

Source: DPU Buku Pintar 1989

4.2.4 Type of Water Source Facility

The most common type of water source facility is the weir covering the schemes over about 60 percent in three provinces, although the type of water source facility depends on the conditions of rainfall, storing capacity of the catchment area, river, etc.

Free intake has the share of about 20% in the South Sulawesi Province and Nusa Tenggara Province. In general free intake is settled at the site where the rivers have comparatively enough discharge. On the contrary, free intake is often used in the case of village irrigation so that construction of weir is impossible owing to less construction budget. For that reason, there are many cases of incomplete intake water during dry

season.

West Nusa Tenggara province has more dam and irrigation tank because of less rainfall in the DPU irrigation project as shown in the above table. The same tendency is not found in the results of inventory survey. The reason is probably considered that such big dam facilities are very limited in the case of village irrigation projects.

As to the pond, they are occasionally counted as dam facility on account of the definition and/or interpretation of the facility as well as the means of dam and weir.

Type of Intake Facility in Objective Area

Type of Intake	North Sumatra	South Sulawesi	NTB	Total	%
	nos	nos	nos	nos	
Dam	3	16	7	26	3.3
Weir	214	227	117	558	70.2
Irrigation tank	8	3	0	11	1.4
Free intake	28	73	27	128	16.1
Pump	7	10	0	17	2.1
Diversion work	8	3	4	15	1.9
Others	11	27	2	40	5.0
Total	279	359	157	795	100

Note; Others include combined type.
Source: Inventory Survey

4.2.5 Structural Condition of Intake Facilities

As the results of inventory survey, rehabilitation and improvement situation of headworks, free intake, pumping site and other intake facilities are divided into following three categories.

Structural Condition of Intake Facility
Unit : nos

Province	Type	Good	Needed Rehabilitation	Needed Replace	Total
North Sumatra	LD	23	7	2	32
"	VI	64	130	53	247
South Sulawesi	LD	3	4	3	10
"	VI	42	160	147	349
NTB	LD	18	2	0	20
"	VI	21	70	46	137
Total		171	373	251	795
Ratio in %		21	47	32	100

Source: Inventory Survey

4.2.6 Topography

Both the existing schemes for land development and village irrigation have similar topographical condition. They are clearly divided into lowland, hilly land, shallow mountainous land and deep mountainous land representing their regional topography in each province. The schemes of each province are located comparatively at hilly places, the elevation of more than 50 m, but those in the west Nusa Tenggara is located comparatively at lower places. The reasons would be ; the entire West Nusa Tenggara is the islands province, rainfall is much less than those in other two provinces and it is very difficult to assure water in the hilly land with narrow river basin.

Distribution for Elevation of Irrigation Area

Ground Height	North Sumatra	South Sulawesi	NTB	Total	%
	nos	nos	nos	nos	
less than 10m	31	30	8	69	8.7
10- 50 m	30	49	43	122	15.3
50-100 m	14	32	18	64	8.1
more than 100m	188	223	59	470	59.1
no answer	16	25	29	70	8.8
Total	279	359	157	795	100

Source: Inventory Survey

Distribution of Topography and Slope

Topography	Slope	North Sumatra	South Sulawesi	NTB	Total	%
		nos	nos	nos	nos	
Plain	less than 5%	136	136	102	374	47.0
Mild slope	5-10 %	125	134	45	304	38.2
Sharp slope	10-15 %	16	50	7	73	9.2
Hilly & mountainous	more than 15 %	2	39	3	44	5.5
Total		279	359	157	795	100

Source: Inventory Survey

4.2.7 Rainfall

Rainfall distribution through the inventory survey of each province is described in Section 4.1. Yearly rainfall at most schemes of only 5 % shows less than 1,000 mm in South Sulawesi and West Nusa Tenggara provinces. High rate of no answer is remarkable, but the reason seems that the data attached include only past five-year record and the area not entered in the questionnaires.

Distribution of Rainfall

Yearly Rainfall	North Sumatra	South Sulawesi	NTB	Total	%
	nos	nos	nos	nos	
less than 500mm	0	1	0	1	0.1
500-1000mm	1	22	18	41	5.2
1000-1500mm	28	20	42	90	11.3
1500-2000mm	67	45	9	121	15.2
2000-2500mm	57	38	6	101	12.7
more than 2500mm	106	152	1	259	32.6
no answer	20	81	81	182	22.9
Total	279	359	157	795	100

Source: Inventory Survey

4.3 Soil and Land Use

4.3.1 Soil Condition of the Project

General soil condition of the Project is shown as provincial wide soil maps, because the sachems are scattered in the whole provincial area. Indonesian soil classification system is based on FAO-Unesco system, but has some modification on it. As the system has not been uniformed in whole country area, Indonesian soil maps and soil information are sometimes complicated. The predominant soils in the three provinces are as follows.

North Sumatra:

Organosol, Alluvial, Regosol, Grumusol,
Andosol, Podosolik, Latosol

South Sulawesi:

Alluvial, Gley, Latosol, Regosol, Grumusol,
Rensina, Podosolik, Mediteran

West Nusa Tenggara:

Mediteran, Regosol, Alluvial, Grumusol, Latosol

The analysis of the soil and land conditions are analyzed on the basis the results of the inventory survey on soil name, ground slope, soil suitability for paddy and secondary crops (palawija) and other physical conditions at the scheme areas. Soil distribution of the scheme areas has some difference among the provinces as shown in Fig. 4-3-1. Soils which have over 10 % share in number of schemes are listed as follows by province.

North Sumatra:

Podosolik (48%), Latosol (14%)

South Sulawesi:

Alluvial (28%), Latosol (22%), Podosolik (17%),
Mediteran (15%)

West Nusa Tenggara:

Regosol (48%), Alluvial (22%), Mediteran (13%),
Grumusol (11%)

According to the inventory survey, soils at more than 97 % of the schemes are suitable or very suitable for paddy cultivation. Water quality at more than 98 % of the schemes is good for irrigation. Schemes with plain (less than 5 % gradient) or mild slope (5 - 10 % gradient) cover 94 % in North Sumatra, 75 % in South Sulawesi and 95 % in West Nusa Tenggara. In conclusion, it is seemed that soils and other physical conditions at the Project areas are not serious constraints for the agricultural development.

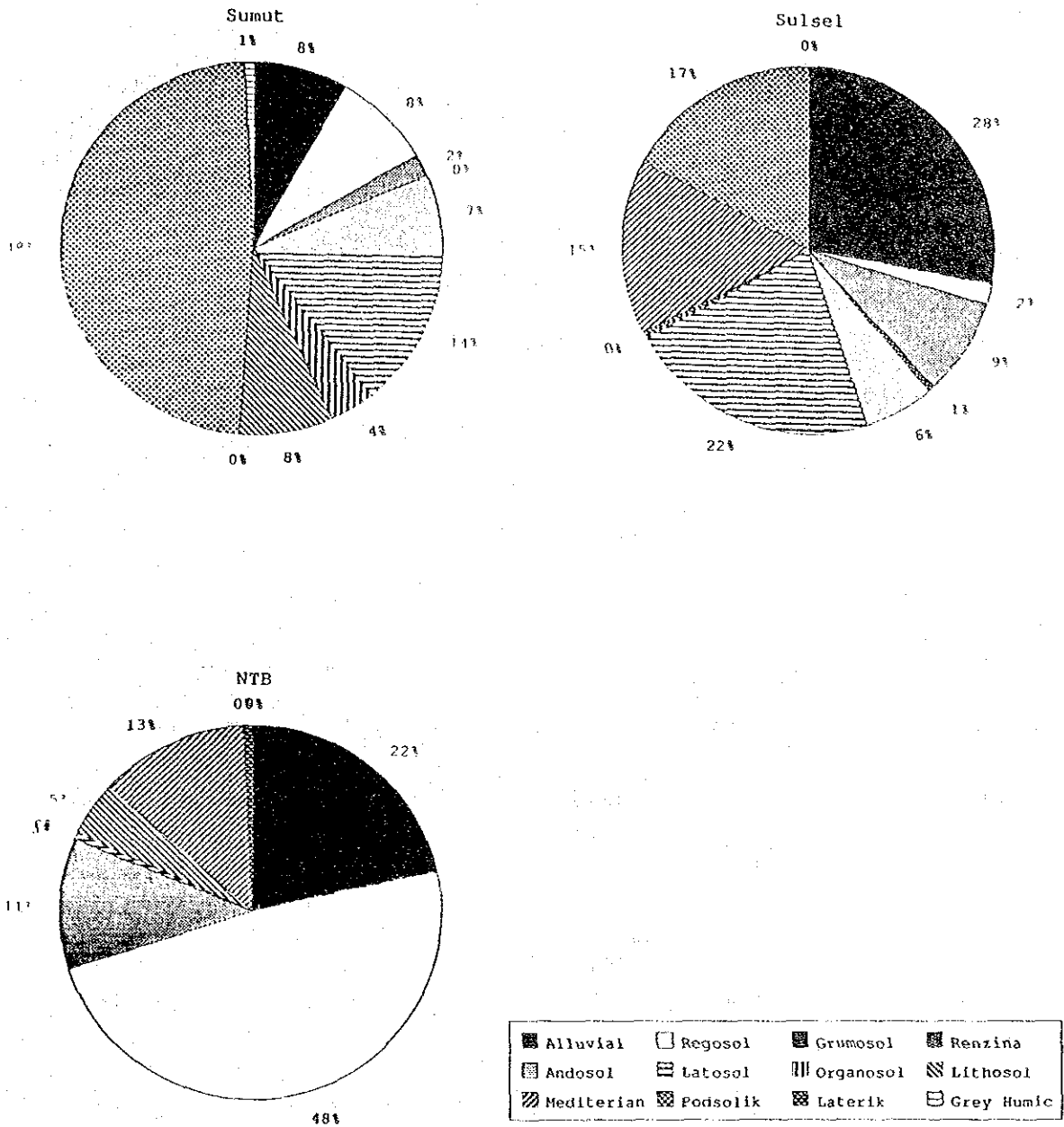


Fig. 4-3-1 SOILS OF THE PROJECT AREA BY INVENTORY SURVEY

4.3.2 Land Use in the Project

General feature of land use in wetland (wet paddy field) and dryland (used land except wet paddy field) is described below, based on statistical data in 1989. Total wet and dryland area and share of them in whole provincial area are as follows.

AREA OF WETLAND AND DRYLAND

Province	Wetland	Dryland	Total Area
North Sumatra	5,418 (7.6%)	35,701 (49.8%)	71,680 km ²
South Sulawesi	5,893 (9.4%)	26,849 (43.0%)	62,482 km ²
West Nusa Tenggara	1,972 (9.8%)	7,150 (35.5%)	20,153 km ²

First, wetland, which has 8 to 10 % share in each province, is divided by condition of irrigation and planting times of paddy per annum. This classification of wetland is represented in Table 4-3-1, and following facts are observed.

- The ratio of irrigated paddy field in total wet paddy field is 77 % in West Nusa Tenggara province, while about 50 % in other two provinces.
- As for technical level of irrigation, North Sumatra province has higher ratio of non technical level irrigated paddy field in total wet paddy field than other two provinces.
- As for planting times of paddy per annum, the ratio of wet paddy field planted twice or more times is about 40 to 45 % in total wet paddy field in all three provinces. Concerning additionally technical level of irrigation, however, there are differences in planting times of paddy by province. In West Nusa Tenggara province planting times are generally limited to be only once in non irrigated paddy field. On the other hand, in North Sumatra province double cropping of paddy is possible in more than 20 % of rainfed paddy field without irrigation.

The above features of land use in wet paddy field come mainly from amount and pattern of rainfall. North Sumatra

Table 4-3-1 AREA OF WETLAND BY IRRIGATION TYPE AND PADDY PLANTING TIMES IN 1989

Division	Planting Times	North Sumatra		South Sulawesi		West Nusa Tenggara	
		(ha)	(%)	(ha)	(%)	(ha)	(%)
Technical		51,317	9.5%	123,648	21.0%	37,727	19.1%
	1 X	478	(0.9%)	22,446	(18.2%)	2,904	(7.7%)
	> 2 X	50,839	(99.1%)	101,202	(81.8%)	34,823	(92.3%)
Semi Technical		62,831	11.6%	41,391	7.0%	76,292	38.7%
	1 X	12,188	(19.4%)	14,960	(36.1%)	44,863	(58.8%)
	> 2 X	50,643	(80.6%)	26,431	(63.9%)	31,429	(41.2%)
Non Technical		159,015	29.3%	151,062	25.6%	38,469	19.5%
	1 X	69,069	(43.4%)	58,200	(38.5%)	24,359	(63.3%)
	> 2 X	89,946	(56.6%)	92,862	(61.5%)	14,110	(36.7%)
Rainfed		209,540	38.7%	256,719	43.6%	39,334	19.9%
	1 X	165,257	(78.9%)	225,788	(88.0%)	39,029	(99.2%)
	> 2 X	44,283	(21.1%)	30,931	(12.0%)	305	(0.8%)
Tidal		9,204	1.7%	990	0.2%	5,242	2.7%
	1 X	7,195	(78.2%)	990	(100.0%)	5,242	(100.0%)
	> 2 X	2,009	(21.8%)	0	(0.0%)	0	(0.0%)
Others		49,925	9.2%	15,533	2.6%	185	0.1%
	1 X	47,756	(95.7%)	14,068	(90.6%)	185	(100.0%)
	> 2 X	2,169	(4.3%)	1,465	(9.4%)	0	(0.0%)
Total		541,832	100.0%	589,343	100.0%	197,249	100.0%
	1 X	301,943	(55.7%)	336,452	(57.1%)	116,582	(59.1%)
	> 2 X	239,889	(44.3%)	252,891	(42.9%)	80,667	(40.9%)

Source: Agricultural Survey: Land Area by Utilization for Outside of Java, 1989. Biro Pusat Statistik

province has a large amount of annual rainfall and some rainfall even in the dry season, and South Sulawesi province also has the elongated rainy season. On the contrary, West Nusa Tenggara has a relatively small amount of annual rainfall and the long dry season. Therefore, great efforts toward irrigation development have been made in West Nusa Tenggara compared with other two provinces.

Here, "non technical irrigation" includes "village irrigation" in this project. The ratio of this in total wet paddy field is about 20 % in West Nusa Tenggara to 30 % in North Sumatra. In the non technical irrigation paddy field, paddy is planted twice or more times a year in less than 40 % in West Nusa Tenggara, 50 to 60 % in the other provinces. Generally, the higher technical level on irrigation is, the higher a ratio of multiple cropping of paddy is.

Next, land use of dryland is described below (refer to Table 4-3-2). Garden and dry field area is mostly used for food crops production, and ratio of it in total dryland is 14 % in North Sumatra and 22 % in other two provinces. From the view point of agricultural land, share of estate land represents feature of land use in dryland. The ratio of estate land in total dryland is 36 % in North Sumatra, 13 % in South Sulawesi, and only 3 % in West Nusa Tenggara. In North Sumatra province, there are many large scale estate farms even in plain land, and great efforts toward estate crop production have been made historically. In South Sulawesi province, estate land is pushed on with in the central area with relatively high elevation. On the contrary, in West Nusa Tenggara estate land is very limited due to unsuitable climatic condition and so on.

Present and future land use areas on each scheme area are studied in a part of the inventory survey. At the same time, present and future planted area of crops on the wetland and dryland are surveyed. The results of land use survey are shown in Table 4-3-3. In the land development schemes the irrigated paddy field expands widely. And in the village irrigation schemes some portion of rainfed paddy field, dryland, plantation is transformed into irrigated paddy field.

Table 4-3-2 AREA OF DRYLAND BY UTILIZATION IN 1989

Division	North Sumatra		South Sulawesi		N.T.B	
	ha	%	ha	%	ha	%
House compound	261,062	7.3	166,108	6.2	24,886	3.5
Garden/dry field	507,303	14.2	595,548	22.2	160,506	22.4
Shifting cultivation	224,817	6.3	191,151	7.1	41,222	5.8
Grass land	172,653	4.8	314,445	11.7	98,861	13.8
Swamp	177,992	5.0	36,655	1.4	963	0.1
Dike	5,808	0.2	78,786	2.9	5,173	0.7
Pond	6,561	0.2	11,251	0.4	622	0.1
Temporary fallow land	417,951	11.7	304,461	11.3	43,877	6.1
Private wood forest	526,961	14.8	630,281	23.5	318,487	44.5
Gov. & Pri. estate land	1,268,960	35.5	356,219	13.3	20,427	2.9
Total	3,570,068	100.0	2,684,905	100.0	715,024	100.0

Source : Agricultural Survey; Land Area by Utilization for Outside of Java, 1989, Biro Pusat Statistik

Table 4-3-3 AVERAGE FARM LAND AREA BY INVENTORY SURVEY
Unit:ha

Land Use	N.Sumatra		S.Sulawesi		W.Nusa Tenggara	
	LD	VI	LD	VI	LD	VI
Present Land Use						
Irrigated Paddy	110	74	168	77	297	70
Rainfed Paddy	23	34	127	77	145	43
Dryland	22	34	81	69	356	98
Plantation	8	5	30	17	67	18
Future Land Use						
Irrigated Paddy	222	122	219	111	340	81
Rainfed Paddy	2	8	24	51	23	8
Dryland	4	10	34	59	183	34
Plantation	3	4	20	14	1	3

Note; LD = Land Development, VI = Village Irrigation.

4.4 Agriculture

4.4.1 Food Crop Production

General condition of food crops production, such as rice and secondary crops (palawija), is discussed in this section, based on harvested area, yield rate and production during 1985 to 1990 as Table 4-4-1.

The three provinces are the greatest rice producers in outer Java. The amount of paddy production in the provinces exceeds demand in the year of 1989. The estimation of the supply and demand of rice is based on the following factors.

Conversion coefficient of husked rice; 68 % of unhusked rice
Use as seed ; 39.24 ton/ha
Forage of livestock; 2 %
Post harvest loss ; 7.9 %

The results of the estimation are shown as bellow. The provinces has larger amounts of rice production than rice consumption.

DEMAND AND SUPPLY ANALYSIS OF RICE IN 1989
Unit:1000 tons of husked rice

Province	Supply	Demand	Balance
N. Sumatra	1,493	1,384	109
S. Sulawesi	1,890	901	989
W. Nusa Tenggara	635	419	215

The three provinces have different features in secondary crops production. Major crops are maize in North Sumatra and South Sulawesi province, and legume, such as soybean and green peas, in West Nusa Tenggara province. In West Nusa Tenggara, which has highest ratio of harvested area of secondary crops to that of paddy in the three provinces, secondary crops are cultivated intensively in many wet paddy fields. In addition, extensive cultivation of secondary crops, such as green peas, is also practiced at dry field with unsuitable condition especially in the Sumbawa island, eastern part of West Nusa Tenggara, so yield rate of green peas is very low. On the other hand, farmers have a traditional custom not to plant any secondary crops in wet paddy field after harvest of paddy at many regions in North Sumatra and South Sulawesi. So, a lot of wet paddy fields are fallowed after harvest of paddy even with good condition of water.

Table 4-4-1 HARVESTED AREA, YIELD RATE AND PRODUCTION BY PROVINCE DURING 1985-1990

Province	Year	Wet Paddy			Upland Paddy			Total Paddy		
		Area (ha)	Yield (t/ha)	Production (t)	Area (ha)	Yield (t/ha)	Production (t)	Area (ha)	Yield (t/ha)	Production (t)
North Sumatra	1985	525,431	3.76	1,977,867	86,919	1.97	171,057	612,350	3.51	2,148,924
	1986	505,937	3.78	1,913,325	76,519	2.02	154,497	582,456	3.55	2,067,822
	1987	569,454	3.78	2,152,146	87,200	1.92	167,047	656,654	3.53	2,319,193
	1988	592,775	3.91	2,318,139	80,110	2.06	164,799	672,885	3.69	2,482,938
	1989	589,523	4.02	2,369,841	79,900	2.14	171,033	669,423	3.80	2,540,874
	*1990	466,201	3.97	1,850,714	54,274	2.23	120,793	520,475	3.79	1,971,507
** Average		556,624	3.85	2,146,264	82,130	2.02	165,687	638,754	3.62	2,311,950
South Sulawesi	1985	663,300	4.01	2,656,825	18,960	1.74	33,009	682,260	3.94	2,689,834
	1986	666,410	4.06	2,707,626	19,525	1.79	34,891	685,935	4.00	2,742,517
	1987	639,952	3.96	2,534,218	16,690	1.70	28,436	656,642	3.90	2,562,654
	1988	681,093	4.13	2,810,973	15,348	1.88	28,848	696,441	4.08	2,839,821
	1989	771,493	4.25	3,277,101	15,344	2.00	30,706	786,837	4.20	3,307,807
	*1990	480,487	4.39	2,108,811	10,771	2.12	22,802	491,258	4.34	2,131,613
** Average		684,450	4.08	2,797,349	17,173	1.82	31,178	701,623	4.02	2,828,527
West Nusa Tenggara	1985	234,823	3.89	913,770	16,445	1.68	27,628	251,268	3.75	941,398
	1986	231,798	3.91	907,191	14,898	1.71	25,490	246,696	3.78	932,681
	1987	230,331	4.02	925,908	13,958	1.69	23,646	244,289	3.89	949,554
	1988	233,511	4.20	981,657	16,224	1.77	28,677	249,735	4.05	1,010,334
	1989	250,509	4.31	1,078,900	17,101	1.85	31,658	267,610	4.15	1,110,558
	*1990	242,014	4.42	1,069,485	14,630	1.99	29,075	256,644	4.28	1,098,560
** Average		236,194	4.07	961,485	15,725	1.74	27,420	251,920	3.92	988,905

Province	Year	Maize			Cassava			Sweet potato		
		Area (ha)	Yield (t/ha)	Production (t)	Area (ha)	Yield (t/ha)	Production (t)	Area (ha)	Yield (t/ha)	Production (t)
North Sumatra	1985	46,909	1.93	90,675	19,018	12.10	230,118	14,838	9.30	137,993
	1986	58,866	1.86	109,373	19,789	12.50	247,362	14,335	9.20	131,882
	1987	63,801	2.21	140,681	20,777	11.80	245,169	13,662	9.50	129,790
	1988	81,383	2.05	166,509	27,379	12.10	331,283	15,089	9.70	146,362
	1989	85,378	2.33	198,759	37,510	12.20	457,627	19,200	8.10	155,524
	*1990	58,250	2.27	132,345	20,927	10.80	226,014	10,889	8.80	95,826
** Average		67,267	2.07	141,199	24,895	12.14	302,312	15,425	9.16	140,310
South Sulawesi	1985	263,201	1.44	379,799	33,237	10.50	348,988	9,161	8.20	75,120
	1986	314,106	1.55	486,550	36,755	11.80	433,709	9,675	8.30	80,302
	1987	284,129	1.55	440,968	31,890	11.50	366,739	8,429	6.60	55,634
	1988	321,074	1.56	501,839	41,084	10.90	447,815	8,581	7.20	61,786
	1989	230,751	1.61	371,278	51,457	11.20	576,319	8,802	8.40	73,936
	*1990	253,403	1.71	432,306	26,549	11.70	310,621	5,115	9.30	47,567
** Average		282,652	1.54	436,087	38,885	11.18	434,714	8,930	7.74	69,356
West Nusa Tenggara	1985	22,767	1.52	34,606	14,794	9.70	143,502	7,527	9.10	68,496
	1986	24,097	1.72	41,447	11,208	10.60	118,805	8,818	9.50	83,771
	1987	18,541	1.54	28,460	11,188	10.30	115,233	6,404	10.30	65,964
	1988	22,628	1.69	38,128	10,881	10.50	114,248	9,419	10.20	96,078
	1989	26,573	1.82	48,310	15,221	11.30	172,000	8,466	11.10	93,973
	*1990	19,834	2.09	41,532	8,478	11.50	97,493	1,151	11.40	13,119
** Average		22,921	1.66	38,190	12,658	10.48	132,758	8,127	10.04	81,656

Table 4-4-1 (CONTINUED)

Province	Year	Peanut			Soybean			Green Pea***		
		Area (ha)	Yield (t/ha)	Production (t)	Area (ha)	Yield (t/ha)	Production (t)	Area (ha)	Yield (t/ha)	Production (t)
North Sumatra	1985	13,082	1.18	15,450	11,398	0.89	10,133	2,220	0.91	2,018
	1986	12,241	1.22	14,959	21,965	0.92	20,274	3,619	0.95	3,423
	1987	18,975	1.06	20,133	26,009	1.08	27,986	5,678	0.92	5,242
	1988	24,750	1.02	25,245	29,467	1.10	32,296	8,094	0.94	7,645
	1989	23,240	0.92	21,334	24,056	1.06	25,403	10,547	0.94	9,966
	*1990	12,719	0.88	11,244	16,098	1.08	17,321			
** Average		18,458	1.08	19,424	22,579	1.01	23,218	6,032	0.93	5,659
South Sulawesi	1985	40,087	1.09	43,815	18,278	0.93	16,999			
	1986	53,364	1.22	65,051	34,763	1.02	35,493			
	1987	47,177	1.09	51,187	38,108	1.04	39,747			
	1988	54,223	1.00	53,952	38,533	1.00	38,610	57,889	0.89	51,779
	1989	39,280	0.91	35,627	23,888	1.10	26,181	35,751	0.86	30,710
	*1990	33,579	0.82	27,367	23,140	1.21	27,999			
** Average		46,826	1.06	49,926	30,714	1.02	31,406	46,820	0.88	41,245
West Nusa Tenggara	1985	10,702	0.97	10,360	60,981	0.84	51,163	28,586	0.44	12,460
	1986	15,385	1.27	19,524	92,467	0.98	90,710	28,085	0.41	11,606
	1987	18,075	1.18	21,292	77,758	1.06	82,657	27,840	0.39	10,876
	1988	16,108	1.11	17,816	98,843	1.05	103,785	30,444	0.40	12,133
	1989	19,045	1.10	20,988	118,289	1.08	127,516	37,808	0.40	15,122
	*1990	10,313	0.95	9,756	74,255	0.99	73,141			
** Average		15,863	1.12	17,996	89,668	1.00	91,166	30,553	0.41	12,439

Source: Statistik Indonesia 1989, Biro Pusat Statistik.
Statistik Indonesia 1990, Biro Pusat Statistik.

Note *: Preliminary figures for the period of January to August 1990.

Note **: Average for 5 years from 1985 to 1989.

Note ***: Source: Sumatera Utara Dalam Angka 1989
Sulawesi Selatan Dalam Angka 1989
Nusa Tenggara Barat Dalam Angka 1989

4.4.2 Cropping Pattern and Cropping Intensity

As for present and future cropping pattern, areas of seven (7) typical patterns are asked in the inventory survey. The results on the item are shown in Fig. 4-4-1. The cropping intensity on wet paddy field can be calculated from these data. The provincial features of cropping intensity are described below.

In North Sumatra province, the cropping intensity of paddy and secondary crops is seemed to increase from 160 % to 200 % after implementation of the project. In South Sulawesi province, the cropping intensity of paddy and secondary crops is seemed not to increase very much, but the cropping intensity of paddy, except secondary crops, is to increase from 140 % to 160 %. Secondary crops will be changed into paddy there. In comparison with those 2 provinces, West Nusa Tenggara province has the feature of high cropping intensity due to lots of secondary crop cultivation in wet paddy field. The present cropping intensity of paddy and secondary crops is 250 % and will increase nearly to 300 %.

Here, the results of the survey may not represent real condition on the fields because of difficulty in the question about that. In further study, the cropping pattern on each project area should be examined thoroughly based on water availability, climate, soils, marketing and farmers' intention.

4.4.3 Yield Rate

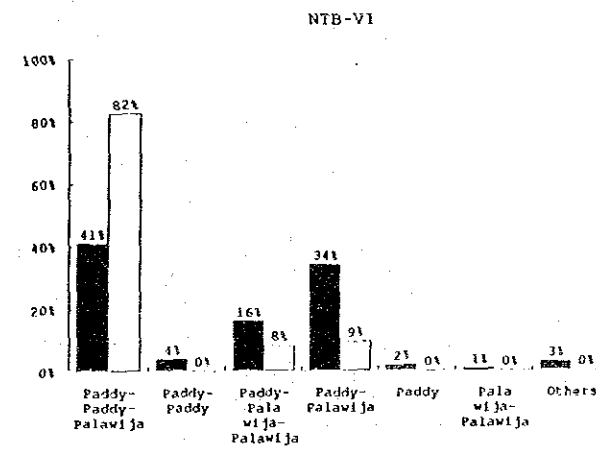
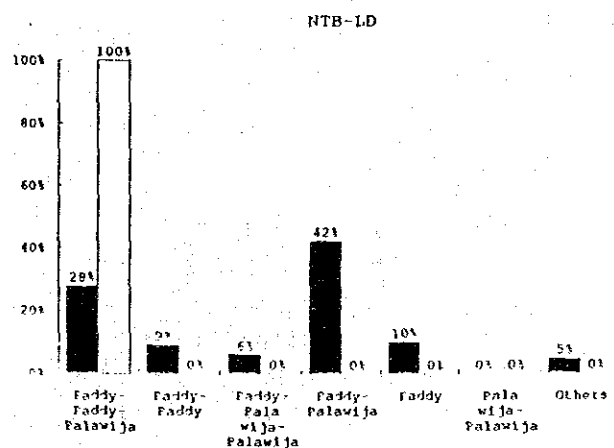
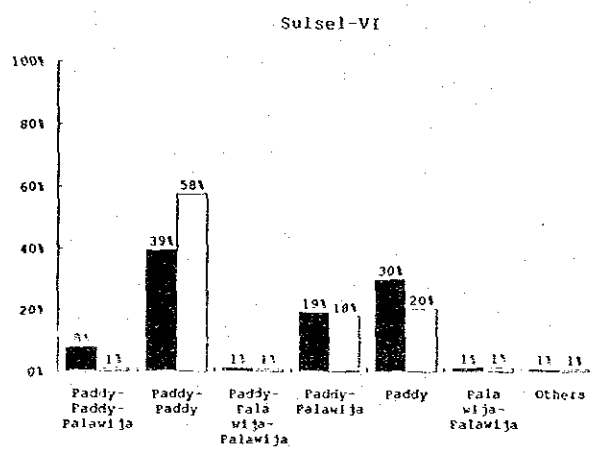
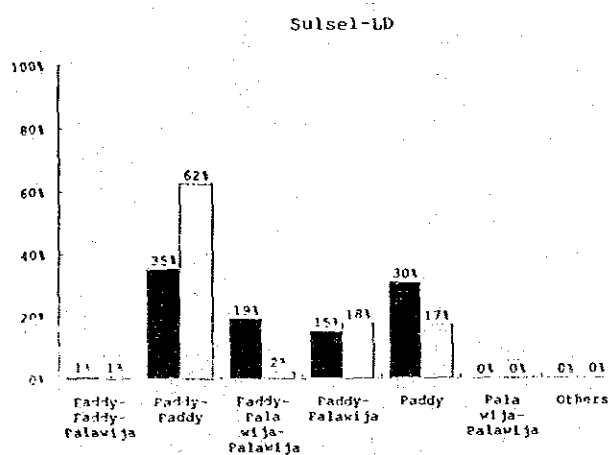
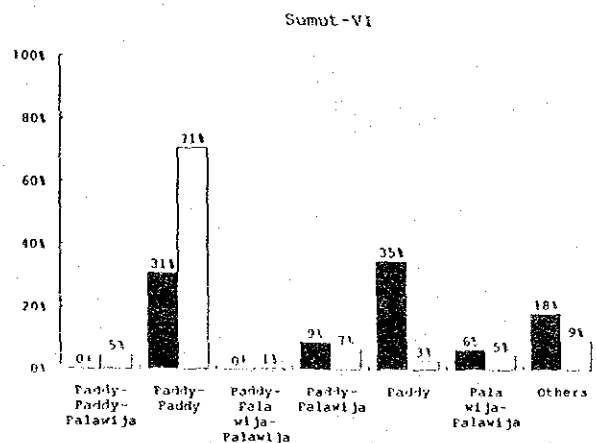
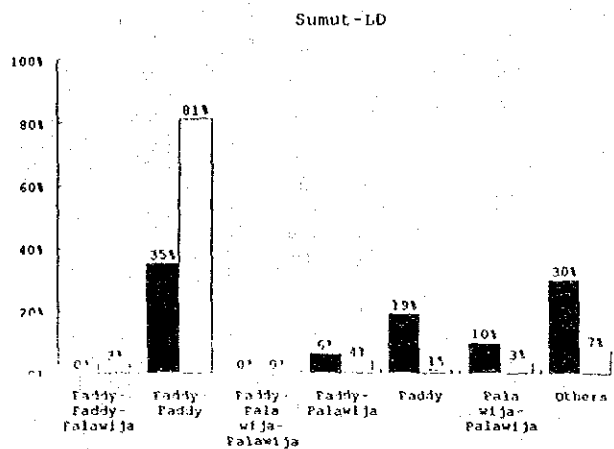
Present and future yield rates of paddy and each secondary crop were also surveyed. The average yield rates of them are illustrated by province and kind of schemes as shown in Fig. 4-4-2, although the data has relatively large deviation.

The answers on yield rate are seemed to have some bias toward higher than real one. For example, average yield rate of wet paddy in village irrigation schemes is higher than statistical data in 5-year average from 1985 to 1989, as below. Those statistical data cannot be simply compared with the results of the survey because of a different category. But the facts, that every average yield rate exceed statistical data and the most of survey areas are not developed very well, are enough for determination of upward bias. Such trend is founded in those of secondary crops.

YIELD OF PADDY ON STATISTICS AND INVENTORY SURVEY
 Unit: ton/ha

Province	Statistics	Inventory Survey	
	Average	Present	Future
N. Sumatra	3.85	4.8	6.6
S. Sulawesi	4.08	4.5	6.0
W. Nusa Tenggara	4.07	4.5	4.8

Source; Statistik Indonesia, BPS



■ Present
□ Future

Fig. 4-4-1 CROPPING PATTERN IN PADDY FIELD BY INVENTORY SURVEY

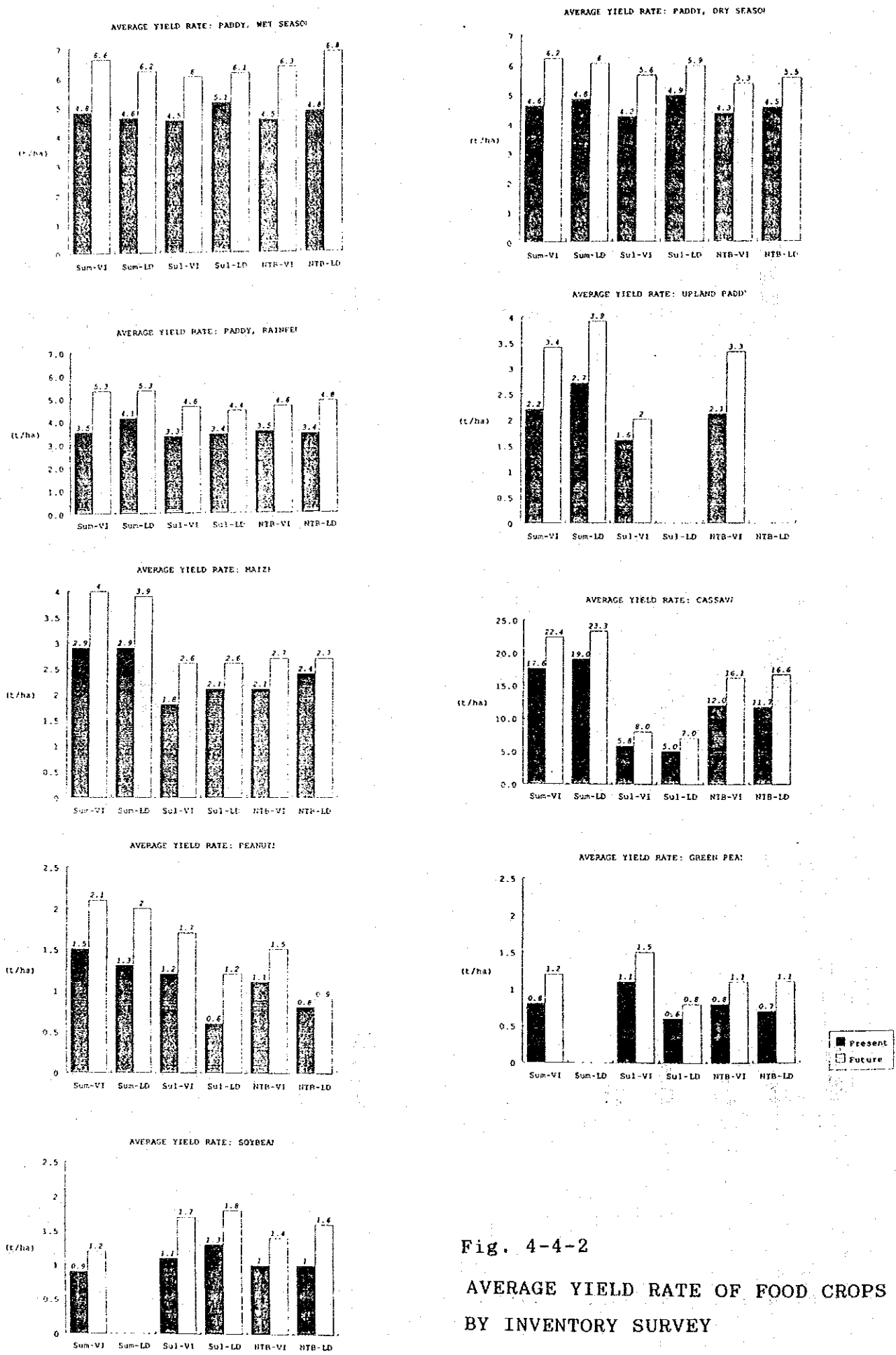


Fig. 4-4-2
 AVERAGE YIELD RATE OF FOOD CROPS
 BY INVENTORY SURVEY

4.5 Agricultural Economy

4.5.1 Population

Average population and labor force size in the schemes are summarized in Table 4-5-1. Average population in village irrigation schemes is about 310 per scheme, whereas that in land development schemes is widely variable due to small number of schemes. As for labor force by sector, ratio of farmers in total labor force is about 80 %, which is higher than national average of 56 % in 1989. Economic activity except agricultural sector is still low in the scheme areas.

Table 4-5-1 AVERAGE POPULATION AND LABOR FORCE
BY INVENTORY SURVEY

Unit: Nos

Item	N.Sumatra		S.Sulawesi		W.Nusa Tenggara	
	LD	VI	LD	VI	LD	VI
Farm Household	269	317	421	306	855	329
Population	2,016	1,474	2,124	1,494	3,925	1,570
Labor Force	879	798	893	632	2,271	838
Agriculture	830	674	853	520	1,278	595
Official	24	18	26	17	42	21
Commercial	8	13	14	8	41	21
Others	41	72	1	8	273	84

4.5.2 Farm Size

According to the inventory results, average gross area of village irrigation schemes is 159 ha in North Sumatra, 310 ha in South Sulawesi and 429 ha in West Nusa Tenggara. Regarding to only irrigated paddy field, however, the area is not so different, i.e., 86 ha, 88 ha and 99 ha, respectively.

The average irrigated paddy field per farm household is about 0.23 ha for village irrigation schemes and about 0.4 ha for land development schemes at present condition, based on the inventory survey. The implementation of the Project enlarges irrigated paddy field managed by each farmers. Extension of irrigated paddy field in West Nusa Tenggara is relatively smaller than other provinces.

AVERAGE IRRIGATED PADDY FIELD AREA
PER FARM HOUSEHOLD BY INVENTORY SURVEY

Item	N.Sumatra		S.Sulawesi		W.Nusa Tenggara	
	LD	VI	LD	VI	LD	VI
Irrigated Paddy Field (ha)						
Present	0.41	0.23	0.40	0.24	0.35	0.22
Future	0.83	0.38	0.52	0.36	0.40	0.25

Real scheme area, as described hereafter, is estimated at about 70 % of inventory results in the detail study on the representative 30 schemes. Therefore, those inventory results concerning to area should be multiplied by 70 % to be real scheme area.

4.5.3 Land Ownership and Land Status

The present conditions of land ownership and land status in the schemes are shown in Table 4-5-2. More than half land owing farmers settles themselves in the scheme area, and the number of land owners living in outside of the kabupaten is very small in average. It is expected that there are little problem on land ownership except some schemes.

Most of land in the schemes is belong to private land, although there are some kabupaten, province or state-owned land. Land boundary of property land is clear in the almost all schemes.

Table 4-5-2 AVERAGE LAND OWNERSHIP AND LAND STATUS
BY INVENTORY SURVEY

Item	N.Sumatra		S.Sulawesi		W.Nusa Tenggara	
	LD	VI	LD	VI	LD	VI
Land Owner (person)						
Farmer at Site	345	259	404	221	765	286
Out of Kecamatan	327	196	86	161	665	238
Out of Kabupaten	5	8	42	7	10	4
Land Status (nos.)						
Private	201	134	326	212	569	148
District	22	26	0	5	27	13
National	12	3	18	44	0	98
Border of Land (nos.)						
Clear	31	227	10	319	20	124
Not Clear	1	1	0	4	0	0

4.5.4 Marketing of Farm Products

The major marketing channels of agricultural products are as follows.

- 1) Traders purchase crops from farmers
- 2) Farmers sell crops directly at open markets
- 3) Village Unit Cooperative (KUD) intervenes between farmers and traders or National Logistics Agency (BULOG)

According to the field survey, the marketing channels through traders and farmers themselves are popular in the scheme areas. Presently, KUDs are not so active as a marketing channel of farm products. The case of 1) and 2) have some advantages to producers. In the case of 1), farmers can get cash directly without transportation of crops and negotiate a price with the traders. And in the case of 2), farmers can also get cash by carrying crops to a near market and selling themselves. Traders offer collected farm products to retailers or wholesalers in an urban area.

Every Kacamatan capitals have a public market which deals in farm products for consumers every day. In every Kabupaten capitals, there are various kinds of open market to sell agricultural products by traders or farmers.

4.5.5 Farm-gate Price

According to the inventory survey, farm-gate prices of the major food crops at the scheme areas are summarized as shown in Table 4-5-3. There are wide deviations in the prices on the inventory results. For instance, a price of rice is more than Rp. 500 per kg at the most of North Sumatra schemes, but the price is between Rp. 200 to 299 per kg at the almost all West Nusa Tenggara schemes. It should be considered that the higher price of North Sumatra is as dry husked paddy and the lower price of West Nusa Tenggara is as dry unhusked paddy. Since the prices of crops are affected by variety, condition and season, the results of the inventory survey are difficult to treat uniformly. The other factors affecting to a price level are distance from farms to markets and access condition of roads. As the most of the schemes area is relatively less developed in infrastructure, the price of crops generally seems to be at lower level than provincial average.

Table 4-5-3 AVERAGE FARM-GATE PRICES OF MAJOR FOOD CROPS
BY INVENTORY SURVEY

Unit:Rp./kg

Crop	N.Sumatra		S.Sulawesi		W.Nusa Tenggara	
	LD	VI	LD	VI	LD	VI
Rice	509	516	491	432	348	247
Maize	222	222	175	193	247	254
Cassava	80	74	50	112	57	75
Peanut	916	955	1,100	1,088	1,363	1,258
Green Pea	889	921	526	717	957	936
Soybean	647	710	613	609	871	843

4.5.6 Farm Economy

An agricultural income and production cost in the scheme areas are investigated through the inventory survey, direct interview to farmers and existing data of provincial agriculture offices. The data surveyed by provincial officers are most reliable on general farm economic conditions in the provinces. The crop budgets of major crops are investigated through sample farmers by provincial agriculture office in 1990/91, as shown in Table 4-5-4. There are some differences among the provinces. The economic return in crop cultivation seems relatively to be lower than provincial average, because the most of the schemes had disadvantage in topographical condition.

Table 4-5-4 PRODUCTION VALUE AND COST ANALYSYS OF MAIN FOOD CROPS IN 1990/91

NORTH SUMATRA

Crops	Yield	Unit Price	Gross Income	Production Cost			Total	Net Income	R/C
				Labor	Material	Others			
	kg	Rp/kg	Rp	Rp	Rp	Rp	Rp	Rp	
Rice	5,737	265	1,520,305	568,100	135,278	245,550	948,928	571,377	1.60
Maize	4,350	180	783,000	290,750	126,820	139,300	556,870	226,130	1.41
Cassava	17,500	50	875,000	299,500	96,500	118,500	514,500	360,500	1.70
Peanut	985	1,300	1,280,500	389,000	175,475	74,750	639,225	641,275	2.00
Soybean	1,350	700	945,000	307,000	65,201	132,800	505,001	439,999	1.87

SOUTH SULAWESI

Crops	Yield	Unit Price	Gross Income	Production Cost			Total	Net Income	R/C
				Labor	Material	Others			
	kg	Rp/kg	Rp	Rp	Rp	Rp	Rp	Rp	
Rice	6,424	220	1,413,280	430,613	131,287	181,282	743,182	670,098	1.90
Maize	2,706	124	335,544	147,120	71,192	73,508	291,820	43,724	1.15
Soybean	790	575	454,250	212,631	80,451	66,991	360,073	94,177	1.26
Peanut	680	1,000	680,000	198,800	164,266	167,906	530,972	149,028	1.28
Green Pea	993	585	580,905	132,457	40,843	71,821	245,121	335,784	2.37
Cassava	19,112	24	458,688	164,300	49,775	3,525	217,600	241,088	2.11

WEST NUSA TENGGARA

Crops	Yield	Unit Price	Gross Income	Production Cost			Total	Net Income	R/C
				Labor	Material	Others			
	kg	Rp/kg	Rp	Rp	Rp	Rp	Rp	Rp	
Rice	25,020	215	5,379,300	1,382,085	621,725	1,661,715	3,665,525	1,713,775	1.47
Peanut	3,475	900	3,127,500	769,000	534,500	531,925	1,835,425	1,292,075	1.70
Soybean	5,300	798	4,229,400	1,244,000	529,500	1,417,990	3,191,490	1,037,910	1.33

Source: Provincial Agriculture Office

4.6 Agricultural Supporting System

The institutional aspects of motivation to farmers' activities are described in this section. Present situation of the intensification programs, agricultural extension services, Village Unit Cooperatives (KUDs) and so on, at the scheme areas is summarized on the basis of the inventory survey, as shown in Table 4-6-1.

Table 4-6-1 AGRICULTURAL SUPPORTING SYSTEM BY INVENTORY SURVEY

Crop	N.Sumatra		S.Sulawesi		W.Nusa Tenggara	
	LD	VI	LD	VI	LD	VI
Introduction of Intensification Programs (sites)						
INSUS	15	151	7	217	13	72
SUPRA INSUS	2	19	1	26	4	26
Both	0	0	0	5	0	0
Others	15	75	0	97	2	30
Activity of Field Extension Worker (sites)						
Active	25	213	8	301	18	109
Not Active	5	25	0	24	2	10
None	1	7	1	2	0	3
Activity of Village Unit Cooperative (sites)						
Active	9	72	1	167	10	61
Not Active	23	155	8	163	7	63

4.6.1 Intensification Program

The Indonesian Government has widely introduced some intensification programs for increasing of agricultural production. Mass Guidance (Bimas) is formulated and adopted in 1965 to guide the process of agricultural change at the farm level. The scheme was basically designed to develop conditions in which a large number of farmers are motivated and guided in the adoption of new agrotechnology as the key to achieving higher productivity and financial return. Regular Intensification (Inmum) involves the dissemination of technology and other farm inputs to individual farmers without any obligation for joint effort with others. Under Special Intensification (Insus), more intensive farming is implemented by individual farmers cooperating in groups, through which farm inputs are channeled. At the highest level of Super Intensification (Supra Insus), starting from 1987, rice production is intensified through cooperation not only among farmers in one group, but also among farmers groups covering a wider geographical area of between 5,000 and 25,000 ha.

In 1989, the wet paddy field covered by Supra Insus, Insus and Inmum amount to about 2.26 million ha, 5.38 million ha and 1.82 million ha, respectively. This means about 96 % of total wet paddy field is covered by some intensification programs in Indonesia. In all of the three provinces, intensification programs are introduced in more than 96 % of wet paddy field, and Supra Insus in 26 to 29 % of wet paddy field in the same year.

According to the inventory survey, Insus program is widely introduced to the most schemes in the three provinces. Supra Insus, the most intensive program, extends to 20 % of the schemes in West Nusa Tenggara province, and fewer in the other two provinces. Compared with provincial average which is in terms of introduced area by Intensification programs, introduction of Supra Insus program delays up to now due to some relatively unsuitable conditions of the project area.

4.6.2 Agricultural Extension Service

For the farm technical support, Field Extension Centers (BPPs) have established with founding of the Agency for agricultural Education, Training and Extension, Ministry of Agriculture, since 1974. The BPP is basically expected to be one unit per kecamatan in rural area. A BPP is organized by an extension supervisor (PPM), field extension workers (PPLs), and sometimes subject-matter specialist (PPS). Total number of the extension workers in Indonesia is 33,000 as of 1990. The numbers of PPM, PPL and PPS are about 7,000, 24,000 and 2,000, respectively.

The main functions of BPP are: 1) formulation of farmers' group, 2) guidance of new cultivation method, 3) training of key farmers at a local level, 4) establishment of demonstration farm, 5) support of marketing channel of production materials, and 6) on-farm research. Main extension methods of BPPs are 1) direct guidance to farmers, 2) visit to demonstration farm, and 3) dissemination of new technologies by booklets or slides.

According to the inventory survey of the Project, agricultural extension services by PPLs are active in the more than 80 % of the scheme areas. The schemes in which there is no PPL amount to only less than 3 % in the whole schemes. Those extension services are expected to be improved in quality, because the PPLs' roll will become larger with implementation of the Project.

4.6.3 Village Unit Cooperative

Village Unit Cooperative (KUD) is established for the purpose of motivation and support of farm production in Indonesia. The organization of KUD is under Ministry of Cooperative. The prime activities of KUD are: 1) marketing channel of farm inputs and products, 2) post-harvest handling, 3) agricultural credit, and 4) banking service. The number of KUDs established until 1989 is 505 in North Sumatra, 474 in South Sulawesi and 152 in West Nusa Tenggara. The number of their members is about 299,000, 842,000 and 221,000, relatively. The scale of KUD is smaller in North Sumatra than in other provinces.

KUD is one of important marketing channels especially in rural area. According to the inventory survey, however, the marketing activity of KUD is still low in general for the Project area. The results show that the marketing services of KUDs are active only in 40 % of the total schemes.

4.6.4 Farming Credit Program (KUT)

The Government serves financial support system for farmers through Indonesia Citizen Bank (BRI). The bank has branch offices in the provincial capitals and kabupaten capitals. Also local branch offices of the bank are established for 600 - 1,000 ha of farm land or 1,000 - 3,000 of farm household.

Since 1984, subsidized credits for food production, including rice, have been made available through the Farming Credit program (KUT). KUT channeled through Village Unit Cooperatives rather than to farmers directly. Disbursal of credit by the cooperatives to farmers groups based on plans drawn up by the groups themselves to define their needs. Repayment of loans and interest is made after harvest-time.

4.7 Operation and Maintenance

On the basis of the data/information collected through the inventory survey on O&M in Phase I, this study results have been derived through their analysis. The study results of the representative 30 schemes in Phase II have been fed back into this analysis.

Prior to the analysis, the effectiveness of the inventory survey data has been checked in order to handle or evaluate the data appropriately. As calculation results, the effective answers is 92-99 % except data on farmer's manpower contribution to O&M. It is thought that many farmers/interviewees could not count and sum up the working days correctly when questioned in the inventory survey.

Based on the effective data, data analysis have been made from following view-points and the analyzed results are given in Table 4-7-1.

- a. Farmer's O&M Organization,
- b. Operation Works,
- c. Maintenance Works, and
- d. Farmer's Contribution to O&M.

4.7.1 Organization for O&M

The categories of present O&M organizations have been divided broadly into three groups i.e. P3A(water user's association), traditional group, no-organization which are explained below :

1) P3A/Water User's Association:

P3A is an official group which is organizationally, technically and financially capable to carry out O&M of an irrigation network including its related structures within a tertiary unit or village irrigation area. The proposed P3A organization by Presidential Instruction No2, 1984 is given in Fig. 4-7-1.

2) Traditional Group:

This group has not been authorized officially but has functions for O&M at present. Generally the group was organized not only for O&M but also for other general works in a traditional/local society. Those groups such as Subak in Lombok or Raja Bondar in North Sumatra are included in

this group.

3) No-Organization:

In this category, farmers have not organized any O&M group at present and do not operate and maintain their network in any organizational way. Water charge/organization fee such as cash or payment in kind is not collected for O&M in this case.

Based on the above grouping, existing schemes have been classified as follows :

Existing O&M Organization

Province	With-Organization		Without No-Group
	WUA/P3A*	Traditional Group	
Village Irrigation	23 %	44 %	33 %
Land Development	47 %	38 %	15 %
Overall W. Average	25 %	43 %	32 %

Note, *;WUA/P3A: Organized Water User's Association

From the study results, following facts on water user's groups can be derived :

- i) In the study area, 25 % of the schemes have official water user's associations(P3A), 43 % have traditional groups and 32 % of the schemes have not organized any water user's groups yet.
- ii) P3As have not been widely organized yet in South Sulawesi and West Nusa Tenggara Province and have started on becoming common O&M organization in North Sumatra Province.
- iii) O&M of irrigation system under farmer's groups or P3As are widely done in West Nusa Tenggara and North Sumatra Province. Half(about 50%) of the system are operated and maintained now without any farmer's organization in South Sulawesi Province.

4.7.2 O&M of the System

Present O&M activities have been checked from following view-points :

- Operation Works: irrigator and rotational irrigation
- Maintenance Works: periodic tree/grass cutting, re-shape/desilting of canals, and minor structure repair.

Based on the above checking, following table showing present O&M activities has been derived :

Present Operation Works

Province	Irrigator Ulu2/Pekasih	Rotational Irrigation
Village Irrigation	50 %	49 %
Land Development	70 %	74 %
Overall W. Average	52 %	51 %

Present Maintenance Works

Province	Tree/Grass Cut	Canal Re-Shape	Minor Repairs of Structures
Village Irrigation	86 %	76 %	83 %
Land Development	90 %	81 %	84 %
Overall W. Average	87 %	76 %	83 %

From the above analysis, following study results on O&M activities have been derived :

- i) In the study area, 3 provinces, 52 % of the schemes have irrigators such as Ulu-Ulu or Pekasih who manage water distribution and maintenance works. In West Nusa Tenggara and North Sumatra Province, more than 65 % of the schemes have irrigators. In South Sulawesi Province around 30 % have such irrigators and O&M are generally made without core responsible men.
- ii) Rotational irrigation in draught period is applied to 51 % of the schemes. This irrigation method is

popular (about 77%) in West Nusa Tenggara Province, since the province is the driest province among the three provinces.

- iii) The above all three maintenance works are made in all 3 provinces. Around 80 % of the schemes carry out some maintenance works periodically. In case of structure maintenance, only simple works such as desilting are thought to be made at present.

4.7.3 Farmer's Contribution to O&M

There are three forms of farmer's contributions for O&M at present which are cash payment, payment in kind and manpower. Payment in kind is generally made by paddy or other common crops in the irrigation area.

Manpower contribution could not be quantified by the results of the inventory survey because effective answers are less. It is thought, however, that all schemes have some forms of manpower contribution for O&M as long as the schemes exist, since Gotong-Royong (cooperation works for communal purposes) has been widely accustomed in the study area. Within the limited available data, averaged manpower contribution is 50 days but the average is thought to be too high.

On the other hand, cash/crop payment as farmer's contribution to water charge are calculated as follows:

Present Payment Contribution to O&M

Province	Payment in Cash		Payment in Kind	
	(%)	(Rp*)	(%)	(Kg#)
Village Irrigation	21 %	14,939	36 %	69
Land Development	36 %	10,805	62 %	63
Overall W. Average	22 %	14,407	38 %	69

Note; ^: Schemes which have the payment custom, *: Average Charge (Rp/ha/year), #: Average Weight in Paddy (Kg/ha/year)

From the study results, following study results on farmer's contribution to O&M can be derived :

- i) 22 % of the schemes in the study area have an internal regulation on irrigation service fee in cash payment

which average payment is 14,400 Rp/ha/year, and 38 % have it in crop payment which average is 69 Kg/ha/year in paddy.

- ii) Around 60-70 % of the schemes have decided to collect water charge in any form from group members in West Nusa Tenggara and North Sumatra Province, but less than 30 % of the schemes in South Sulawesi Province have done. Generally water charge as a form of organization fee is paid in cash or in kind, and payment in paddy is ordained as the fee in most cases.

4.7.4 Evaluation of Present O&M

The analyzed data have been evaluated in order to grasp general present conditions investigated by the inventory survey.

The evaluation items and their ranking marks have been considered through the above data analyses which are given in Table 4-7-2 and summarized as follows:

- a. O&M Organization: 25 points,
- b. Operation Activity: 20 points,
- c. Maintenance Activity: 25 points, and
- d. Farmer's Contribution to O&M: 30 points.

In accordance with the above evaluation criteria, present O&M of the respective schemes have been evaluated. Their evaluated marks are summarized below:

Averaged Marks in O&M Evaluation

Province	Village Irrigation	Land Development
North Sumatra	59	64
South Sulawesi	40	53
West Nusa Tenggara	60	71
Overall Average	50	65

Note: Full mark is 100 points.

The averaged mark is 50 points in village irrigation schemes and 65 points in land development schemes. Their breakdown and distribution of evaluated marks are given in Table 4-7-3 and Fig. 4-7-2.

4.7.5 Present Constraints on O&M

Present O&M constraints in the study area have been studied on the basis of the above general data analyses and field visits to sample schemes, however, generally O&M situations depend upon site specific conditions on which a irrigation scheme is located. Following O&M constraints at farm level have been identified :

Authorized water user's associations(P3A) have not been widely organized yet in 3 provinces. In West Nusa Tenggara and North Sumatra, existing traditional O&M groups are needed to be transformed or authorized into P3As. In South Sulawesi, half of the schemes have not any form of O&M organization, therefore, farmers in those schemes are required to be organized in any type of O&M group as a first step and to be transformed to authorized P3As as a second step.

As for the system operation, efficient and equal water distribution are thought to be rarely made, since half of the schemes operate canal systems without irrigators such as Ulu-Ulu and Pekasih and without rotational irrigation when water is not sufficient, especially in South Sulawesi.

Execution of simple maintenance works for canal systems have been widely accustomed in all 3 provinces, but it is thought from field visits that the maintenance works are insufficient in many cases. It is necessary that maintenance works shall be made efficiently and canals and related structures shall be designed so as to minimize regular maintenance works as far as the design has a economic feasibility.

Generally the collection of water charge has already started in all 3 provinces. About 20 % of the schemes have ordained the charge in cash and/or about 40 % in common crops, mainly paddy, in the irrigation area, but most of the schemes have not decided on the charge. In order to give a firm financial foundation to the farmer's O&M group, it is essential to introduce some water charge to those which do not collect the charge at present.

Table 4-7-1 INVENTORY SURVEY RESULTS FOR O&M(1/2)

Data Effectiveness

Question Items	Effective Answer
1. Farmer's Organization	98.4 %
2. Operation Works	
- Irrigator	92.6 %
- Rotational Irrigation	95.7 %
3. Maintenance Works	
- Tree/Grass Cut	97.0 %
- Canal Re-shaping	95.4 %
- Minor Structure Repair	94.8 %
4. Farmer's Contributions	
- Cash Payment	99.7 %
- Payment in Kind	99.7 %
- Working Days for O&M	60.6 %

Existing O&M Organization

Province	With-Organization		
	WUA/P3A*	Traditional G.	No-Group
I. Village Irrigation Area			
North Sumatra	48 %	28 %	24 %
South Sulawesi	9 %	45 %	46 %
West Nusa Tenggara	15 %	67 %	18 %
(Weighted Average)	(23 %)	(44 %)	(33 %)
II. Land Development Area			
North Sumatra	53 %	28 %	19 %
South Sulawesi	33 %	33 %	33 %
West Nusa Tenggara	45 %	55 %	0 %
(Weighted Average)	(47 %)	(38 %)	(15 %)
Overall W. Average	25 %	43 %	32 %

Note, *;WUA/P3A: Organized Water User's Association

Present Operation Works

Province	Irrigator Ulu2/Pekasih	Rotational Irrigation
I. Village Irrigation Area		
North Sumatra	65 %	50 %
South Sulawesi	30 %	40 %
West Nusa Tenggara	73 %	77 %
(Weighted Average)	(50 %)	(49 %)
II. Land Development Area		
North Sumatra	69 %	66 %
South Sulawesi	33 %	56 %
West Nusa Tenggara	90 %	95 %
(Weighted Average)	(70 %)	(74 %)
Overall W. Average	52 %	51 %

Table 4-7-1 INVENTORY SURVEY RESULTS FOR O&M(2/2)

Present Maintenance Works

Province	Tree/Grass Cut	Canal Re-Shape	Minor Repairs of Structures
I. Village Irrigation Area			
North Sumatra	84 %	77 %	83 %
South Sulawesi	87 %	71 %	80 %
West Nusa Tenggara	90 %	87 %	91 %
(Weighted Average)	(86 %)	(76 %)	(83 %)
II. Land Development Area			
North Sumatra	88 %	77 %	87 %
South Sulawesi	100 %	89 %	89 %
West Nusa Tenggara	90 %	85 %	79 %
(Weighted Average)	(90 %)	(81 %)	(84 %)
Overall W. Average	87 %	76 %	83 %

Present Payment Contribution to O&M

Province	Payment in Cash (%) (Rp*)		Payment in Kind (%) (Kg#)	
I. Village Irrigation Area				
North Sumatra	26 %	15,480	56 %	39
South Sulawesi	14 %	15,424	10 %	194
West Nusa Tenggara	26 %	13,176	67 %	68
(Weighted Average)	(21 %)	(14,939)	(36 %)	(69)
II. Land Development Area				
North Sumatra	22 %	15,960	72 %	35
South Sulawesi	67 %	9,750	22 %	81
West Nusa Tenggara	45 %	7,500	65 %	110
(Weighted Average)	(36 %)	10,805	(62 %)	(63)
Overall W. Average	22 %	14,407Rp	38 %	69kg

Note; ^: Schemes which have the payment custom, *: Average Charge(Rp/ha/year), #: Average Weight in Paddy(Kg/ha/year)

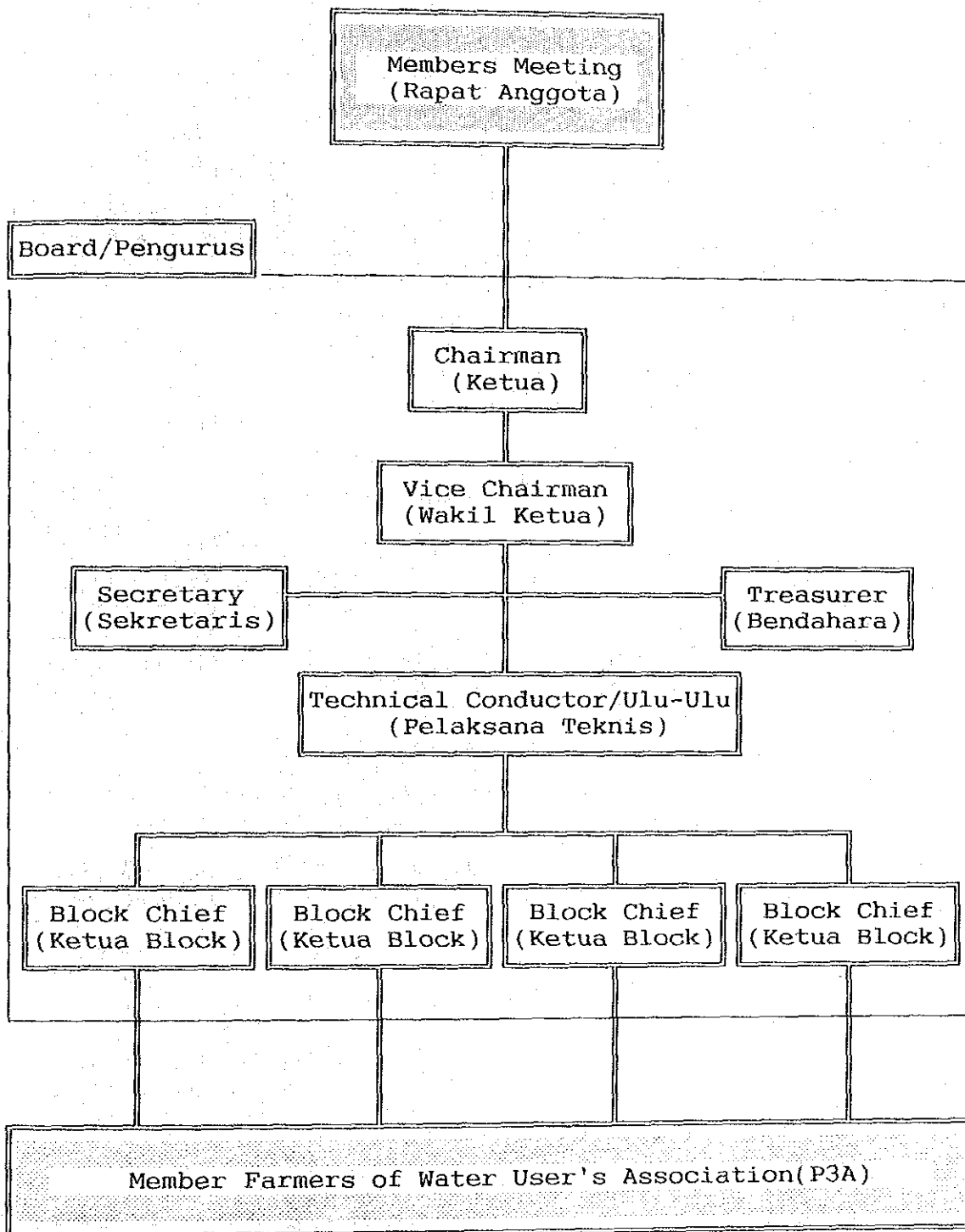
Table 4-7-2 EVALUATION CRITERIA FOR O&M

No	Evaluated Items & Marks
a.	O&M Organization(Full mark: 25 points) <ul style="list-style-type: none"> - Registered P3A Organization(25 points), - Traditional Farmer's Organization(15 points), - No Organization(0 point).
b.	Operation Activity(Full mark: 20 points) <ul style="list-style-type: none"> - Irrigator(10 points) - Rotational Irrigation in Drought Time(10 points)
c.	Maintenance Activity(Full mark: 25 points) <ul style="list-style-type: none"> - Grass/Tree Cutting along Canal(5 points) - Canal Re-shaping(10 points) - Minor Repairs for Structure(10 points)
d.	Cash/Crop Payment for Irrigation Service Fee (Full mark: 20 points) <ul style="list-style-type: none"> - Fee > 20,000 Rp (20 points) - Fee = 10,000 to 20,000 Rp (15 points) - Fee = 0 to 10,000 Rp (5 points) - No Fee (0 point)
e.	Manpower Contribution to O&M(Full mark: 10 points) <ul style="list-style-type: none"> - Manpower > 60 days (10 points) - Manpower = 30 to 60 days (8 points) - Manpower = 0 to 30 days (5 points) - No Manpower Contribution (0 points)
Total (Full Mark)	
	100

Table 4-7-3 SUMMARY OF EVALUATED MARKS OF PRESENT O&M

Full Mark:100

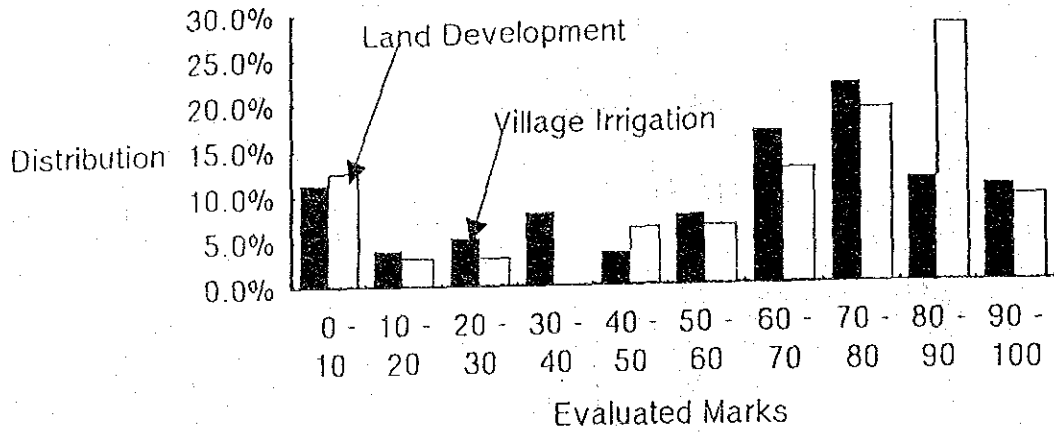
No	Province	District/Kabupaten	Nos	Marks
I. Village Irrigation Schemes				
1	North Sumatra	Tapanuli Selatan	39	73
2	"	Tapanuli Tengah	29	52
3	"	Tapanuli Utara	46	46
4	"	Labuhan Batu	21	35
5	"	Asahan	5	50
6	"	Dairi	44	81
7	"	Karo	31	55
8	"	Deli Serdang	10	45
9	"	Langkat	22	63
			Averaged Mark	59.0
1	South Selawesi	Bulkumba	43	46
2	"	Bantaeng	9	36
3	"	Jeneponto	22	44
4	"	Gowa	12	54
5	"	Sinjai	13	65
6	"	Bone	32	11
7	"	Maros	27	18
8	"	Barru	10	36
9	"	Soppeng	10	75
10	"	Wajo	16	43
11	"	Sdrap	1	25
12	"	Enrekang	34	43
13	"	Luwu	27	57
14	"	Tana Toraja	35	34
15	"	Polmas	39	41
16	"	Majene	1	20
17	"	Mamuju	14	29
18	"	Pare-Pare	4	75
			Averaged Mark	39.9
1	West Nusa Tenggara	Lombok Barat	20	54
2	"	Lombok Tengah	14	43
3	"	Lombok Timur	25	70
4	"	Sumbawa	39	51
5	"	Dompu	10	78
6	"	Bima	29	68
			Averaged Mark	59.7
II. Land Development Schemes				
1	North Sumatra	-	19	64
2	South Selawesi	-	10	53
3	West Nusa Tenggara	-	20	71
			Averaged Mark	64.6



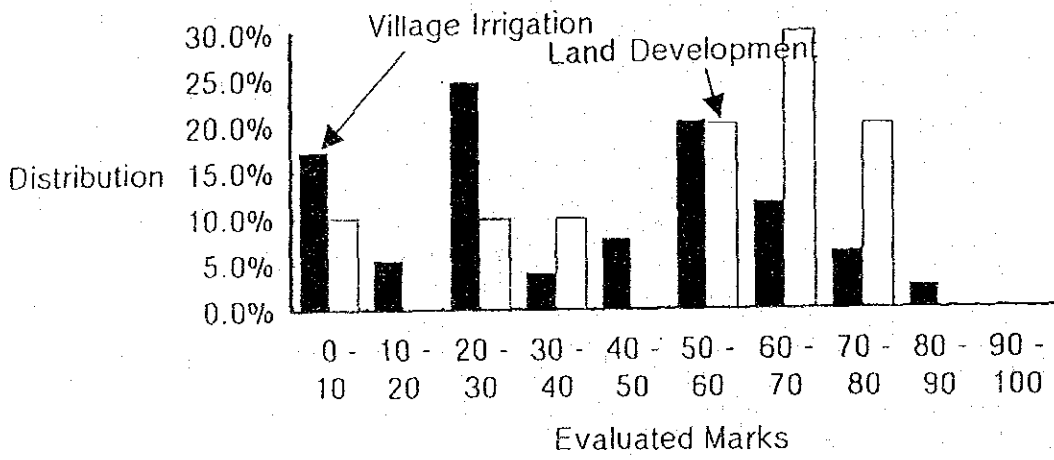
Source : Implementation Guidance of P3A Management in Appendix of the Presidential Instruction, No.2,1984.

Fig. 4-7-1 ORGANIZATION OF WATER USER'S ASSOCIATION(P3A) by Presidential Instruction

North Sumatra Province



South Selawesi Province



West Nusa Tenggara Province

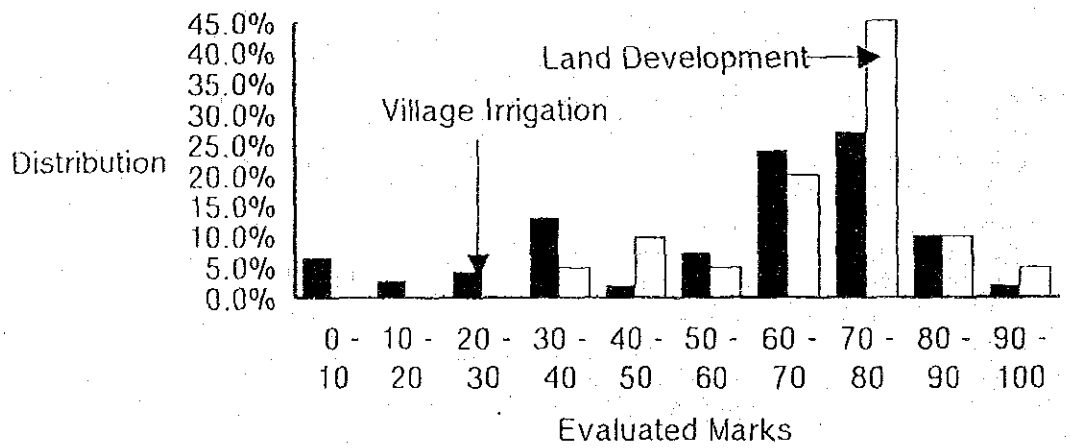


Fig.4-7-2 DISTRIBUTION OF EVALUATED MARKS

4.8 Related Projects in the Study Areas

Recent sectors and program loan which involve agriculture and irrigation development are as follows. Fig.4-8-1 and Fig.4-8-2 show the outline of irrigation system and allotment of responsibility in each Ministry.

(1) Main Irrigation Works with a Loan from Asian Development Bank

Works	Loan number	Period	Objective areas
1. First irrigation Package Project	518-INO	Sep. '82-Jun. '91	Eastern Java Central Java
2. Second Irrigation Package Project	627-INO	May '83-Jun. '92	North Sumatra
3. Second Irrigation Sector Project	638-INO	Sep. '83-Jul. '92	North Sumatra
4. Third Irrigation Package Project (TIPP)	799-INO	Nov. '86-Mar. '93	Ache, Central Java West Nusa Tenggara
5. Irrigated Command Area Development Project	818-INO	Dec. '86-Dec. '92	Lampung Bengkulu
6. Third Irrigation Sector Project	860-INO 861-INO	Nov. '87-Sep. '93	
7. Nusa Tenggara Agricultural Development Project (NTADP)	952-INO 953-INO	Feb. '89-Sep. '94	West Nusa Tenggara East Nusa Tenggara
8. First Integrated Irrigation Sector		Jun. '90-Sep. '95	Central Java Jakarta South Sumatra West Sumatra South-East Sulawesi
9. Second Integrated Irrigation Sector Project (Technical Assistance) (IISP-II)	1337-INO. 1991		North Sulawesi, Central Sulawesi South Sulawesi South-East Sulawesi Bali, West Nusa T, East Nusa Tenggara, East Timor Maluku, Irian Jaya

(2) Main Irrigation Works with Loan from OECF , and Cooperative Loan with OECF and USAID

Works	Loan number	Period	Objective areas
1.Small Scale Irrigation Management Project (SSIMP)	497-0347	Jul. '85-Jul, '93	South Sulawesi West Nusa Tenggara East Nusa Tenggara
2.Sector Loan (OECF)	INP-12/14		Whole Indonesia

(3) Main Irrigation Works with a World Bank Loan

Works	Loan number	Period	Objective areas
1.Irrigation Sub-Sector Project			
1) Second Provincial Irrigation Development Project (SPIDP)	2375-IND	1984-1988	
2) Irrigation Sub-Sector Project (SSSP-1)	2880-IND	Dec. '88-Dec. '91	
3) Second Irrigation Sub-Sector Project (ISSP-2), (O&M)	3392-IND	Sep. '91-Mar. '95	
2.Provincial Irrigation Agriculture Development Project (PIADP)	3302-IND	May '91-Jun. '96	13 provinces Ache, Riau Bengkulu, Lampung, North Sulawesi, Central Sulawesi, South Sulawesi, South-East Sulawesi West Kalimantan Central Kalimantan South Kalimantan

(4) Irrigation Scale of the Related Works in North Sumatra, South Sulawesi and NTB Provinces

Works	Overseas Loan	Province/ Location	Numbers	Objective Area	Remarks
1. PIADP	IBRD	S. Sulawesi	11	84,270	
		nos.		ha	
2. ISSP II	IBRD	S. Sulawesi		72,843	Special Maintenance
3. TIPP	ADB	NTB/Mamak	1	5,200	
4. NTADP	ADB	NTB	12	22,930	
5. SSIMP	USAID/OECF	NTB	4	12,850	
		S. Sulawesi	4	9,000	
6. Project	OECF	N. Sumatra	1	9,277	S. Ular
		S. Sulawesi	1	2,991	Langkeme

Fig.4-8-1 OUTLINE OF IRRIGATION SCHEME SYSTEM

Ministry of Public Works

1. Management and Rehabilitation for Irrigation Scheme

- Operation and Maintenance Works: Routine operation and maintenance works for the existing principal facilities
- Special Management Works : Improvement works for the appropriation of the above works
- Rehabilitation Works : Works to restore original functions. Namely, rehabilitation works

2. New Scheme (including insurance of water sources and constant water supply by constructing dams, and improvement of expansion of project area)

3. Swamp Development Works

- Swamp Development Works : Most of canals function as both irrigation and drainage canals. Drainage improvement is the main subject in the schemes. The scheme is carried out in cooperation with transmigration schemes.
- Fish Pond Development Works : Fish pond development in the coastal region.

4. Training Scheme : Technical training

5. Research and Development Scheme : Research and Study

6. Resources and Environment Scheme : Flood control, Sabo, and coastal conservation.

7. Road Construction Scheme : Access road to reclamation and settlement areas.

Ministry of Agriculture

1. Rehabilitation Scheme for Peripheral Facilities : Construction and rehabilitation of tertiary and quaternary facilities under large and middle scale schemes.

2. Village Irrigation Schemes : Construction and rehabilitation for facilities from water source facilities to peripheral facilities.

3. Reclamation Schemes : Land development(land clearing, reclamation, and land leveling)
Land improvement(bund, farm road, and soil improvement)

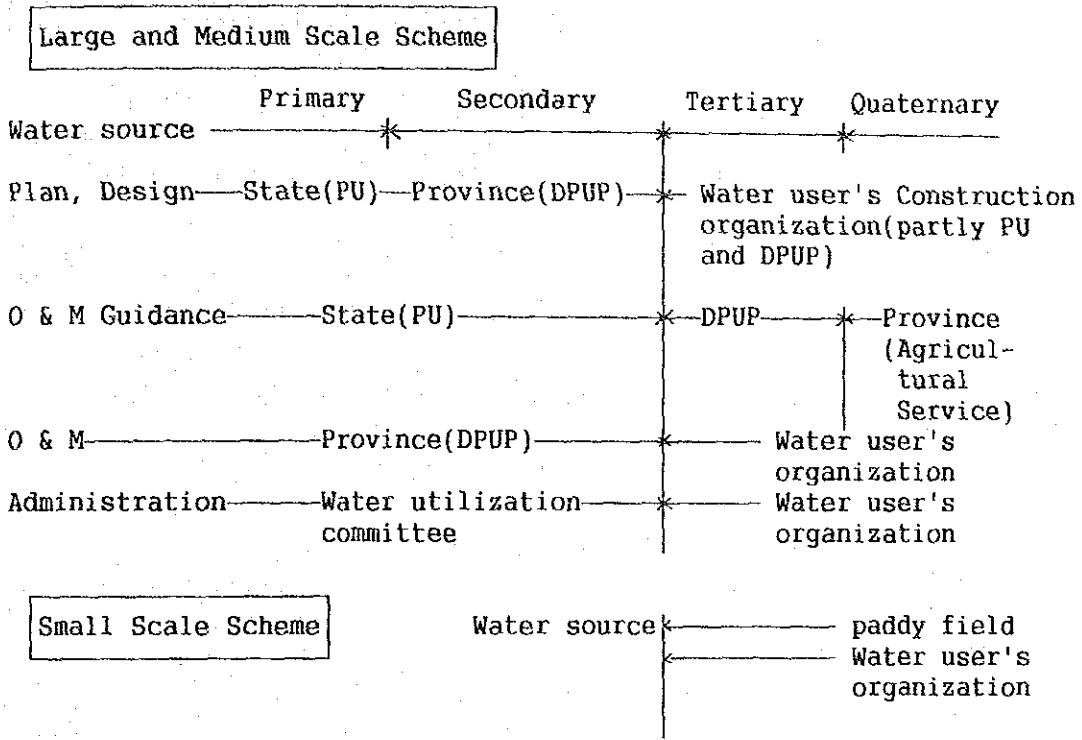
Ministry of Cooperative

1. The ministry carries out land adjustment works for settlement schemes as the ministry of agriculture do the same works.

Ministry of Transmigration

1. Land reclamation of transmigration area to be settled(land clearing and reclamation)

Fig. 4-8-2 ALLOTMENT OF RESPONSIBILITY FOR IRRIGATION SYSTEM



V. STUDIES ON REPRESENTATIVE SCHEMES FOR FEASIBILITY STUDY

5.1 Objective and Work Procedures

(1) Objective of Selecting Representative Schemes

Selection of representative schemes is to improve the planning of project implementation.

(2) Work Procedures of Selecting Representative Schemes

Total number of executed inventory surveys in North Sumatra, South Sulawesi, and Nusa Tenggara Barat (NTB) has reached 985 projects. However, it takes a lot of time and costs a great deal to survey the whole projects in more detail. At the present stage of survey, it is difficult to cover the whole projects as mentioned above.

The objective of the survey to be carried out currently is to plan project implementation covering the above three provinces. Therefore, the projects for inventory survey have been classified, in which thirty (30) representative schemes have been selected out of three provinces as model cases.

On the other hand, it is preferable for the representative schemes to satisfy the following conditions :

- a. The possible scheme to be implemented.
- b. The possible scheme to be fed back for the calculation of cost and benefit.

The procedures of selecting the representative schemes are mentioned as follows:

1. The schemes for inventory survey are to be classified into land development area, village irrigation area, and excluded area.
2. The village irrigation area is to be classified into potential and non-potential areas for irrigated paddy field development thereafter.
3. Land development scheme is to be classified into four(4) groups.
4. Village irrigation scheme is to be grouped by intake facility.

5. The total schemes are to be subdivided into thirteen(13) groups.
6. The schemes are to be counted based on by province, by district, and by group, and
7. The average irrigation area of each group is to be selected as the representative scheme.

5.2 Grouping of Irrigation Scheme

(1) Study of Grouping

As a result of field survey, the schemes carried out inventory survey are classified broadly as in the following:

Total Survey Areas 985 schemes	Land Development Area	62 schemes
	Village Irrigation Area	733 schemes
	Excluded Area	190 schemes

Village irrigation area has been divided into potential area and non-potential areas for irrigated paddy field development thereafter.

Village Irrigation Area 733 schemes	Land Development, Rehabilitation and	485 schemes
	Improvement Area Rehabilitation and Improvement Area	248 schemes

Then, the objective area for the study is divided broadly into the following three(3) groups:

- A group : Land Development Schemes.
- B group : Land Development, Rehabilitation and Improvement Schemes
- C group : Rehabilitation and Improvement Schemes

5.3 Selection of Representative Schemes

The detailed study is performed to calculate the actual project cost and benefit which are carried out for the

representative schemes selected from each group mentioned above. The detailed study, however, is not carried out less number of schemes in each group. The detailed study is made for as many as about ten(10) schemes in each province. Hence, the calculation basis for the project cost and benefit is obtained by carrying out the detailed studies of thirty(30) schemes in total.

1. Based on the number of schemes within group of each province, the number of schemes to be carried out the detailed study in each province is decided:

Province	No. of Objective Scheme	No. of Objective Regency	No. of Schemes to be carried out detailed study
North Sumatra	279	9	10
South Sulawesi	359	18	12
West Nusa Tenggara	151	6	8

2. In the case of land development, several schemes are to be selected for calculating the average of increase in irrigation area.
In village irrigation scheme, several schemes are selected for the average area of the current paddy field area.
3. In land development, and rehabilitation and improvement, the ranking are to be calculated from the average of expanded area of paddy field as reference.
4. The schemes which come in second place or more in the priority decided by Agricultural Service Office of Regency are to be selected.
5. Two(2) schemes in maximum are to be the detailed study areas in each regency.
6. The detailed study areas are selected considering the areas satisfying the above item, 4 as well as distribution table of group in each province.
7. Confirmation as to whether or not there exist detailed study areas in the regencies which have many schemes are to be made.
8. The distribution of selected detailed study areas in the provinces are to be confirmed.
9. The selected detailed study areas are to be confirmed on water sources and intake facilities basis.
10. In the case when 7, 8, and 9 items are not adequate,

selection is to be made again by returning to item 6.

The representative schemes selected according to the above procedures are shown in Table 5-3-1, 5-3-2, and 5-3-3 by province.

Fig. 5-2-1 Selection of Objective Area for the Study

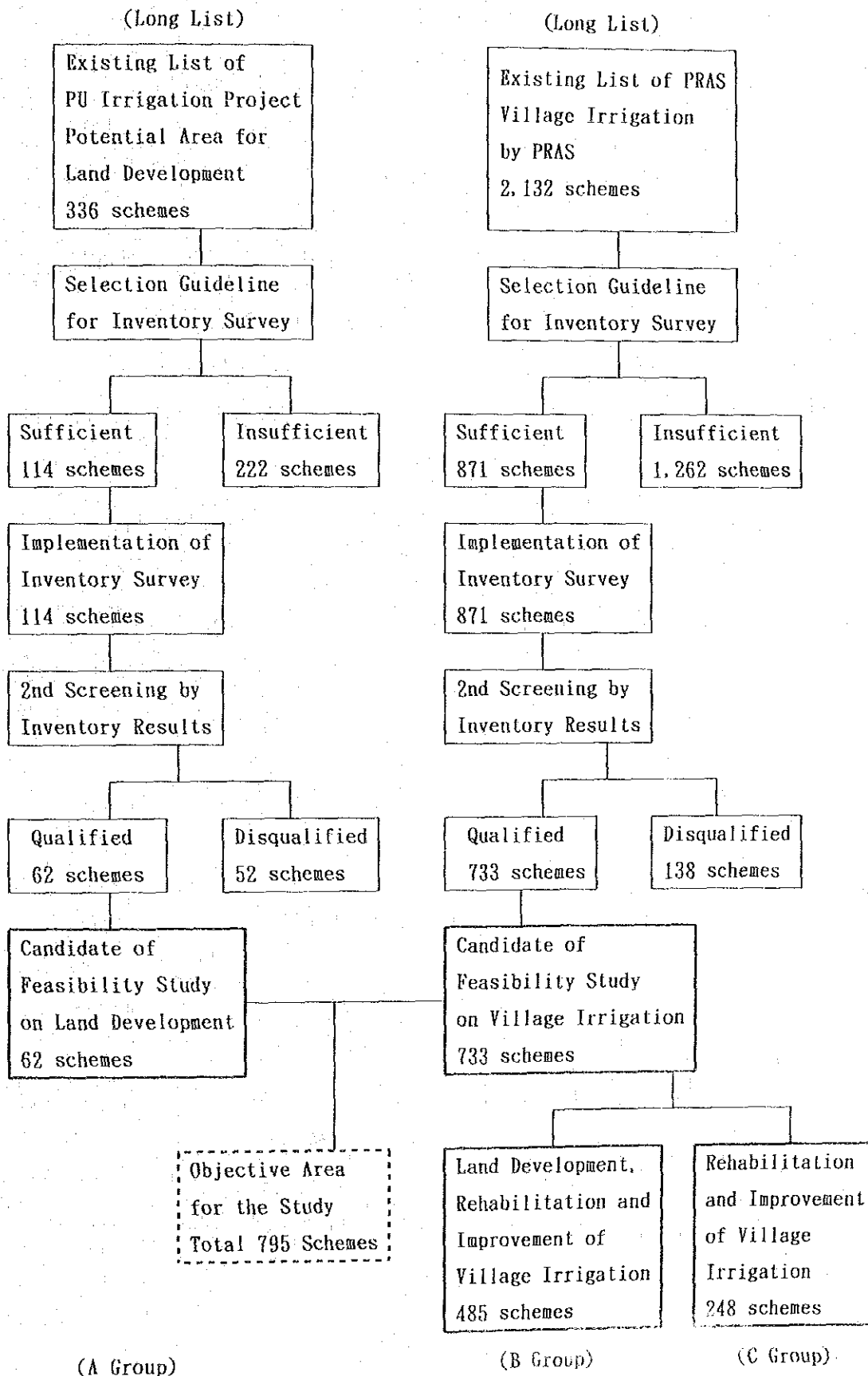


Table 5-2-1 SUMMARY OF AREA FOR ALL SCHEMES BY INVENTORY SURVEY

1	2	3	4	5	6	7	8	9	10	11
Province	LD No. of Scheme	LD Potential Area	LD Present Area	VI No. of Scheme	VI Potential Area	VI Present Area	Total No. of Scheme	Total Potential Area	Total Present Area	Difference (9-10)
	nos	ha	ha	nos	ha	ha	nos	ha	ha	ha
North Sumatra	50	11,438	6,968	308	46,157	27,333	358	57,595	34,301	23,294
South Sulawesi	19	4,885	3,466	374	44,079	29,943	393	48,965	33,409	15,556
Nusa Tenggara Barat	45	25,073	19,462	189	91,963	16,420	234	45,057	35,882	9,175
Total	114	41,397	29,896	871	110,220	73,696	985	151,617	103,592	48,025

Note-1 Figure of each area is the results of Inventory survey.
At the time of planning, reduction coefficient(0.70) would be adopted.

Note-2 Potential Area means future irrigable area,
Present area means present irrigable area.

Table 5-2-2 SUMMARY OF AREA FOR OBJECTIVE SCHEMES

(Objective Scheme)

1	2	3	4	5	6	7	8	9	10	11
Province	LD No. of Scheme	LD Potential Area	LD Present Area	VI No. of Scheme	VI Potential Area	VI Present Area	Total No. of Scheme	Total Potential Area	Total Present Area	Difference (9-10)
	nos	ha	ha	nos	ha	ha	nos	ha	ha	ha
North Sumatra	32	6,916	3,477	247	30,500	18,184	279	37,416	21,661	15,755
South Sulawesi	10	3,046	1,676	349	41,479	27,960	359	44,525	29,636	14,889
Nusa Tenggara Barat	20	10,568	7,197	137	15,750	12,083	157	26,318	19,280	7,038
Total	62	20,530	12,350	733	87,729	58,227	795	108,259	70,577	37,682

Table 5-2-3 SUMMARY OF AREA FOR EXCLUDED SCHEMES

(Exclude Scheme)

1	2	3	4	5	6	7	8	9	10	11
Province	LD No. of Scheme	LD Potential Area	LD Present Area	VI No. of Scheme	VI Potential Area	VI Present Area	Total No. of Scheme	Total Potential Area	Total Present Area	Difference (9-10)
	nos	ha	ha	nos	ha	ha	nos	ha	ha	ha
North Sumatra	18	4,522	3,491	61	15,657	9,149	79	20,179	12,640	7,539
South Sulawesi	9	1,840	1,790	25	2,600	1,983	34	4,440	3,773	667
Nusa Tenggara Barat	25	14,505	12,265	52	4,234	4,337	77	18,739	16,602	2,137
Total	52	20,867	17,546	138	22,491	15,469	190	43,358	33,015	10,343

No. of Schemes in Each Province

	SUMUT	SULSEL	NTB	TOTAL	
<LD Project>	A1	3	4	15	22
	A2	12	1	1	14
	A3	5	4	3	12
	A4	12	1	1	14
<VI Project>	B1	75	49	30	154
	B2	10	9	6	25
	B3	17	21	1	39
	B4	88	76	17	181
	B5	14	35	12	61
	B6	6	16	3	25
TOTAL		279	359	157	795

<LD Project>
Land Development

Area for Inventory Survey

<VI Project>
Improvement of Village Irrigation

Slope < 5 %
Slope >= 5 %

Slope < 5 %
Slope >= 5 %

With Land Development

Without Land Development

Without Clearing
With Clearing
Without Clearing
With Clearing
Weir
Free Intake
Other
Weir
Free Intake
Other
Weir
Free Intake
Other

Fig. 5-2-2 GROUPING FOR FEASIBILITY SURVEY

Table 5-3-1 LIST OF REPRESENTATIVE SCHEMES IN NORTH SUMATRA

NO. CODE	NAME OF SCHEME	DIVISION	GROUP	VILLAGE	DISTRICT	REGENCY	Present Paddy			Water Resource	Intake	Ground Slope	Land Condition
							ha	ha	ha				
CODE	IRR			VIL	DIS	REG	PR101	FU101	FU110	SOU01	FAC32	TOP21	
1	60011 Sumbang	LD	A4	Sumbang	Silima Pangsa2	Dairi	34	1	77	163	42	River Weir	>= 5% with clearing
2	60038 Raming (B)	LD	A2	Siture	Batang Angkola	Tapanuli Selatan	5	14	66	99	47	River Weir	< 5% with clearing
3	50025 Sumbul Berampu	VI	C1	Sumbul Berampu	Silima Pangsa2	Dairi	124	-124	234	0	0	River Weir	>= 5%
4	50057 Sidomukti	VI	B1	Berulap	Selesai	Langkat	12	15	27	68	3	River Weir (Temporary)	< 5% with clearing
5	50091 Aek Palia	VI	B1	Gunung Melayu	Kualuh Hulu	Labuhan Batu	34	38	38	64	4	River Weir	< 5% with clearing
6	50129 Pangambatan (B)	VI	B2	Pelita	Sorkam	Tapanuli Tengah	30	12	48	56	8	River Free Intake	< 5% with clearing
7	50141 Aek Siparbut	VI	B4	Unte Mungkur	Mhara	Tapanuli Utara	23	1	26	37	2	River Weir	>= 5% with clearing
8	50218 Kutamale	VI	B4	Butuh Naman	Munte	Tanah Karo	32	40	69	8	8	River Weir	>= 5% with clearing
9	50240 Asahan VIII Pengajian	VI	B3	Tinggi Raja	Buntu Pane	Asahan	45	2	66	100	19	River Pump	< 5% with clearing
10	50256 Aek Sihim	VI	B5	Gepuk Julu	Batang Toru	Tapanuli Selatan	40	48	48	103	8	River Free Intake	>= 5% with clearing
Total							379	45	560	993	139		

Note: Area of rainfed includes old paddy field due to damaged irrigation facilities.
 Figure of area was estimated using surveyed topo-map.
 Sumbang scheme was replaced from former Scheme Lae Pinagar, Type A4.

Table 5-3-2 LIST OF REPRESENTATIVE SCHEMES IN SOUTH SULAWESI

NO. CODE	NAME OF SCHEME	DIVISION	GROUP	VILLAGE	DISTRICT	REGENCY	Present Paddy			Water Resource	Intake	Ground Slope	Land Condition
							ha	ha	ha				
CODE	IRR			VIL	DIS	REG	PR101	FU101	FU110	SOU01	FAC32	TOP21	
1	20003 Kalu	LD	A3	Lilirawans	Lappariaja	Bone	47	70	101	23	Spring Water Tank	>= 5% without clearing	
2	10055 Pajjenge	VI	C1	Tompo	Barru	Barru	100	43	143	180	0	River Weir	< 5%
3	10099 Kadieng	VI	B1	Tambangan	Kajang	Bulukumba	171	224	270	53	River Weir	< 5% without clearing	
4	10115 Kaindi	VI	B4	Mampu	Anggeraja	Enrekang	67	124	185	57	River Weir	>= 5% without clearing	
5	10140 Lembang/Beta	VI	B5	Kelurahan Malino	Tingsiraocong	Gowa	72	76	175	4	River Free Intake	>= 5% with clearing	
6	10188 Panrita	VI	B2	Palantikang	Bangkala	Jenepono	55	65	78	10	River Free Intake	< 5% with clearing	
7	10182 Mario I-II-III	VI	B4	Cempaniga	Camba	Maros	50	57	74	7	River Weir	>= 5% without clearing	
8	10201 Pakelli II	VI	B5*	Kassi Buleng	Sinjai Barat	Sinjai	19	54	168	35	River Free Intake	>= 5% with clearing	
9	10227 Limou/Padaelo	VI	B3	Tua/Lampulung	Majauleng/Pammana Wajo	Sinjai	77	138	161	61	River Pump	< 5% with clearing	
10	10287 Malimbu	VI	C2	Malimbu	Sabbang	Luwu	0	32	32	44	0	River Free Intake	< 5%
11	10332 Salu Akung	VI	C1	Pangli Palawa	Sesean	Tana Toraja	26	26	30	30	0	River Weir	< 5%
12	10354 Mariri	VI	B1*	Tedisi	Sumarorong	Polmas	0	34	63	151	29	River Weir	< 5% without clearing
Total							684	109	1,072	1,607	278		

Note: Area of rainfed includes old paddy field due to damaged irrigation facilities.
 Group with *marked was reviewed from the field condition.
 Figure of area was estimated using surveyed topo-map.
 Kalu Scheme was replaced from former Scheme, Taratta Type A3.
 Kaindi also from S. Burian Type B4.
 Pakelli II was replaced from Ladope Scheme, Type B6.

Table 5-3-3. LIST OF REPRESENTATIVE SCHEMES IN WEST NUSA TENGGARA

NO. CODE	NAME OF SCHEME	DIVISION	GROUP	VILLAGE	DISTRICT	REGENCY	Present Paddy			Future Scheme			Water Resource	Intake	Ground Slope	Land Condition
							ha	PR101	ha	ha	ha	ha				
1	45010 Damar Jengkrang	LD	A4*	Kelongsong	Sukamulia	Lombok Timur	5	120	227	115	River Weir	>= 5% with clearing				
2	32013 Mada Manini	VI	C2	Adu	Hau	Dompu	70	70	98	0	River Free Intake	< 5%				
3	33050 Uma Lebang	VI	B1	Piampang	Piampang	Sumbawa	88	89	96	21	River Weir	< 5% without clearing				
4	34004 Lombok Tripas	VI	C1	Bayan	Bayan	Lombok Barat	34	34	57	0	River Weir	>= 5%				
5	35035 Lengkok Dudu	VI	B1	Tanjung	Selong	Lombok Timur	24	26	45	2	River Weir	< 5% with clearing				
6	35045 Kelokos Udang	VI	B5	Priggsajurang	Terara	Lombok Timur	105	111	128	6	River Free Intake	>= 5% without clearing				
7	36016 Raba Sangga	VI	C1	Kendo	Rasmae	Bima	111	111	125	0	River Weir	< 5%				
8	37003 Montong Sapah/Puri	VI	C1*	Montong Sapah	Praya Barat	Lombok Tengah	13	20	37	0	River Weir	>= 5%				
Total							480	594	813	144						

FS30LIST.WK1

Note: Area of rainfed includes old paddy field due to damaged irrigation facilities.

Group with *marked was reviewed from the field condition.

Figure of area was estimated using surveyed topo-map.

Darar Jeng Kang was replace from Tarusan Scheme, Type A1.

List of F/S Scheme				
NO.	CODE	NAME OF SUBPROJECT	DISTRICT	REGENCY
1	60038	Ranning (B)	Batang Angkola	Tapanuli Selatan
2	60044	Sombaci	Silima Pungga2	Dairi
3	50091	Aek Palia	Kualuh Hulu	Labuhan Batu
4	50057	Sidomukti	Setesai	Langkat
5	50129	Pangambatan (B)	Sorkam	Tapanuli Tengah
6	50240	Setia Janji Pompanisasi	Buntu Pane	Asahan
7	50141	Aek Siparbee	Moara	Tapanuli Utara
8	50218	Kutawale	Munte	Tapanuli Selatan
9	50256	Aek Sihim	Batang Toru	Tapanuli Selatan
10	50025	Sumbel Berampo	Silima Pungga2	Dairi

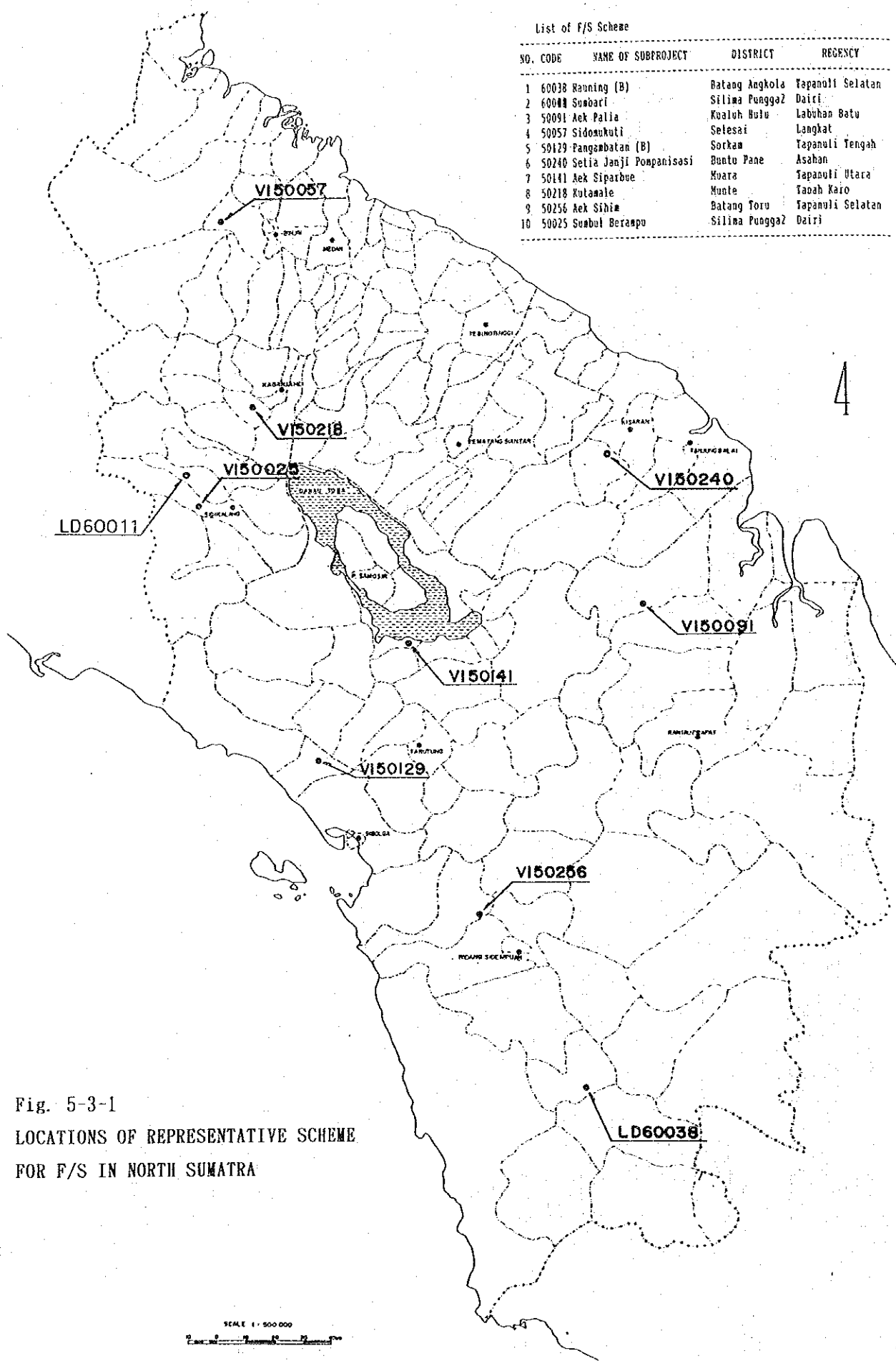
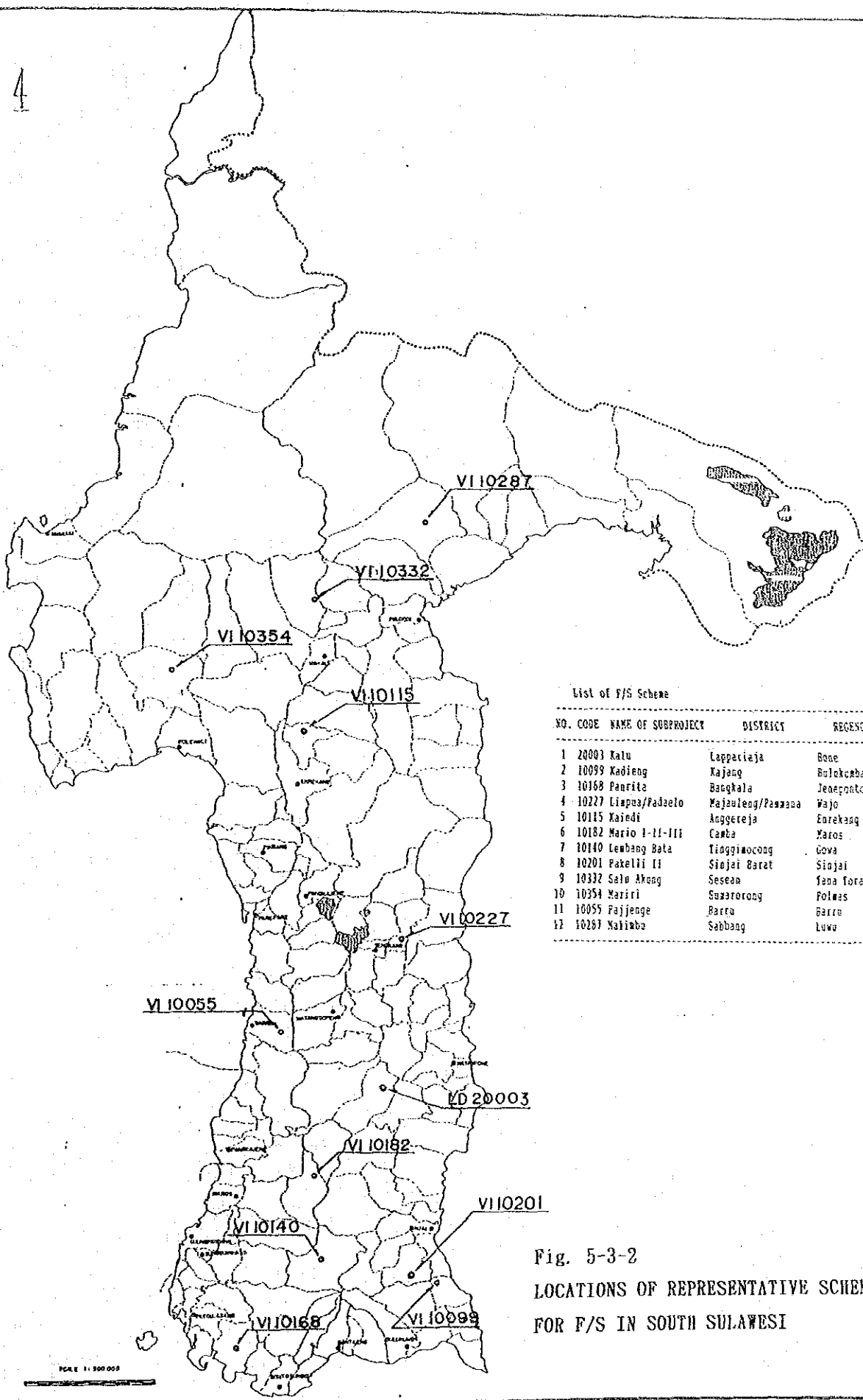


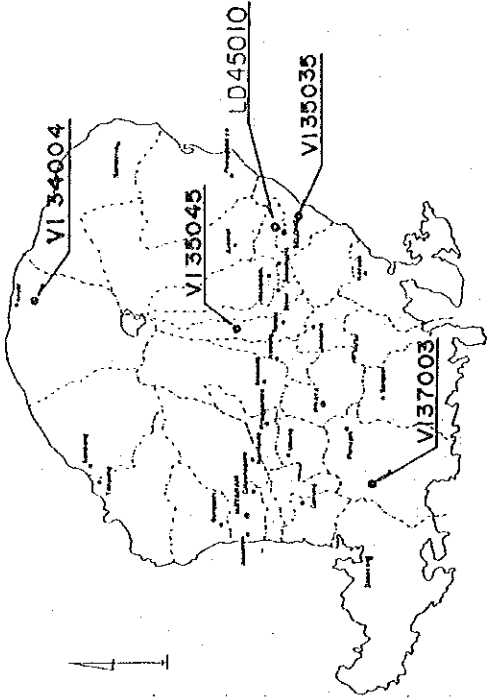
Fig. 5-3-1
 LOCATIONS OF REPRESENTATIVE SCHEME
 FOR F/S IN NORTH SUMATRA



List of F/S Scheme

NO.	CODE	NAME OF SUBPROJECT	DISTRICT	REGENCY
1	20003	Kalu	Lappariaja	Bone
2	10099	Kadieng	Kajang	Bulekoba
3	10168	Panrita	Baengkala	Jeneponto
4	10227	Liapus/Padaelo	Majauleng/Panuaaa	Wajo
5	10115	Kaindi	Anggeteja	Enrekang
6	10182	Mario I-II-III	Camba	Maros
7	10140	Lembang Bata	Tiaggimocong	Gowa
8	10201	Pakelii II	Sinjai Barat	Sinjai
9	10332	Salo Ahong	Seseaa	Tana Toraja
10	10354	Mariri	Suaarorong	Polmas
11	10055	Pajjenge	Barra	Barra
12	10287	Kaliraba	Sebbang	Luwu

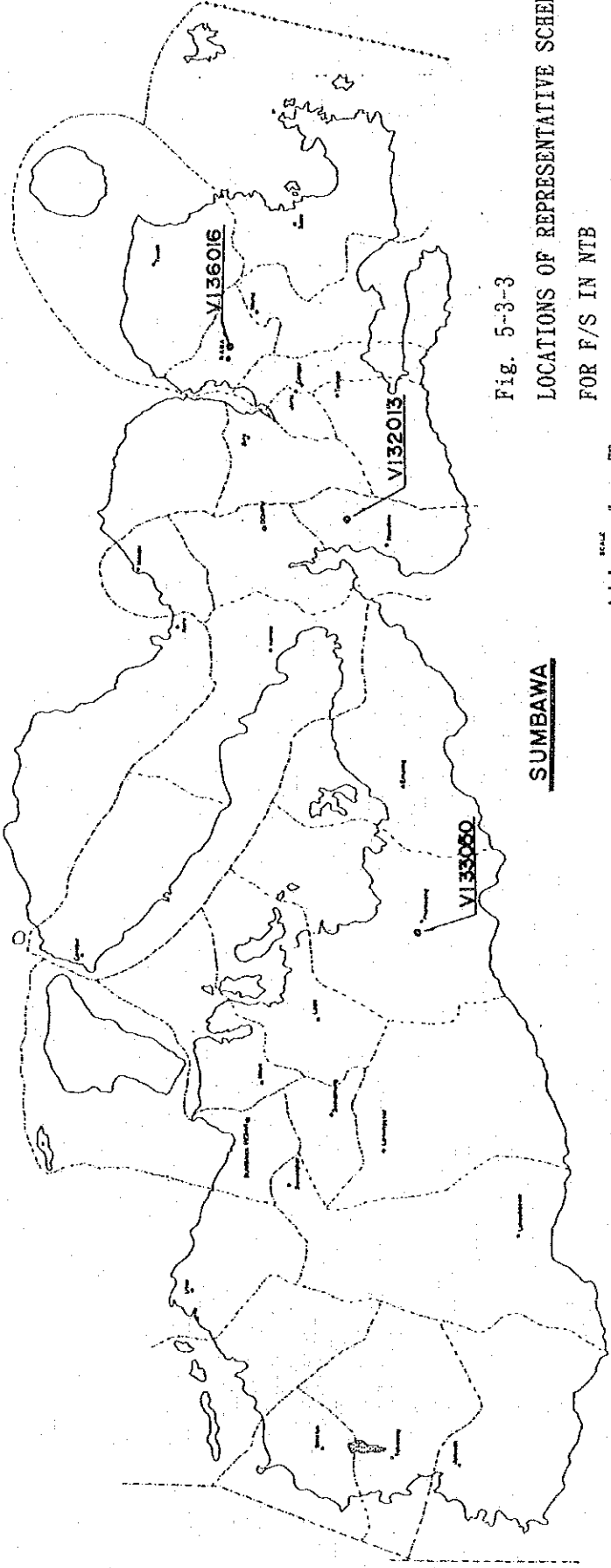
Fig. 5-3-2
LOCATIONS OF REPRESENTATIVE SCHEME
FOR F/S IN SOUTH SULAWESI



LOMBOK

List of F/S Scheme

NO. CODE	NAME OF SUBPROJECT	DISTRICT	REGENCY
1	45010 Banjar Jangkang	Sukaaulia	Lombok Timur
2	33050 Lima Lebaq	Plempang	Sumbawa
3	35035 Bengkok Dudu	Secong	Lombok Timur
4	37003 Montong Sapah/Puri	Praya Barat	Lombok Tengah
5	35845 Melokos Uidang	Terata	Lombok Timur
6	36816 Raba Saungga	Rasazae	Bima
7	34004 Lokok Tripas	Bayah	Lombok Barat
8	32013 Bada Mahala	Hou	Denpasu



SUMBAWA

Fig. 5-3-3

LOCATIONS OF REPRESENTATIVE SCHEME
FOR F/S IN NTB

5.4 Present Situation of Schemes

5.4.1 Meteorology and Hydrology

The present condition of the thirty (30) representative schemes are shown in the next Table 5-4-1.

Table 5-4-1 PRESENT CONDITION OF METEOROLOGY AND HYDROLOGY ON REPRESENTATIVE SCHEMES (1/3)

Province : North Sumatra											
Code	60011	60038	50025	50057	50091	50129	50141	50218	50240	50256	
Scheme	Sumbari	Rauning	Sumbul Berampu	Sidamukuti	Aek Paila	Pangambatan B	Aek Siparubue	Kutamaie	Asahan VIII Penga	Aek Sihim	
Regency	Dairi	Tapaneli Selatan	Dairi	Langkat	Labuhan Batu	Tapaneli Tengah	Tapaneli Utara	Tanah Karo	Asahan	Tapaneli Selatan	
Division	LD	LD	VI	VI	VI	VI	VI	VI	VI	VI	
Location	N 02° 50' 00" E 98° 7' 00"	N 01° 15' 30" E 98° 22' 30"	N 02° 46' 00" E 98° 15' 30"	N 03° 35' 30" E 98° 24' 30"	N 02° 28' 30" E 99° 38' 30"	N 01° 55' 30" E 98° 38' 30"	N 02° 20' 00" E 98° 55' 00"	N 03° 05' 00" E 98° 24' 00"	N 02° 54' 30" E 99° 34' 30"	N 01° 28' 00" E 99° 09' 30"	
Water Resource	Lee Dondau	Sibara-bara	Lenuha Riv.	Bekulap Riv.	Paila (Goti) Riv.	Sitadiang Riv.	Siparubue Riv.	Lauberas Riv. /Spring	Piassa Riv.	Sigumuru Riv.	
Catchment Area	3.6 Km ²	34.1 Km ²	8.5 Km ²	2.1 Km ²	6.3 Km ²	22.1 Km ²	2.3 Km ²	342 Km ²	2.8 Km ²		
River Width	2.0 m	30.0 m	2.0 m	3.0 m	4.0 m	15.0 m	8.0 m	50.0 m	6.0 m		
River Depth	0.8 m	2.0 m	0.2 m	1.5 m	0.3 m	0.5 m	4.0 m	1.5 m	0.5 m		
River Discharge											
Rainy Season Ave.	860 Lt./sec	18,675 Lt./sec	675 Lt./sec	300 Lt./sec	3,678 Lt./sec	2,000 Lt./sec	14,400 Lt./sec	7,000 Lt./sec	46,400 Lt./sec	2,215 Lt./sec	
Dry Season Ave.	540 Lt./sec	13,750 Lt./sec	297 Lt./sec	65 Lt./sec	1,377 Lt./sec	1,200 Lt./sec	7,200 Lt./sec	3,500 Lt./sec	30,900 Lt./sec	1,400 Lt./sec	
Max. Discharge	1,190 Lt./sec	21,250 Lt./sec	1,348 Lt./sec	700 Lt./sec	3,748 Lt./sec	2,500 Lt./sec	14,900 Lt./sec	15,000 Lt./sec	50,000 Lt./sec	2,406 Lt./sec	
Min. Discharge	600 Lt./sec	11,250 Lt./sec	198 Lt./sec	50 Lt./sec	1,350 Lt./sec	1,000 Lt./sec	7,450 Lt./sec	3,000 Lt./sec	10,000 Lt./sec	1,200 Lt./sec	
Water Quality	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	
Elevation	550 m	300 m	675 m	39 m	20 m	5 m	900 m	951 m	50 m	840 m	
Ave. Rainfall Monthly	199 mm	217 mm	199 mm	292 mm	188 mm	219 mm	229 mm	113 mm	283 mm	317 mm	
Period Rainy Season	Sep. ~ Apr.	Jul. ~ Nov.	Sep. ~ Apr.	Sep. ~ Dec.	Sep. ~ Dec.	Sep. ~ Dec.	Sep. ~ Feb.	Sep. ~ Apr.	Sep. ~ Dec.	Sep. ~ Mar.	
Dry Season	May ~ Aug.	Jan. ~ Jun.	May ~ Aug.	Jan. ~ Aug.	Feb. ~ May	Jan. ~ Jul.	Apr. ~ Aug.	May ~ Aug.	May ~ Aug.	May ~ Aug.	

Table 5-4-1 PRESENT CONDITION OF METEOROLOGY AND HYDROLOGY ON REPRESENTATIVE SCHEMES (2/3)

Province : South Sulawesi		20003	10055	10099	10115	10140	10168	10182	10201	10227	10287	10332	10354
Scheme	Kalu	Pajjenge	Kadieng	Kaindi	Lembang Beta	Panrita	Mario I-II-III	Pakeli II	Padaelo	Malimbu	Salu Akung	Mariri	10354
Regency	Bone	Barru	Bulkumba	Enrekang	Gowa	Jeneponto	Maros	Sinjai	Wajo	Luwu	Tana Toraja	Polmas	
Division	LD	VI	VI	VI	VI	VI	VI	VI	VI	VI	VI	VI	VI
Location	S 04° 45' 00" E 120° 02' 00"	S 04° 24' 30" E 119° 42' 30"	S 05° 21' 00" E 119° 29' 00"	S 03° 22' 00" E 119° 47' 30"	S 05° 15' 00" E 119° 02' 00"	S 05° 33' 00" E 119° 46' 00"	S 04° 53' 30" E 119° 52' 00"	S 05° 19' 30" E 119° 13' 30"	S 04° 08' 30" E 120° 06' 30"	S 02° 43' 00" E 120° 13' 00"	S 03° 00' 00" E 120° 00' 00"	S 03° 08' 00" E 119° 18' 30"	
Water Resource	Spring in Lonrong Riv. Catch Area	Barang Riv.	Kadieng Riv.	Dewata Riv.	Bulan Riv.	Panirita Riv. Cangkureng torrent Riv. / Spring	Branch of Mariopakeli Riv.	Walanae Riv.	Benuang Riv.	Akung Riv.	Mariri Riv.		
Catchment Area		7.0 Km ²	52.0 Km ²	4.6 Km ²	16.1 Km ²	0.9 Km ²	2.6 Km ²	2.8 Km ²	4,000 Km ²	300.0 Km ²	4.0 Km ²	54.5 Km ²	
Spe. Discharge Dry	10 Lt./sec/km ²	10 Lt./sec/km ²	13 Lt./sec/km ²	27 Lt./sec/km ²	13 Lt./sec/km ²	13 Lt./sec/km ²	10 Lt./sec/km ²	13 Lt./sec/km ²	10 Lt./sec/km ²	27 Lt./sec/km ²	27 Lt./sec/km ²	27 Lt./sec/km ²	27 Lt./sec/km ²
Rainy	48 Lt./sec/km ²	48 Lt./sec/km ²	63 Lt./sec/km ²	64 Lt./sec/km ²	63 Lt./sec/km ²	63 Lt./sec/km ²	48 Lt./sec/km ²	63 Lt./sec/km ²	48 Lt./sec/km ²	64 Lt./sec/km ²	64 Lt./sec/km ²	64 Lt./sec/km ²	64 Lt./sec/km ²
River Width	-	25.0 m	15.0 m	3.5 m	20.0 m	9.0 m	50.0 m	6.0 m	150 m	15.0 m	9.0 m	17.0 m	
River Depth	-	1.9 m	1.0 m	0.8 m	1.0 m	0.5 m	1.5 m	0.5 m	2.0 m	1.0 m	2.0 m	1.0 m	
River Discharge													
Rainy Season Ave.	150 Lt./sec	15,000 Lt./sec	732 Lt./sec	2,400 Lt./sec	400 Lt./sec	500 Lt./sec	46,400 Lt./sec	2,215 Lt./sec	7,000 Lt./sec	22,500 Lt./sec	3,500 Lt./sec	6,375 Lt./sec	
Dry Season Ave.	100 Lt./sec	6,000 Lt./sec	301 Lt./sec	220 Lt./sec	100 Lt./sec	55 Lt./sec	30,900 Lt./sec	1,400 Lt./sec	1,500 Lt./sec	7,500 Lt./sec	4,500 Lt./sec	2,125 Lt./sec	
Max. Discharge	150 Lt./sec	15,000 Lt./sec	13,634 Lt./sec	2,400 Lt./sec	12,000 Lt./sec	N.A	50,000 Lt./sec	2,406 Lt./sec	8,000 Lt./sec	37,500 Lt./sec	7,650 Lt./sec	18,417 Lt./sec	
Min. Discharge	100 Lt./sec	6,000 Lt./sec	165 Lt./sec	220 Lt./sec	100 Lt./sec	N.A	10,000 Lt./sec	1,203 Lt./sec	1,000 Lt./sec	7,500 Lt./sec	1,350 Lt./sec	708 Lt./sec	
Water Quality	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Elevation	222 m	60 m	150 m	600 m	800 m	40 m	50 m	135 m	17 m	200 m	905 m	800 m	
Ave. Rainfall Monthly	153 mm	194 mm	258 mm	117 mm	270 mm	76 mm	283 mm	117 mm	120 mm	310 mm	313 mm	303 mm	
Period	Mar. ~ Jul.	Oct. ~ Mar.	Dec. ~ Mar.	Nov. ~ Apr.	Nov. ~ May	Dec. ~ Mar.	Dec. ~ May	Feb. ~ May	Jun. ~ Apr.	Oct. ~ Jun.	Dec. ~ Jun.	Nov. ~ Jul.	
Rainy Season	Aug. ~ Feb.	Apr. ~ Sep.	Apr. ~ Sep.	May ~ Oct.	Jun. ~ Oct.	Apr. ~ Oct.	Jun. ~ Nov.	Jul. ~ Apr.	Oct. ~ Mar.	Jul. ~ Sep.	May ~ Nov.	Aug. ~ Oct.	
Dry Season													

Table 5-4-1 PRESENT CONDITION OF METEOROLOGY AND HYDROLOGY ON REPRESENTATIVE SCHEMES (3/3)

Province : West Nusa Tenggara									
Code	45010	32013	33050	34004	35035	35045	36016	37003	
Scheme	Damar Jengkang	Mada Manini	Uma Lebang	Lolok Tripas	Lengkok Dudu	Kelokos Uduang	Raba Sanga	Monton Sapah/Puri	
Regency	Lombok Timur	Dompu	Sumbawa	Lombok Barat	Lombok Timur	Lombok Timur	Bima	Lombok Tengah	
Division	LD	VI	VI	VI	VI	VI	VI	VI	
Location	S 08° 39' E 116° 33'	S 08° 42' E 117° 31'	S 08° 49' E 117° 46'	S 08° 16' E 116° 26'	S 08° 40' E 116° 34'	S 08° 35' E 116° 25'	S 08° 29' E 118° 48'	S 08° 48' E 116° 08'	
Water Resource	Selimbing Riv.	Manini Riv. & Spring	Pemasar Riv.	Lolok Tripas River	Belimbing Riv.	Kelokos Uduang Riv	Kendo Riv. Puri Riv.	Puri River	
Catchment Area	83.7 Km ²	3.0 Km ²	4.0 Km ²	11.2 Km ²	22.0 Km ²	14.1 Km ²	4.0 Km ²	8.8 Km ²	
Spe. Discharge Dry	9 Lt./sec/km ²	3 Lt./sec/km ²	3 Lt./sec/km ²	9 Lt./sec/km ²	9 Lt./sec/km ²	9 Lt./sec/km ²	3 Lt./sec/km ²	9 Lt./sec/km ²	
Rainy	48 Lt./sec/km ²	44 Lt./sec/km ²	44 Lt./sec/km ²	48 Lt./sec/km ²	48 Lt./sec/km ²	48 Lt./sec/km ²	44 Lt./sec/km ²	48 Lt./sec/km ²	
River Width	11.0 m	6.0 m	25.0 m	8.0 m	22.0 m	5.0 m	12.0 m	20.0 m	
River Depth	6.0 m	1.5 m	1.5 m	3.2 m	10.0 m	10.0 m	0.5 m	3.5 m	
River Discharge									
Rainy Season Ave.	400 Lt./sec	132 Lt./sec	176 Lt./sec	538 Lt./sec	400 Lt./sec	1000 Lt./sec	176 Lt./sec	326 Lt./sec	
Dry Season Ave.	300 Lt./sec	9 Lt./sec	12 Lt./sec	101 Lt./sec	100 Lt./sec	200 Lt./sec	12 Lt./sec	61 Lt./sec	
Max. Discharge	500 Lt./sec	N.A	N.A	N.A	600 Lt./sec	2000 Lt./sec	N.A	N.A	
Min. Discharge	250 Lt./sec	N.A	N.A	N.A	75 Lt./sec	100 Lt./sec	N.A	N.A	
Water Quality	Good	Good	Good	Good	Good	Good	Good	Good	
Elevation	100.0 m	25.0 m	0 m	200 m	156 m	303 m	15 m	5 m	
Ave. Rainfall Monthly	100.4 mm	80.0 mm	125 mm	109 mm	100 mm	146 mm	53 mm	122 mm	
Period Rainy Season	Oct. ~ Mar.	Oct. ~ Mar.	Nov. ~ Mar.	Dec. ~ Apr.	Nov. ~ Mar.	Oct. ~ Mar.	Nov. ~ Apr.	Dec. ~ Mar.	
Dry Season	Apr. ~ Nov.	Apr. ~ Sep.	Apr. ~ Dec.	May ~ Nov.	Apr. ~ Oct.	Apr. ~ Sep.	May ~ Oct.	May ~ Oct.	

5.4.2 Land Use and Cropping Pattern

(1) Soils

The soil profile survey and laboratory test are carried out for the sake of analysis of soil fertility and suitability for cropping on the representative schemes. Items of the laboratory test are enough for determination of the physical and chemical features of the soils. The results of the soil profile survey and laboratory test shows that there is no crucial problem in the studied soils for cropping (refer to APPENDIX-V). The general soil characteristics defined by those soil analyses are reflected to application plan of fertilizer for paddy cultivation.

(2) Land Use

For the representative 30 schemes, land use survey results are described in APPENDIX-V and land use maps of each site are shown in DRAWINGS. The Project expands irrigated paddy field area in most schemes except in some village irrigation schemes. The converted land is originally rainfed paddy field, dryland, plantation and light forest lands. Fig. 5-4-1 shows present and future land use in the representative schemes.

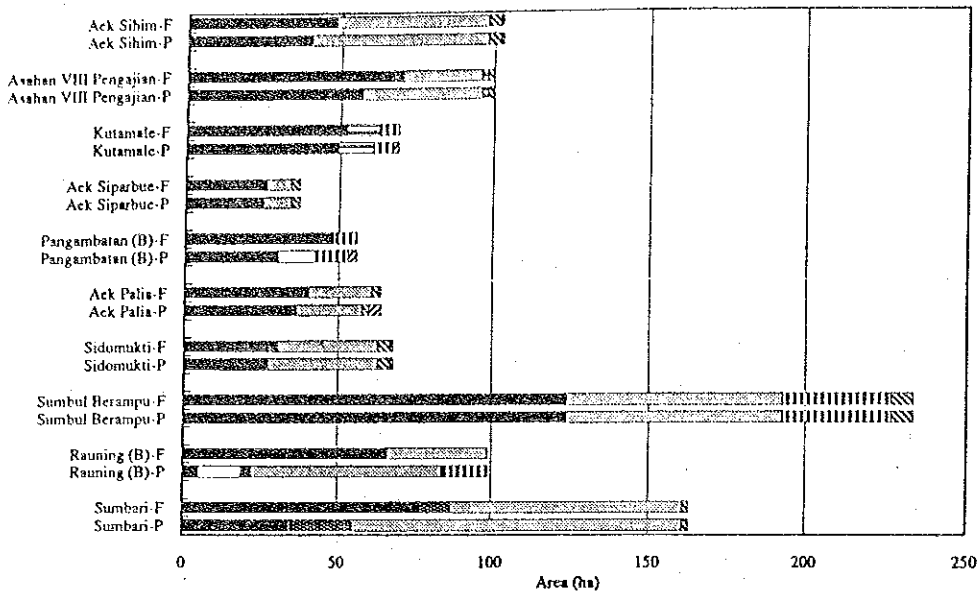
The increment of irrigated paddy field is shown as below. The average increment rates of irrigated area including the land development and village irrigation schemes are about 47 % in North Sumatra, 56 % in South Sulawesi and 37 % in West Nusa Tenggara.

AVERAGE IRRIGATED PADDY FIELD AREA
OF REPRESENTATIVE SCHEMES

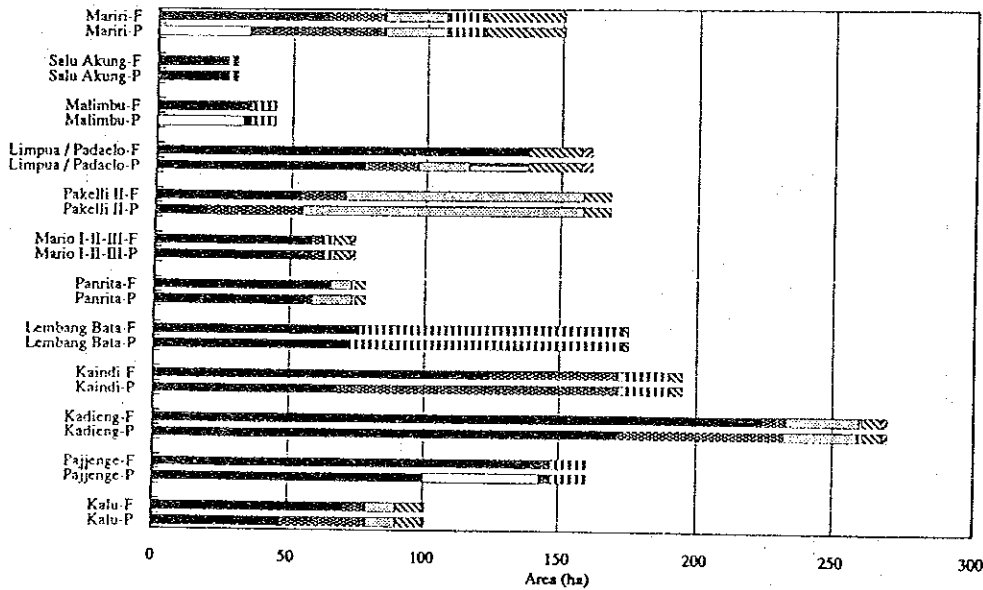
	N.Sumatra (10 schemes)	S.Sulawesi (12 schemes)	W.Nusa Tenggara (8 schemes)
Present Irrigated Paddy Field (ha)	38	57	54
Future Irrigated Paddy Field (ha)	56	89	74
Increment (%)	47	56	37

The planted area is defined as 90 % of the farm land such as paddy field and dryland. The reason is that the portion of wasted area accompanied with levee and terraced field is

LAND USE AREA OF REPRESENTATIVE SCHEMES IN NORTH SUMATRA



LAND USE AREA OF REPRESENTATIVE SCHEMES IN SOUTH SULAWESI



LAND USE AREA OF REPRESENTATIVE SCHEMES IN WEST NUSA TENGGARA

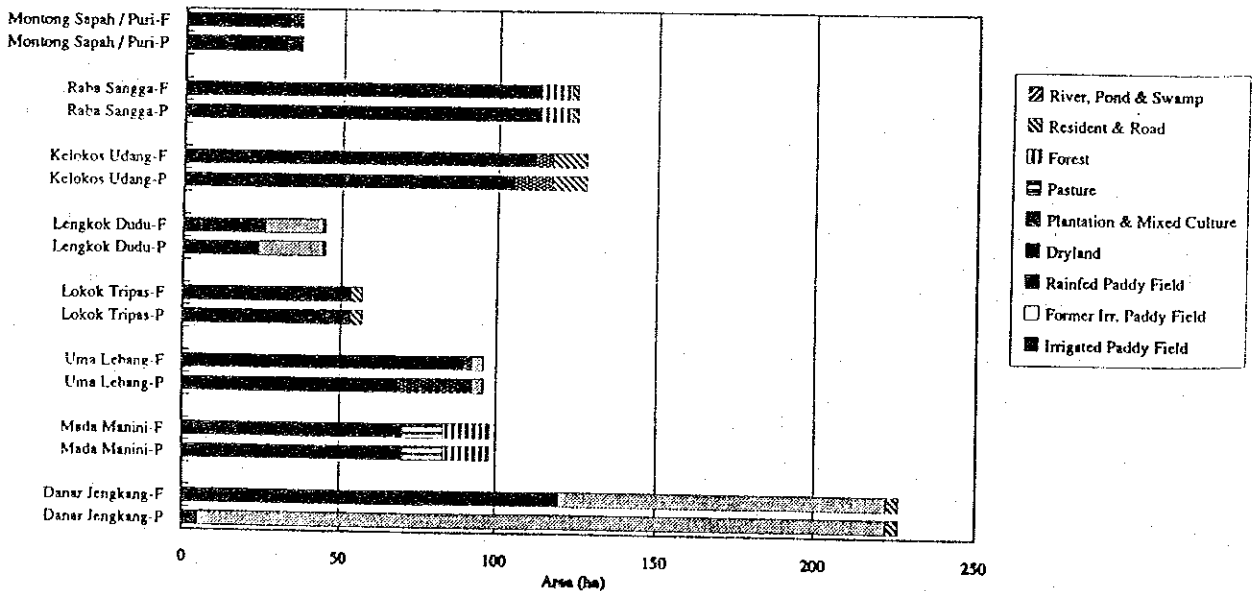


Fig. 5-4-1 PRESENT AND FUTURE LAND USE OF REPRESENTATIVE SCHEMES

relatively large due to generally steep ground of the Project area.

(3) Cropping Pattern

Although there are various cropping patterns in the irrigated paddy field, predominant pattern is single or double cropping of paddy, combined with after crops such as secondary crops (palawija), vegetables or annual industry crops if possible. Generally cropping intensity of paddy is 100 % to 200 %. When considering about paddy and after crops, upper limit of cropping intensity is expected to be 300 %. The present and future cropping patterns of the representative schemes are shown in APPENDIX-VI.

Following table shows the cropping intensity of paddy in irrigated paddy fields of the 30 schemes. In the table, planted area during the dry season comes from mainly the water resources analyses. Generally speaking, the cropping intensity of paddy will increase at a rate of 20 to 30 % in each province.

AVERAGE PLANTED AREA AND CROPPING INTENSITY
OF PADDY OF REPRESENTATIVE SCHEMES

	N.Sumatra (10 schemes)		S.Sulawesi (12 schemes)		W.Nusa Tenggara (8 schemes)	
	Pr	Fu	Pr	Fu	Pr	Fu
Planted Area of Paddy (ha)						
Wet Season	34	50	51	81	49	67
Dry Season	19	42	24	58	17	33
Cropping Intensity of Paddy (%)	155	184	147	172	134	150

Note; Pr = Present, Fu = Future.

5.4.3 Crop Yields and Production

(1) Yield Rate

The yield levels of major food crops is estimated on the basis of statistic data published by Central Bureau of Statistics in Indonesia. Although yield rates of crops are surveyed through the inventory survey and interview to farmers, those results not enough reliable due to upper bias and large deviation.

In estimation of paddy yield rate, the key factor determining paddy yield rate is assumed to be technical level of

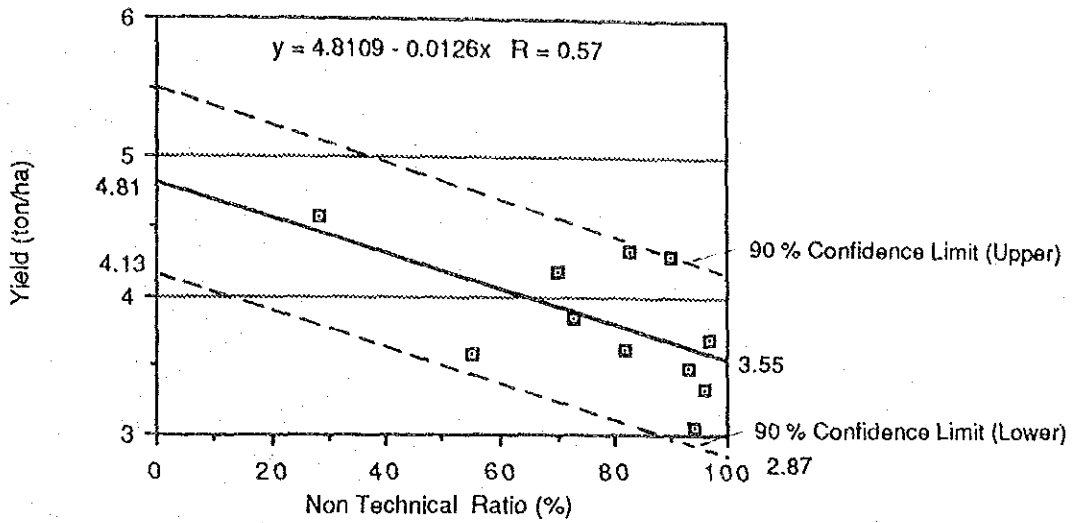
irrigation out of complicated factors such as stable water supply and overall improvement of farming. Paddy field area is divided into two groups, of which one is technical and semi technical irrigation area, and another is simple irrigation, rainfed, tidal and other paddy field. The ratio of the latter in total paddy field area ('non technical ratio' hereinafter) is assumed to be determining factor of paddy yield rate. Then, simple regression between non technical ratio and 5-year average yield rate of paddy are calculated by using each Kabupaten data (refer to Fig. 5-4-2). Since the Project area is generally located in lesser productive area, correlation in the Project area is estimated on lower limit of 90 % confidence interval which is presented as dotted line in the figure. Since present paddy field of the Project is classified into the non technical group, present yield rate is at 100 % of the non technical ratio. The improvement level of irrigation facilities within the Project will not reach fully technical irrigation conducted by Ministry of Public Works. Therefore target yield are decided to be at 20 % of the non technical ratio. To achieve target yield of paddy will require five years.

Present paddy yield in rainfed field is determined at 75 % of irrigated paddy mentioned above. The ratio is derived from the inventory results of irrigated and rainfed paddy. A part of rainfed paddy field is to transformed to irrigated field but the rest is not directly affected by the Project. It is seemed to get indirect effect of regional progress in cropping methods, but the indirect effect is not stable and countable. Therefore, yield rate of rainfed paddy is expected to remain at a present level in future, at least.

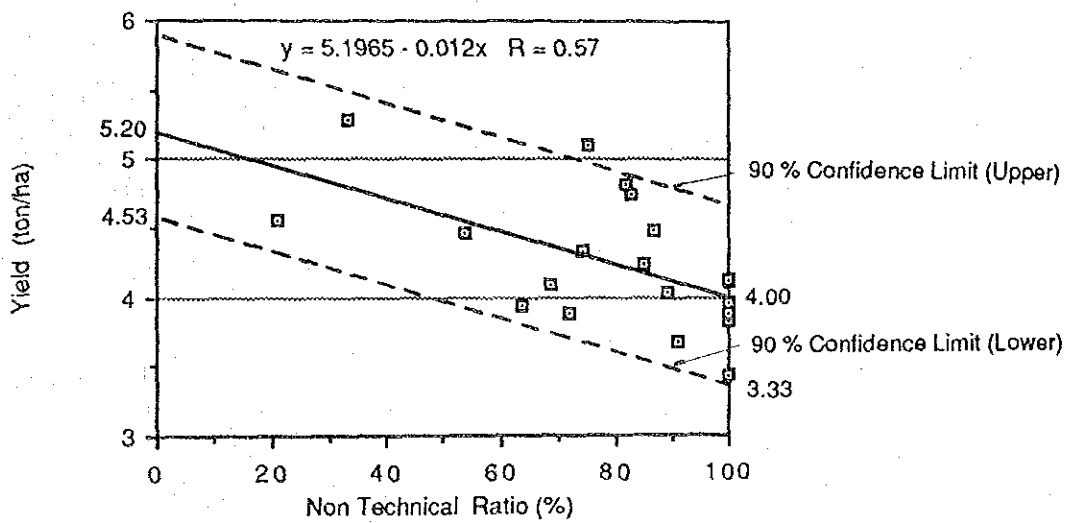
As for yield rates of palawija crops, vegetables and other crops, present yields are estimated at 5-year average rates on statistics modified by the ratio of provincial average and adopted figure of irrigated paddy illustrated in the figure. The decreasing factors are 81 % in North Sumatra, 83 % in South Sulawesi and 94 % in West Nusa Tenggara. Future yield rates of those crops are to be present level at least, for the same reason of rainfed paddy.

The present and future yield rates of major food crops are summarized in following Table 5-4-2.

Paddy Yield and Non Technical Irrigation Ratio in North Sumatra, 1989



Paddy Yield and Non Technical Irrigation Ratio in South Sulawesi, 1989



Paddy Yield and Non Technical Irrigation Ratio in NTB, 1989

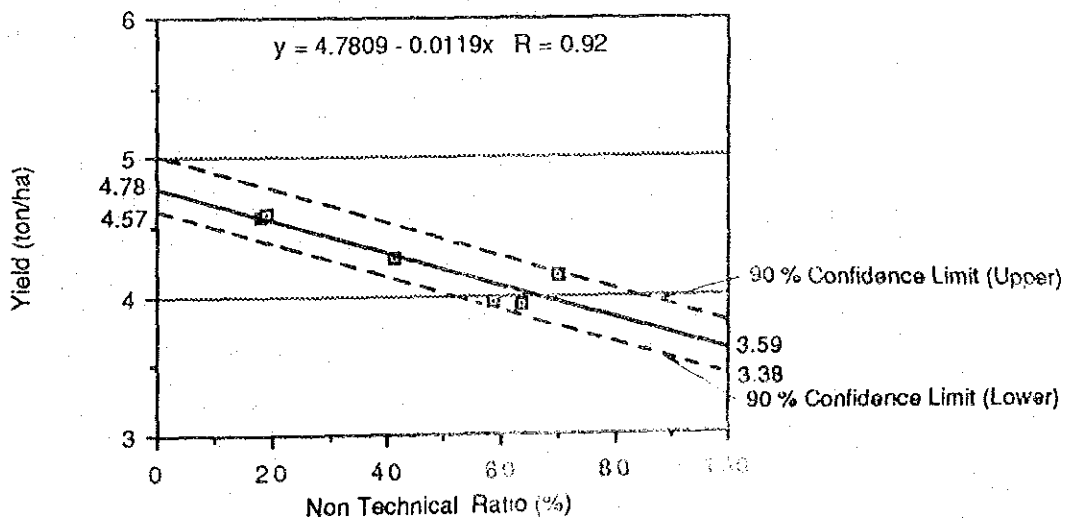


Fig. 5-4-2 PADDY YIELD AND NON TECHNICAL IRRIGATION RATIO

Table 5-4-2 PRESENT AND FUTURE YIELD RATES OF MAJOR FOOD CROPS OF REPRESENTATIVE SCHEMES

Unit: ton/ha

Crops	N.Sumatra (10 schemes)		S.Sulawesi (12 schemes)		W.Nusa Tenggara (8 schemes)	
	Pr	Fu	Pr	Fu	Pr	Fu
Irrigated Paddy	2.87	3.88	3.33	4.29	3.38	4.33
Rainfed Paddy	2.15	2.15	2.50	2.50	2.54	2.54
Upland Paddy	1.63	1.63	1.52	1.52	1.64	1.64
Maize	1.67	1.67	1.28	1.28	1.56	1.56
Cassava	9.81	9.81	9.31	9.31	9.87	9.87
Sweet Potato	7.41	7.41	6.44	6.44	9.45	9.45
Peanut	0.87	0.87	0.88	0.88	1.05	1.05
Soybean	0.82	0.82	0.85	0.85	0.94	0.94
Green Pea	0.75	0.75	0.73	0.73	0.39	0.39

Note; Pr = Present, Fu = Future.

(2) Crop Production

The amount of paddy production will be almost doubled due to expansion of irrigate field, increase of cropping intensity and increase of yield rate. On the contrary, The production of upland crops will sometimes decrease due to reduction of planted area.

The change of paddy production in the 30 schemes are presented by province as below. The increment rates of paddy production are estimated to be about 120 % in North Sumatra and South Sulawesi and about 90 % in West Nusa Tenggara.

CHANGE OF PADDY PRODUCTION OF REPRESENTATIVE SCHEMES

Unit: ton

Crops	N.Sumatra (10 schemes)		S.Sulawesi (12 schemes)		W.Nusa Tenggara (8 schemes)	
	Total	Average	Total	Average	Total	Average
Present Production	1,624	162	3,250	271	1,815	227
Future Production	3,595	360	7,143	595	3,462	433
Increment	1,971	197	3,893	324	1,647	206
Increment Rate (%)		121		120		91

5.4.4 Farm Economy

(1) Population and Farm Household

Average population and number of farm households in the study schemes are summarized as below. The average scheme in North Sumatra and South Sulawesi has about 600 of population and about 120 farm households. In West Nusa Tenggara the average size of scheme is smaller with about 800 people and 170 farm households.

AVERAGE POPULATION AND NUMBER OF FARM HOUSEHOLD
OF REPRESENTATIVE SCHEMES

	Unit:nos.		
	N.Sumatra (10 schemes)	S.Sulawesi (12 schemes)	W.Nusa Tenggara (8 schemes)
Number of Farm Households	123	124	174
Total Population	620	593	800

(2) Farm Size

Average farm size per farm household in the representative schemes is calculated based on land use survey and number of household, as below. Presently average farmer manage 0.37 ha of irrigated paddy field in North Sumatra and 0.50 ha in West Nusa Tenggara. As for other farm lands, plantation land, which size is as large as irrigated paddy field, has important roll for farm management in North Sumatra. Acreage of irrigated paddy field will increase and one of other farm land has deceasing trend in future.

AVERAGE FARM SIZE PER HOUSEHOLD
OF REPRESENTATIVE SCHEMES

Farm Land	Unit:ha/household					
	N.Sumatra (10 schemes)		S.Sulawesi (12 schemes)		W.Nusa Tenggara (8 schemes)	
	Pr	Fu	Pr	Fu	Pr	Fu
Irrigated Paddy	0.37	0.56	0.50	0.76	0.41	0.50
Rainfed Paddy	0.05	0.00	0.09	0.00	0.01	0.00
Dryland	0.06	0.03	0.20	0.07	0.09	0.06
Plantation	0.39	0.29	0.16	0.13	0.15	0.09
Grass Land	0.01	0.01	0.01	0.00	0.01	0.01

Note; Pr = Present, Fu = Future.

(3) Farm Inputs

The interview survey was carried out in terms of crop budget of major food crops. The survey results of crop budget of paddy, maize, soybean and peanut are explained in APPENDIX-VI. However, since the number of sample farmer is not enough on palawija crops, the data is used just as referential figures.

In cultivation of paddy, average amount of fertilizer is approximately 250 kg/ha in each province. The fertilizer applied into 1 ha paddy field consists of about 150 kg of Urea, 70 kg of TSP and 30 kg of KCl. Farm chemicals, such as pesticide are dosed at the rate of 1.0 to 1.6 liter/ha. Labor input is about 130 to 140 man-day/ha, of which more than 50 % is family labor themselves.

(4) Farm Economy

On the basis of the crop budget analysis and interview survey, farm economic analysis was carried out for typical farm households of the 30 representative schemes. The results are shown as below.

About 86 % of the income originates from agricultural products, so non-agricultural income accounts for only small portion in family finances. The major part of non-agricultural income comes from agricultural works at other farmers' fields. On the other hand, about 63 % of expenditure is for purchase of foods. According to the survey on farmers' family finances in the scheme areas, they have only a few surplus, and some farm households suffers from a deficit. Therefore, the construction or rehabilitation costs of agricultural infrastructure are hardly paid by farmers themselves.

AVERAGE FARM ECONOMIC CONDITION OF THE REPRESENTATIVE SCHEMES

Unit:Rp./household/year

	N.Sumatra (10 schemes)	S.Sulawesi (12 schemes)	W.Nusa Tenggara (8 schemes)
Income	962,000	888,000	960,000
On-farm Income	819,000	743,000	877,000
Off-farm Income	143,000	145,000	83,000
Expenditure	937,000	843,000	932,000
Surplus	25,000	45,000	27,000

- Note: 1. On-farm income is net income in agricultural works.
2. Off-farm income consists of wage, pension, remittance and so on.

5.4.5 Irrigation and Drainage Facilities

The current facilities and their scales of the thirty(30) representative schemes are shown in the next Table 5-4-3.

Table 5-4-3 (1/3) PRESENT FACILITY'S CONDITION FOR 30 REPRESENTATIVE SCHEMDS (NORTH SUMATRA)

Province : North Sumatra

Code No.	80038	80038	80057	80091	50129	50141	50213	50220	50256
Project name	Sumbul Berampu	Sumbul Berampu	Sidomukti	Aek Palla	Pangasabtan B	Aek Siparubue	Autamale	Asahan VIII	Aek Sibih
District	Dairi	Dairi	Langkat	Labuhan Batu	Tapanuli Tengah	Tapanuli Utara	Tana Karo	Asahan	Tapanuli Selatan
Group	LD	VI	VI	VI	VI	VI	VI	VI	VI
Construction/repairing year	1979	1978, 1981	1980	1979/80, 1990/81	1976	1920 s. 1976	1989	1971, 1985	1982, 1984
Executing agency	DPUP	Farmers, DPUP	Farmers	Farmers & BPP	Farmers & DIPERRA	Farmers	Farmers	FARMERS PRAS	FARMERS BANGDES
Topographic condition	Mountainous & hilly area	Mountain/hilly area	Alluvial plain	Alluvial plain	Alluvial plain	Mountainous & hilly area	Mountainous & hilly area	Plain area	Hilly area
Elevation	875 m	975 m	39 m	20 m	3 m	900 m	180 m	180 m	135 m
Water source	Kanjou river	Lenuata river	Berulap river	Palla(Gotl)	Stadlang river	Siparubue river	Lauberas river	Piassa river	Sigemuruh river
River discharge	Average 0.6 m ³ /s Wet S. 3.0 m ³ /s Dry S. 2.5 m ³ /s	1.35 m ³ /s 0.6 m ³ /s 1.5 m ³ /s 1.2 m ³ /s	0.5 m ³ /s 0.8 m ³ /s 0.2 m ³ /s	0.38 m ³ /s 0.75 m ³ /s 0.025 m ³ /s	0.475 m ³ /s 0.80 m ³ /s 0.15 m ³ /s	0.275 m ³ /s 0.50 m ³ /s 0.05 m ³ /s	0.5 m ³ /s 0.8 m ³ /s 0.2 m ³ /s	0.5 m ³ /s 0.8 m ³ /s 0.3 m ³ /s	0.45 m ³ /s 0.8 m ³ /s 0.3 m ³ /s
Irrigated area	35 ha	124 ha	12 ha	34 ha	30 ha	23 ha	32 ha	45 ha	40 ha
Damaged paddy field	14 ha	-	-	-	12 ha	-	-	-	-
Rainfed paddy field	1 ha	-	15 ha	-	-	1 ha	-	2 ha	-
Planted area	30 ha	124 ha	27 ha	34 ha	42 ha	24 ha	32 ha	47 ha	40 ha
Intake facility & intake direction	Weir made of masonry LxH=7.5x7.0 m, left side	Weir made of natural stones filled with concrete LxH=6.0x1.0 m, left side	Both sides by several temporary weirs	Both sides by weir	Weir made of wet masonry, left side	Weir made of wet masonry LxH=15.8x1.2 m, right side	Weir with LxH=15x1.5 m, left side	Centrifugal pump with 200 mm in diameter, right side	Free intake, right side
Canals	Earthen canal 7 Km	Earthen canal 2 Km	Earthen canal	Earthen canal 1.0 Km in right	Earthen canal 0.5 Km in left	Earthen canal 4 Km	Earthen canal 1.5 Km	Lined canal 0.7 Km, earth canal lined, 0.4 Km	Earthen canal with partly lined, 0.4 Km
Condition of facility	Damaged in free intake and it leaves as it is	Collapse in side slope of canal & flood into canal	No permanent facilities, required stop log in two places	No intake gate, required one stop log	Damaged in river protection, necessary to repair damaged free intake	No intake gate, collapse in canal bank	Collapse in earthen canal	Much leakage from canal, high flood, water level, not enough in intake W.L.	Much leakage from canal, damaged in free intake
Water shortage & its cause	Weir is too downstream	Leakage from canals	Short but not defined	Short, especially in dry season	Short, even in wet season	Short, especially in dry season	Water is not stable even in wet season	Short, especially in dry season	Short even in wet season
Damage by flood	Damaged in earthen canal every year	Damaged in earthen canal every year	Possible	Damaged in canals	Damaged in some facilities	Damaged in wet season every year	Damaged in wet season every year	Damaged in wet season every year	Damaged in wet season every year
Possibility of land development	Possible	Impossible	Possible	Possible	Possible	Possible	Possible	Possible	Possible
Present land use for land development	Upland field & mixed field forest & coconut garden	Upland field, mixed field, forest & coconut garden	Oil palm forest	Rubber, swamp	Forest & swamp	Upland field & oil palm forest	Upland field & swamp	Upland field & mixed field	Mixed field

Table 5-4-3 (2/3) PRESENT FACILITY'S CONDITION FOR 30 REPRESENTATIVE SCHEMES (SOUTH SULAWESI)

Province : South Sulawesi		Code No.	10033	10034	10035	10036	10037	10038	10039	10040	10041	10042	10043	10044	
Project name		Katu	Kadleng	Bandi	Leabang Mata	Gona	Enrekang	1951 & 1955	1982	1980	1980	1982	1980	1982	
District		Bone	Bulumbaba	Bontomatene	Bontomatene	Bontomatene	Bontomatene	Bontomatene	Bontomatene	Bontomatene	Bontomatene	Bontomatene	Bontomatene	Bontomatene	
Group		LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	
Construction/repairing year		1982	1982	1982	1982	1982	1982	1982	1982	1982	1982	1982	1982	1982	
Executing Agency		PPUP	PPUP	PPUP	PPUP	PPUP	PPUP	PPUP	PPUP	PPUP	PPUP	PPUP	PPUP	PPUP	
Topographic condition		Mountainous	Alluvial plain	Alluvial plain	Alluvial plain	Alluvial plain	Alluvial plain	Alluvial plain	Alluvial plain	Alluvial plain	Alluvial plain	Alluvial plain	Alluvial plain	Alluvial plain	
Elevation		222 m	130 m	130 m	130 m	130 m	130 m	130 m	130 m	130 m	130 m	130 m	130 m	130 m	
Water source		Spring water in Lonrong river basin	Kadleng river	Devata river	Bulan river	Bulan river	Bulan river	Bulan river	Bulan river	Bulan river	Bulan river	Bulan river	Bulan river	Bulan river	
River discharge		Average: 0.15 m ³ /s Wet S. 0.10 m ³ /s Dry S. 0.10 m ³ /s	1.75 m ³ /s 2.5 m ³ /s 4.0 m ³ /s	1.8 m ³ /s 3.0 m ³ /s 4.0 m ³ /s	2.25 m ³ /s 3.0 m ³ /s 4.0 m ³ /s	0.125 m ³ /s 0.15 m ³ /s 0.10 m ³ /s	0.4 m ³ /s 0.4 m ³ /s 0.4 m ³ /s	0.7 m ³ /s 1.0 m ³ /s 1.0 m ³ /s	4.25 m ³ /s 20.75 m ³ /s 40.0 m ³ /s	13.4 m ³ /s 30.0 m ³ /s 6.4 m ³ /s	15.4 m ³ /s 30.0 m ³ /s 6.4 m ³ /s	15.4 m ³ /s 30.0 m ³ /s 6.4 m ³ /s	15.4 m ³ /s 30.0 m ³ /s 6.4 m ³ /s	15.4 m ³ /s 30.0 m ³ /s 6.4 m ³ /s	15.4 m ³ /s 30.0 m ³ /s 6.4 m ³ /s
Irrigated paddy field		47 ha	171 ha	67 ha	72 ha	55 ha	55 ha	55 ha	55 ha	55 ha	55 ha	55 ha	55 ha	55 ha	
Damaged paddy field		-	-	-	-	-	-	-	-	-	-	-	-	-	
Watered paddy field		-	-	-	-	-	-	-	-	-	-	-	-	-	
Planted area		43 ha	171 ha	67 ha	72 ha	55 ha	55 ha	55 ha	55 ha	55 ha	55 ha	55 ha	55 ha	55 ha	
Intake facility		Reservoir for spring water LxH=22.0x1.0 m	Weir made of masonry LxH=20.0x1.0 m	Weir made of masonry LxH=4.0x1.5 m	Free intake, right side & other stream intakes	Free intake, right side	Free intake, right side	Free intake, right side	Free intake, right side	Free intake, right side	Free intake, right side	Free intake, right side	Free intake, right side	Free intake, right side	
Intake direction		Left side	Right side	Right side	Right side	Right side	Right side	Right side	Right side	Right side	Right side	Right side	Right side	Right side	
Canals		Earthen canal 0.9 km	Earthen canal 4 km	Earthen canal 2.5 km	Earthen canal 1 km	Earthen canal 0.8 km	Earthen canal 0.8 km	Earthen canal 4 km	Earthen canal 4 km	Earthen canal 4 km	Earthen canal 4 km	Earthen canal 4 km	Earthen canal 4 km	Earthen canal 4 km	
Condition of facility		Damaged in canal slope, necessary to repair masonry stream weir to collect supplement water	Damaged by flood in intake facility necessary to repair weir body into masonry	No permanent facility for irrigation	Imperfect intake facility, much leakage from damaged slopes, need weir and lining of canal	Imperfect intake facility, lack of irrigation facility	Imperfect intake facility, lack of irrigation facility	Necessary to study on irrigation system by dividing river, need permanent intake facility	Temporary weir by piling natural stones, need fixed weir	Use rent-a-pump river water, level varies widely	Free intake, right side	Free intake, right side	Free intake, right side	Free intake, right side	
Water shortage & its cause		Short in dry season, leakage from canals	Short in wet season	Short due to structural problems in intake facility	Short	Short	Short	Short in dry season	Short in dry season	Short in dry season	Short in dry season	Short in dry season	Short in dry season	Short in dry season	
Damage by flood		-	Damaged by poor drainage	-	-	-	-	-	-	-	-	-	-	-	
Possibility of land development		Possible	Possible	Possible	Possible	Possible	Possible	Possible	Possible	Possible	Possible	Possible	Possible	Possible	
Present land use for land development		Upland field	Upland field & sparse forest	Upland field	Mixed field	Upland field & mixed field	Upland field & mixed field	Upland field	Upland field	Upland field & grass	Upland field & grass	Upland field & grass	Upland field & grass	Upland field & grass	

Table 5-4-3 (3/3) PRESENT FACILITY'S CONDITION FOR 30 REPRESENTATIVE SCHEMES (WEST NUSA TENGGARA)

Province : West Nusa Tenggara

Code No.	32013	33050	34004	35005	35145	36016	37003
Project name	Damar Jangkang	Laa Lebang	Lombok Tripas	Lengkok	Kelobes Udag	Naba Sanga	Werton Sapah/
District	Lombok Timur	Sumbawa	Lombok Barat	Lombok Timur	Lombok Timur	Bima	Puri Lombok Tengah
Group	VI	VI	VI	VI	VI	VI	VI
Construction/ repairing year	1970, 1990		1984, 1989	1970, 1978	1981, 1989	1971/72	1989
Executing agency	Farmers & DPUK	Farmers	Farmers & PRAS	Farmers	Farmers & DPUK	Farmers & DPUK	Farmers
Topographic condition	Hilly area	Hilly area	Mountainous	Alluvial plain	Mountainous/ Hilly area	Alluvial plain	Hilly area
Elevation	25 m	20 m	200 m	158 m	303 m	15 m	188 m
Water source	Scalming river	Pemasar river	Lombok Tripas river	Belimbing	Kelobes Udag river & return flow from U/S	Kendo river & mountain torrent	Puri river
River Average discharge	0.8 m ³ /s 0.7 m ³ /s 0.5 m ³ /s	0.3 m ³ /s 0.3 m ³ /s 0.1 m ³ /s	0.2 m ³ /s 0.3 m ³ /s 0.1 m ³ /s	1.375 m ³ /s 2.50 m ³ /s 0.25 m ³ /s	0.275 m ³ /s 0.40 m ³ /s 0.15 m ³ /s	0.195 m ³ /s 0.30 m ³ /s 0.09 m ³ /s	0.25 m ³ /s 0.50 m ³ /s
Irrigated paddy field	3 ha	58 ha	34 ha	24 ha	105 ha	111 ha	13 ha
Damaged paddy field	-	-	-	-	-	-	-
Bainred paddy field	-	-	-	-	-	-	20 ha
Planted area	5 ha 5 ha	58 ha 10 ha	34 ha 34 ha	24 ha 24 ha	105 ha 87 ha	111 ha 35 ha	33 ha
Intake facility & intake direction	Weir made of wet masonry & free intake left side	Weir made of dry masonry LxH=7.0x1.4 m right side	Weir made of wet masonry LxH=7.0x4.6 m both sides	Weir made of wet masonry LxH=25.0x3.5 m right side	Free intake 2 places of right side river width : 4.6 m	Weir for left side LxH=12x4.5 m river width : 1.0 m	Weir-2 nos left side (U/S) right side (D/S) river width : 1.0 m
Canals	Earthen canal 4 Km	Earthen canal 2.5 Km	Earthen canal 2 Km	Earthen canal 4 Km	Earthen canal 9 Km	Earthen canal 2.6 Km	Earthen canal 2.6 Km
Condition of facility	Crest elevation of weir is too low to take water from downstream free intake need to repair free intake	Necessary to repair intake line on weir to prevent imperfect intake	Damaged in weir body, croted in downstream epri need to repair weir body	Collpse of weir in half of body, erosion in downstream epiron being repaired using bamboo, wood & stone	Intake facility functions well but much sedimentation	Facilities well maintained, leakage from embanked canal	Weirs are often damaged by flood because simple ones without gates i.e. imperfect facilities
Water shortage & its cause	Short out to imperfection of free intake leakage from canal	Short in dry season period of wet season is short	Short	Short in dry season	Short in dry season	Short in dry season	Short in dry season
Damage by flood	Damaged in canal every year	Damaged in canal every year	Damaged	Damaged in facilities every year	Damaged in facilities every year	Damaged in facilities every year	Damaged in facilities every year
Possibility of land development	Possible	Possible	Impossible	Possible	Possible	Impossible	Impossible
Present land use for land development	Mixed field	Upland field	Orchard	Orchard	Upland field		

5.4.6 Operation and Maintenance

(1) Organization for O&M

Present organizations for O&M are broadly divided into 3 categories in the 30 representative schemes. They are an authorized O&M group: P3A, a traditional O&M group like "Subak" and a general farmer's working group which often functions as an O&M group. Analyzed results are summarized below :

O&M Organization of 30 Representative Schemes

Description	North Sumatra	South Sulawesi	West Nusa Tenggara	Weighted Average
Authorized P3A	50 %	8 %	38 %	30 %
Traditional O&M Group	30 %	0 %	50 %	23 %
Farmer's Work Group	10 %	84 %	0 %	37 %
No-organization	10 %	8 %	12 %	10 %
Irrigator in Group	70 %	92 %	75 %	80 %
O&M Rules in Group	70 %	50 %	88 %	67 %
Penalty in Rules	30 %	42 %	75 %	47 %

Unit: Distribution in %

From the above summary table, following facts on water user's groups can be derived in the representative 30 schemes:

- i) Authorized P3A and not-authorized traditional O&M group are popular in both North Sumatra and West Nusa Tenggara Province, but they are not in South Sulawesi Province.
- ii) Farmer's working groups organized for mutual assistance (Gotong-royong) are popular in South Sulawesi, and the group acts as a water user's group in some cases.
- iii) About 10 % of the representative schemes have not had any type of O&M group yet in 3 provinces.
- iv) 70-90 % of the schemes have a irrigator(Ulu-Ulu) who is in charge of O&M.
- v) 50-90 % of the schemes have certain rules in which 30-75 % have some penalty rules.

(2) O&M of the System

Present O&M in the 30 representative schemes are analyzed in following main view-points :

- Operation Works: Irrigation Schedule & Rotation, Flood Operation, Irrigation Record, etc.
- Maintenance Works: Periodic Maintenance, Emergency Repair, Maintenance Record, etc.

The analyzed results are given in Table 5-4-6 and summarized below :

- i) Irrigation schedule is not widely prepared. Even if there is a schedule, the schedule is still based on traditional/primitive irrigation custom in most cases.
- ii) About 50 % of the schemes execute rotational irrigation, especially in drought period.
- iii) As a part of periodic maintenance, most of the schemes carry out grass/tree cutting and re-shaping/desilting works for their canals, but structure repairs are rarely made at present.
- iv) Existing farmer's groups have less experience in major construction/repairs of bigger-scale structures such as intake weir or concrete lined canals.
- v) About 80 % of the farmers want Government support for operation as well as maintenance.
- vi) Most of the schemes do not keep records of O&M.

(3) Farmer's Contribution to O&M

Farmer's contributions in the 30 representative schemes are analyzed in terms of water charge and manpower contribution for O&M, and the analyzed results are summarized below :

Farmer's Contribution of 30 Representative Schemes

Description	North Sumatra	South Sulawesi	West Nusa Tenggara	Weighted Average
<u>Water Charge</u>				
By Money: Distribution %	10 %	33 %	25 %	23 %
" Average Rp	50,000Rp	11,125Rp	3,500Rp	21,542Rp
By Crop: Distribution %	40 %	17 %	88 %	43 %
" Paddy Kg	101 kg	28 kg	51 kg	60 kg
<u>Manpower</u>				
Distribution %	80 %	92 %	100 %	90 %
Working Days	9.4 day	8.1 day	5.4 day	7.6 day

From the data analysis, following facts on present farmer's contribution have been derived :

- i) About 20-40 % of the representative schemes on average collect certain water charge in a form of money or crops.
- ii) Collected water charge is 21,500 Rp in currency or 60 kg in paddy on average.
- iii) Most of farmers maintain their irrigation systems by themselves and their annual working days are around a week.

(4) Present Constraints in O&M

Present O&M constraints in the representative schemes had been studied on the basis of the above analyses, and following major O&M constraints at farm level have been identified :

- 1) Authorized O&M groups: P3A have not been established widely in 3 provinces, especially in South Sulawesi Province.
- 2) About 50 % of the schemes do not collect any type of water charge, therefore the schemes have not any budget for O&M at present.
- 3) Irrigation schedule is not generally prepared and rotational irrigation is not widely spread even in drought period.

- 4) Repair works for structures are not made in most cases though simple earth works such as canal re-shaping/desilting works are done periodically.
- 5) Most of the farmers want Government supports to improve their present O&M.

Table 5-4-6 EXISTING O&M CONDITION OF REPRESENTATIVE SCHEMES

I. Existing O&M Organization

(1/2)

No	Description	North Sumatra	South Selawesi	West Nusa Tenggara	Weight Average
A Organization					
	Authorized O&M Group/P3A	50%	8%	38%	30%
	Traditional O&M Group	30%	0%	50%	23%
	General Farmer's Group	10%	84%	0%	37%
	No Organization	10%	8%	12%	10%
B Organization Structure					
	Chief of Group	90%	92%	78%	88%
	Irrigator	70%	92%	75%	80%
	Assistant Irrigator	70%	8%	50%	40%
	Treasurer/Secretary	80%	8%	38%	40%
C Group Regulation					
	Written Regulation	10%	0%	13%	7%
	Not-written Regulation	60%	50%	75%	60%
	Penalty in Regulation	30%	42%	75%	47%
D Meeting for O&M					
	Regular Meeting	90%	92%	88%	90%
	Irregular Meeting	20%	0%	13%	10%
E Others					
	Attendance: Irr. Committee	30%	8%	63%	30%
	Advice by Extension: PPL	60%	83%	75%	73%
	Advice by Irri. Service: PU	10%	0%	38%	13%

II. Operation/Water Management

No	Description	North Sumatra	South Selawesi	West Nusa Tenggara	Weight Average
A Irrigation Schedule					
	Irrigation Rotation	10%	75%	38%	43%
	- Year-round	50%	25%	50%	40%
	- Drought Time	60%	50%	50%	53%
B Irrigation Water					
	- Enough Water	30%	8%	88%	37%
	- W. Shortage sometimes	40%	50%	12%	37%
	- Water Shortage	30%	42%	0%	27%
C Flood Operation					
	- Close Intake Gate	30%	33%	25%	30%
	- Close Farm-inlet	20%	17%	0%	13%
D Others					
	Keeping Irrigation Record	0%	0%	13%	3%
	Operation without Support	40%	8%	0%	17%
	Operation with Support	60%	32%	100%	83%

III. Maintenance

(2/2)

No	Description	North Sumatra	South Selawesi	West Nusa Tenggara	Weighted Average
A	Periodic Maintenance				
	Grass/Tree Cut	80%	83%	100%	87%
	Canal Reshape/Desilting	60%	75%	100%	77%
	Mainor Repair of Structure	50%	58%	0%	40%
B	Procurement of Repair Material				
	Local Market	50%	42%	13%	37%
	Government Supply	30%	17%	13%	20%
C	Emergency Repair	70%	50%	13%	47%
D	Experience of Major Repair	30%	8%	0%	13%
E	Others				
	Keeping Maintenance Record	20%	0%	38%	17%
	Maintenan. without Support	40%	0%	62%	30%
	Maintenance with Support	60%	100%	38%	70%

IV Farmer's Contribution for O&M

No	Description	North Sumatra	South Selawesi	West Nusa Tenggara	Weighted Average
A	Water Charge				
	By Money: Distribution %	10%	33%	25%	23%
	Average Charge Rp	50.000	11.125	3.500	21.542
	By Crop: Distribution %	40%	17%	88%	43%
	Average Kg	Paddy:101	Paddy:28	Paddy:51	Paddy 60
B	Manpower Contribution				
	Distribution %	80%	92%	100%	90%
	Average Work Days Man/day	9.4 days	8.1 days	5.4 days	7.6 days

5.5 Development Plan of the Representative Schemes

5.5.1 Land Development Plan

The current irrigation area of the representative schemes in three(3) provinces has reached 1,493 ha in total. After review of water sources, topography, soil and so on, the area of 2,226 ha has been identified to be irrigable if adequate irrigation facilities, and operation and maintenance system are introduced.

In the potential irrigable area, the area of 562 ha is to be newly developed for paddy fields resulting from transfer of other land use. In transferring upland field to paddy field, land leveling and clearing, and paddy field formation are required. On the other hand, land clearing, uprooting works, land leveling and paddy field formation are required in transferring other land to paddy field.

(1) Scheme Division

Unit : nos

Province	Land Development	Village Irrigation	Total
North Sumatra	2	8	10
South Sulawesi	1	11	12
NTB	1	7	8
Total	4	26	30

(2) Objective Area

Unit : ha

Province	Land Development Scheme		Village Irrigation Scheme	
	Land Development Area	Scheme Area	Land Development Area	Scheme Area
North Sumatra	89	262	50	731
South Sulawesi	23	101	256	1,506
NTB	115	227	29	586
Total	227	590	335	2,823

Note) Total area of thirty(30) schemes is 3,413 ha.