

Present Status of Swamp Irrigation Scheme by Region (Existing Scheme)

Unit : 1,000 ha

	Nos. of schemes	Designed Area (Luas Rencana)	Paddy Field Functioned	Paddy Field not yet Functioned	Area for Non-Paddy Field
Sumatera	333	986	407	38	541
Jawa	0	0	0	0	0
Bali & Nusa Tenggara	0	0	0	0	0
Kalimantan	275	593	249	146	190
Sulawesi	94	469	122	15	332
Maluku & Irian Jaya	1	6	1	5	0
Indonesia	703	2,054	787	204	1,063

Present Status of Swamp Irrigation Scheme by Region (New Construction Scheme)

Unit : 1,000ha

	Nos. of schemes	Designed Area (Luas Rencana)	Paddy Field Functioned	Paddy Field not yet Functioned	Area for Non-Paddy Field
Sumatera	40	158	0	44	114
Jawa	0	0	0	0	0
Bali/Nusa Tenggara	0	0	0	0	0
Kalimantan	4	10	0	8	2
Sulawesi	29	52	0	2	50
Maluku/ Irian Jaya	7	52	0	0	52
Indonesia	80	272	0	54	218

Out of the designed area of 2.05 million ha, the actual functional area as paddy field is 790 thousand ha and the area of about 200 thousand ha is not used for paddy field for some reason. The remaining 1 million ha is used for other purposes than paddy field. On the other hand, new construction schemes have more than 50 thousand ha expandable for paddy field. Therefore, it can be estimated that there are about 250 thousand ha of potential expandable area as paddy field in swamp area. and these areas are mostly distributed in Kalimantan and Sumatera.

6.4 Assessment of Effect of Irrigation Development on Paddy Production Increase

Effect of irrigation development on paddy production is assessed for the following five types of development related to paddy production increase:

- (1) New Irrigation Development/Extension
- (2) Rehabilitation/Special Maintenance
- (3) Operation and Maintenance

- (4) Village Irrigation
- (5) Handing over small schemes to farmers (Proyek Irigasi Kecil; PIK)

6.4.1 New Irrigation

New irrigation development is defined as the construction of new irrigation system to irrigate agricultural land. There are three types of system: surface water irrigation, groundwater irrigation and swamp irrigation.

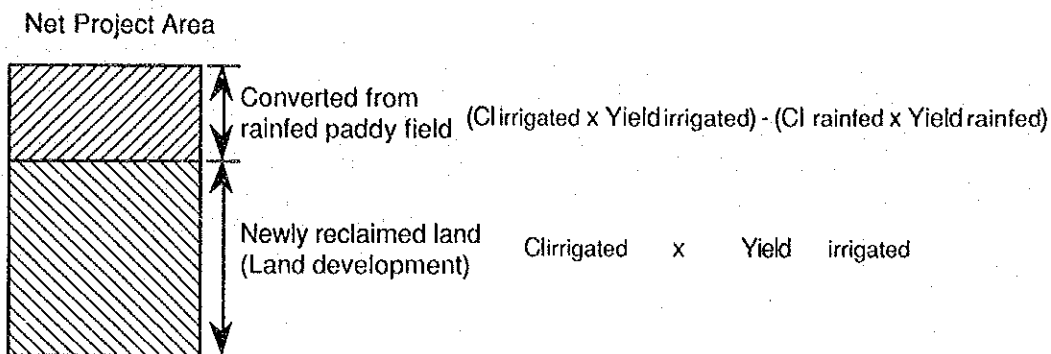
(1) Surface irrigation

Most surface irrigation systems found in Indonesia consists of headworks including weir and intake structures, main canal, secondary canal and tertiary system. Objective land to be irrigated is usually rainfed paddy field and/or newly reclaimed land. More than one cropping of paddy will be possible after completion of the system. In the study, in case the information on present land use of proposed irrigation area is not available, it is assumed that 30 % of the total irrigation area is rainfed and the remaining 70% is newly reclaimed area. Yield and cropping intensity is estimated by province on the basis of present actual condition, which will be described later.

Extension of existing irrigation area is expected to bring about the same effect on paddy production increase as new irrigation development. Upgrading/improvement of the existing system which is accompanied by the expansion of irrigation area will also be treated in this category.

Since full development stage will be realized with the simultaneous effort of land development, we deal with land development as a part of new development/extension works. Conceptual explanation on the effect of the development is presented below.

Effect of Irrigation Development (Surface water) on Paddy Production Increase



Example:

Net Project Area : 500 ha
 Rainfed area : 200 ha Present CI rainfed=1.0, Yieldrainfed=3.5ton/ha
 Newly reclaimed area : 300 ha
 Proposed CI irrigated=1.7, Yieldirrigated=5.5ton/ha

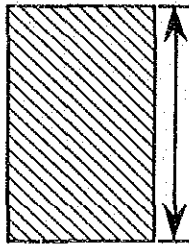
Then, expected production increase is calculated at:
 $200 \times \{(1.7 \times 5.5) - (1.0 \times 3.5)\} + 300 \times 1.7 \times 5.5 = 3,975 \text{ ton}$

(2) Groundwater irrigation

Groundwater development is usually designed to provide supplement water to existing rainfed paddy field. One scheme covers relatively small area due to low yield of groundwater per well. The wells will be handed over to farmers two years after the construction. As construction cost of well and its maintenance costs are high, farmers tend to cultivate high-value crops such as vegetables in dry season. It is, therefore, assumed that existing land use is rainfed paddy field and that paddy cropping intensity is 1.0 for groundwater schemes, considering that crop diversification for higher value crops will proceed in this type of schemes in order to pay high O&M costs. Conceptual explanation on the effect of the development on paddy production increase is shown below.

Effect of Irrigation Development (Groundwater) on Paddy Production Increase

Net Project Area



Converted from
rainfed paddy field

$$(CI_{irrigated} \times Yield_{irrigated}) - (CI_{rainfed} \times Yield_{rainfed})$$

Example:

Net Project Area : 500 ha

Rainfed area : 500 ha Present CI rainfed=0.9, Yieldrainfed=3.5ton/ha

Proposed CI irrigated=1.0, Yieldirrigated=5.5ton/ha

Then, expected production increase is calculated at:

$$500 \times \{(1.0 \times 5.5) - (0.9 \times 3.5)\} = 1,175 \text{ ton}$$

(3) Swamp Irrigation

No new construction scheme of swamp irrigation development has been planned in Repelita V. As for the effect of swamp irrigation, although some production increase due to the conversion from not yet irrigated paddy field to irrigated one is deemed, it is difficult to bring about big production increase without considerable amount of investment from the view points of present circumstances of existing swamp schemes. Therefore, the expected increase of yield is very small and negligible as a whole.

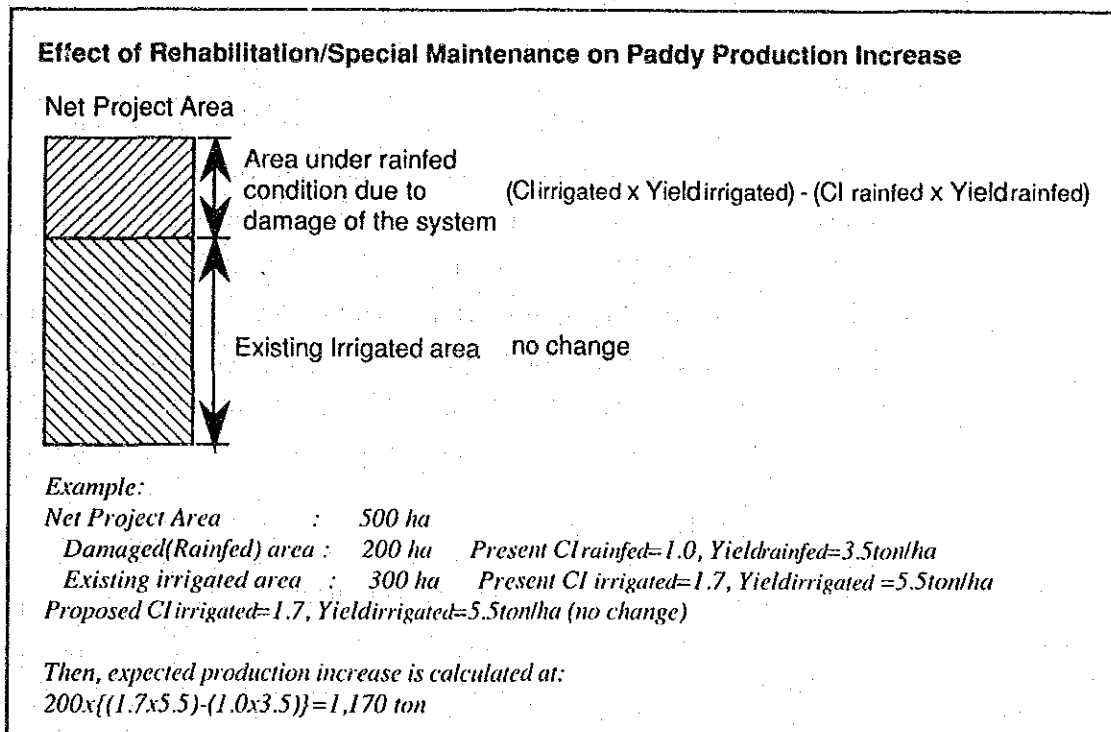
6.4.2 Rehabilitation/Special Maintenance

Rehabilitation/special maintenance is defined as repair works for the damaged portions of the existing irrigation systems in order to recover the system's designed irrigation capacity. Those works are not accompanied by the increase of irrigation area (extension of area). It is assumed that same effects on paddy production increase is expected for rehabilitation and special maintenance. The effect of repair works on paddy production varies much, depending on the damaged portion and grade of damage. Some schemes require reconstruction of weir and others need repair works only for tertiary boxes.

Rehabilitation/special maintenance works may bring about paddy production increase through yield increase as well as increase in cropping intensity. The World Bank staff appraisal report

on ISSP II estimated that special maintenance, which is followed by Efficient O&M, will increase cropping intensity of dry season crop by 0.2 for Jawa and 0.3 for outer Jawa.

In case basic data on land use is not obtained for any project plan, we assume, based on the results of field survey, that only 30% of those areas are currently rainfed condition due to insufficient water supply resulted from the damage of systems, and that the rehabilitation works will recover the rainfed field back into irrigated field condition. Increase in yield and cropping intensity of the to-be-recovered area can be counted as the benefit from the rehabilitation works. Conceptual explanation on the effect of rehabilitation/special maintenance on paddy production increase is depicted below:



6.4.3 Operation and Maintenance

(1) Surface irrigation system

Operation and Maintenance (O&M) consists of regular O&M and so-called Efficient O&M. Those works are to maintain the existing irrigation system through necessary minor works such as dredging of canal, weeding, other minor repair works. If these works are properly carried out to keep the systems well-maintained condition, rehabilitation and/or special

maintenance works would not be necessary during project life period (maybe 20 years). Unit O&M costs for existing irrigation schemes are, however, said to be insufficient.

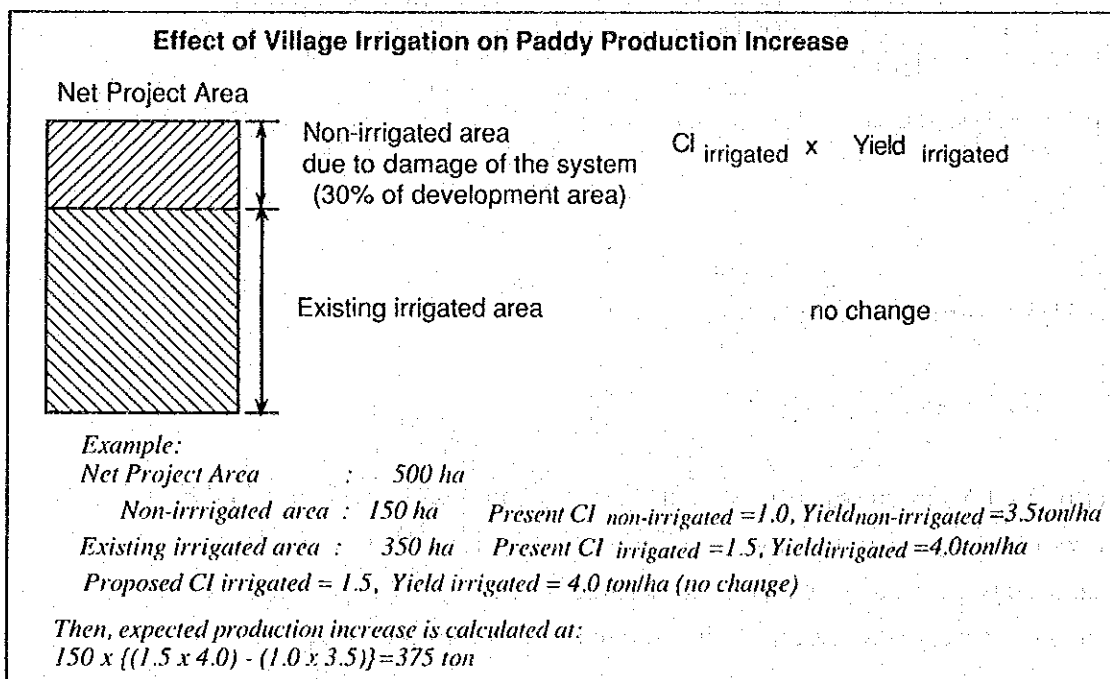
Future unit O&M costs are assumed to increase upto the level of cost for EOM, and the effects of O&M works on paddy production increase is assumed to be negligible.

(2) Swamp system

Upgrading and Efficient O&M program for the existing swamp system are on-going under the World Bank financed "ISSP II". Benefits from those works are expected by the increase of paddy yield only. We assume here that all benefits expected from the program is included in the autonomous increase of paddy yield described later.

6.4.4 Village Irrigation

As described in the subsection 6.1.5, it is reported that 60 % of the whole village irrigation schemes of 98.6 thousand ha have not-well-functioning intake facilities. Under the circumstances, it is assumed that 30 % of the designed areas are not irrigated paddy field. Further, the yield of village irrigation schemes is taken to be higher by 15 % than that of not-yet irrigated paddy field as described in the subsection 5.2.3 because the paddy field in village irrigation area has unstable base for production on account of simple intake facilities and canal systems. As a whole, effect of village irrigation on paddy production increase is estimated as follows;



6.4.5 Hand over Small Schemes to Farmers (Proyek Irigasi Kecil; PIK)

According to the policy of the Government, small irrigation schemes at a scale of less than 500 ha is to be handed over from the government to farmers. Total area of such small schemes amounts to about 2.1 million ha. Before hand over, the government is supposed to carry out minor rehabilitation works with technical guidance on operation and maintenance of the system.

Although the efforts by the government, this program has not been progressed on schedule. One important reason of this is that farmers are not willing to pay for costs for O&M to be shouldered to them. The effect of this program on crop productivity is assumed to be negligible as the major work item of this program is technical guidance to farmers.

6.5 Realization Period of Irrigation Development Effect

In the previous section, the effect of irrigation development on paddy production increase is assessed. However, the effect is not realized in a short period because irrigation development requires a certain period for implementation. In case that a new construction scheme needs the land development, the time lag naturally happens between the construction of irrigation facilities and the land development works because the land development usually starts after the completion of irrigation facilities. In addition, taking the period for soil to be stable after the land development into consideration, it takes longer time for the effect of irrigation development to reach to the maximum. In this section, the construction period of irrigation facilities and the period for the paddy production increase to reach the maximum are assessed theoretically by scale of scheme and type of development.

(1) Periods for Construction of Irrigation Facilities and Land Development by Scale of Scheme

The construction period of irrigation facilities is categorized into the following four types by scale of scheme. Further, this category is assumed to be applied irrespective of the type of development such as new construction, rehabilitation, etc.

Estimated Construction Period of Irrigation Facilities by Scale of Scheme

Scale of Scheme (ha)	Construction Period (Year)	Progress of Land Development after Commencement of Construction(%)					
		1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
Less than 2,000	3	0	0	100	100	100	100
2,000-5,000	4	0	0	50	100	100	100
5,000-10,000	5	0	0	30	60	100	100
More than 10,000	6	0	0	20	40	70	100

In case of new construction scheme, the land development is implemented in parallel with the construction work. Regardless of the scale of the work, no land development work in the first and second year is carried out because of mobilization, preparation of office quarter, construction of head works and main canal, etc. Land development starts from the third year when the construction of tertiary systems commence and four types of the progress are categorized by scale of scheme as shown in the above table. A scheme less than 2,000 ha completes the whole paddy fields within one year at the third year after the commencement of construction works. A scheme more than 10,000 ha completes the works by 20 % of the whole in the 3rd and 4th year (accumulated to 40% in two years total), by 30 % in the 5th and 6th year (accumulated to 60 % in two years total), and all the land development are assumed to be completed in 6 year after the commencement of the work.

(2) Period to Realize Productivity after Land Development

It is known by experience that the paddy field newly developed has disturbed soil through clearing and leveling and requires long time until realizing its potential productivity. This period for realization of productivity is taken as 3 years in case of the scale of scheme less than 500 ha and 5 years in case of the scheme more than 500 ha. The following table shows the annual realization rate before the attainment of target production.

Realization Rate of Productivity after Land Development

Scale of Scheme	Build up Period (year)	Realization Rate of Productivity after Land Development (%)					
		1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
less than 500	3	0	30	70	100	100	100
More than 500	5	0	20	40	60	80	100

Whereas, as for rehabilitation, groundwater irrigation and village irrigation, it is assumed that the target productivity is soon realized just after the completion of construction of works because paddy fields already exist in the area.

(3) Period to Realize Potential Productivity for Paddy Field

The summary described in the above is that the period from the commencement of construction to the realization of target productivity of paddy field is estimated combining the annual progress of land development and the period to realize the target productivity of paddy field. The following table shows an example for the scheme with the scale more than 10,000 ha.

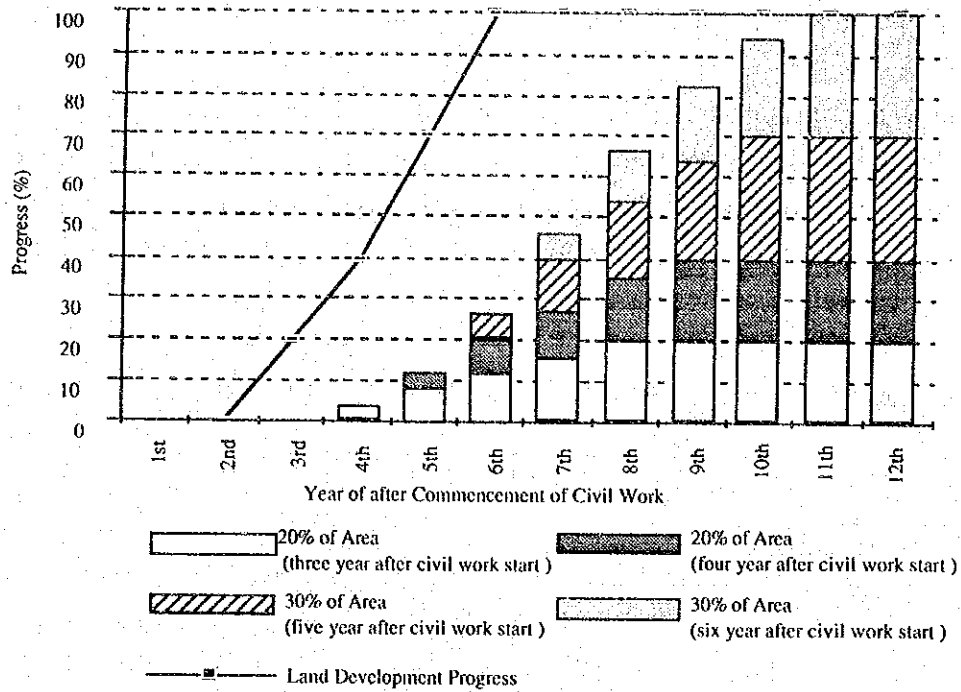
Progress of Land Development and Realization Rate of Productivity after Commencement of Construction

After Commencement of Construction	Progress of Development	Period after Commencement of Construction											
		1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	11 Year	12 Year
3rd Year	20%	0%	0%	0%	20%	40%	60%	80%	100%	100%	100%	100%	100%
4th Year	20%	0%	0%	0%	0%	20%	40%	60%	80%	100%	100%	100%	100%
5th Year	30%	0%	0%	0%	0%	0%	20%	40%	60%	80%	100%	100%	100%
6th Year	30%	0%	0%	0%	0%	0%	0%	20%	40%	60%	80%	100%	100%

At first, annual realization rate is obtained multiplying respective annual progress of land development by realization rate of target productivity. Further, the comprehensive realization rate of paddy productivity in a whole irrigation scheme is calculated by adding all the annual realization rate. The result is shown in the following table

Realization Period of Productivity after Commencement of Construction of Irrigation Scheme with More Than 10,000 ha

After Commencement of Construction	Period after Commencement of Construction											
	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	11 Year	12 Year
3rd Year	0%	0%	0%	4%	8%	12%	16%	20%	20%	20%	20%	20%
4th Year	0%	0%	0%	0%	4%	8%	12%	16%	20%	20%	20%	20%
5th Year	0%	0%	0%	0%	0%	6%	12%	18%	24%	30%	30%	30%
6th Year	0%	0%	0%	0%	0%	0%	6%	12%	18%	24%	30%	30%
	0%	0%	0%	4%	12%	26%	46%	66%	82%	94%	100%	100%



Build up Period of Paddy Production after Commencement of Construction Work of Irrigation Scheme with an area of 10,000ha and more

In the same way, the period until realizing the target paddy productivity is estimated by scale of scheme as shown in the following table.

Realization Period of Productivity after Completion of Irrigation Facilities by Scale of Scheme

Scale of Scheme	Period after Commencement of Construction											
	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	11 Year	12 Year
Less than 500	0%	0%	0%	30%	70%	100%	100%	100%	100%	100%	100%	100%
500-2,000	0%	0%	0%	20%	40%	60%	80%	100%	100%	100%	100%	100%
2,000-5,000	0%	0%	0%	10%	30%	50%	70%	90%	100%	100%	100%	100%
5,000-10,000	0%	0%	0%	6%	18%	38%	58%	78%	92%	100%	100%	100%
more than 10,000	0%	0%	0%	4%	12%	26%	46%	66%	82%	94%	100%	100%

Table 6.1 Physical Progress of DGWRD Works during Repelita V

Type of Work	Unit	1989/90	1990/91	1991/92	1992/93	1993/94	Total
		Progress	Progress	Progress	Progress	Target	
Sub-Sector; Irrigation							
Construction of Irrigation Networks							
New Construction	ha	96,257	81,009	73,419	59,805	95,604	406,094
Groundwater Development	ha	6,592	2,446	3,890	4,202	3,136	20,266
Sub-total		102,849	83,455	77,309	64,182	98,740	426,535
Rehabilitation of Irrigation Networks							
Rehabilitation	ha	104,411	99,912	79,595	95,909	68,170	447,997
Special Maintenance	ha	67,303	136,940	182,480	186,539	144,038	717,300
Sub-total		171,714	236,852	262,075	282,448	212,208	1,165,297
Swamp Development							
Upgrading of Swamp	ha	131,224	41,227	56,452	n.a.	129,868	358,771
Upgrading of Fish Pond	ha	3,920	2,685	3,913	n.a.	300	10,818
Development of Fish Pond	ha	0	0	0	n.a.	300	300
Rehabilitation of Swamp	ha	0	0	0	0	11,290	11,290
New Construction of Swamp	ha	0	0	0	0	10,404	10,404
Flood Control in Swamp	ha	0	0	0	0	3,500	3,500
Sub-total		135,144	43,912	60,365	n.a.	155,662	395,083
Others							
Efficient O&M	ha	979,994	1,267,875	1,360,987	1,337,945	1,283,458	1,283,458
Handing over Small Schemes	ha	14,358	19,696	33,726	0	96,541	216,958
Tertiary Development	ha	0	0	0	0	82,629	82,629
Village Irrigation Development	ha	0	0	0	0	4,085	4,085
Flood Control in Irrigation Scheme	ha	0	0	0	0	3,000	3,000
Maintenance of River in Irrigation scheme	ha	0	0	0	0	40	40
Sector; Education and Research							
Education	nos	0	0	0	0	0	0
Research	nos	10	23	38	38	40	149
Sub-Sector; National Resources							
Flood Control	ha	73,008	85,031	116,450	88,634	90,150	453,273
Exploitation	nos	0	0	0	113	113	226
Maintenance of River	km	629	2,253	1,816	2,253	3,182	10,133
Coastal Area Development	nos	0	1	0	2	2	5

Source: Mid Term Review, DOI-I and II for 1992/93 and DIP 1993/94

Table 6.2 Summary of Expenditure in Each Year of Repelita V

Sector/ Sub-sector/Program	Unit : Million Rp					Total
	1989/90 Actual	1990/91 Actual	1991/92 Actual	1992/93 Actual	1993/94 DIP	
DGWRD	980,941	1,122,719	1,217,638	1,408,090	1,577,126	6,306,514
Sector: Agriculture and Irrigation	632,681	749,081	889,884	1,039,615	1,101,784	4,413,045
Sub-Sector: Irrigation	632,681	749,081	889,884	1,039,615	1,101,784	4,413,045
Program: Rehabilitation and Maintenance of Irrigation Networks	198,580	206,854	314,396	256,021	330,643	1,306,494
Program: Construction of New Irrigation Networks	383,766	483,347	531,582	667,586	705,075	2,771,356
Program: Development of Swamp	50,335	58,880	43,906	116,008	66,066	335,195
Sector: Education and Research	18,025	20,543	35,289	15,041	20,770	109,669
Sub-Sector: Education of Irrigation	5,200	4,014	5,000	3,224	3,760	21,199
Sub-Sector: Research of Irrigation	12,825	16,529	30,289	11,817	17,010	88,470
Sector: National Resources and Life Environment	330,235	353,095	292,465	353,434	454,572	1,783,801
Sub-Sector: National Resources	330,235	353,095	292,465	353,434	454,572	1,783,801
Program: Preservation of Forest, Land and Water	329,985	351,098	285,637	349,230	443,892	1,759,842
Program; Coastal Area Development	250	1,997	6,828	4,204	10,680	23,959

Source : Mid Term Review, Data from SETDITJEN for 1992/93 and DIP 1993/94

Table 6.3 Development Expenditure and Loan Amount during Repelita V

Unit : Million Rp.

Sector/Program	1989/90		1990/91		1991/92		1992/1993		1993/94		Total	%						
	Total	Loan	Total	Loan	Total	Loan	Total	Loan	Total	Loan	Total	Loan						
DGWRD	980,941	816,303	83	1,122,719	732,298	65	1,217,638	714,412	59	1,408,090	751,841	53	1,577,126	797,275	51	6,306,514	3,812,130	60
Sub-Sector: Irrigation	632,681	606,704	96	749,081	504,206	67	889,884	533,502	60	1,039,615	522,495	50	1,101,784	555,659	50	4,413,045	2,722,566	62
Program: Rehabilitation and Maintenance of Irrigation Networks	198,580	185,192	93	206,854	126,088	61	314,396	152,655	49	256,021	171,727	67	330,643	191,595	58	1,306,494	827,257	63
Program: Construction of Irrigation Networks	383,766	382,127	100	483,347	348,098	72	531,582	348,361	66	667,586	335,075	50	705,075	349,343	50	2,771,356	1,763,004	64
Program: Development of Swamp	50,335	39,386	78	58,880	30,020	51	43,906	32,485	74	116,008	15,693	14	66,066	14,721	22	335,195	132,305	39
Sector: Education and Research	18,025	16,424	91	20,543	22,126	108	35,289	24,352	69	15,041	18,521	123	20,770	12,252	59	109,669	93,676	85
Sub-Sector: National Resources	330,235	193,175	58	353,095	205,966	58	292,465	156,559	54	353,434	210,824	60	454,572	229,365	50	1,783,801	995,888	56

Remarks: Total Expenditures from 1989/90 to 1992/93 are actual ones, while that for 1993/94 and Loan amount in every year are of Development Budget (DIP).
 Source: Mid Term Review, Data from SETDIJEN and Anggaran Pendapatan dan Belanja Negara, April 1989, 1990, 1991, 1992 and 1993

Table 6.4 Routine Expenditure for DGWRD during Repelita V

Fiscal year	Division	Unit: '000 Rp				Total
		Wage, Rice, Overtime and Others	Office Expenditure Electricity, Phone, Other Service	Office, Vehicle and Other Maintenance	Official Trip and Subsidy	
1989/90	General Administration Cost	1,660	352	108	124	2,243
	Irrigation Development	3,941	213	106	19	4,278
	Swamp and River Development	2,673	193	68	25	2,959
	Total	8,275	758	281	167	9,480
1990/91	General Administration Cost	1,742	346	115	124	2,326
	Irrigation Development	4,970	232	116	26	5,343
	Swamp and River Development	2,917	239	75	30	3,261
	Total	9,629	817	306	179	10,930
1991/92	General Administration Cost	1,985	422	155	136	2,698
	Irrigation Development	5,660	338	149	32	6,179
	Swamp and River Development	3,323	317	96	37	3,773
	Total	10,968	1,078	401	205	12,651
1992/93	General Administration Cost	3,150	481	159	142	3,932
	Irrigation Development	6,215	346	152	34	6,746
	Swamp and River Development	3,943	348	103	39	4,433
	Total	13,308	1,175	413	215	15,111
1993/94	General Administration Cost	2,983	691	248	192	4,114
	Irrigation Development	8,556	483	226	61	9,325
	Swamp and River Development	4,513	500	167	43	5,224
	Total	16,052	1,675	641	296	18,663
Pelita V	General Administration Cost	11,520	2,292	784	717	15,314
	Irrigation Development	29,342	1,611	749	170	31,873
	Swamp and River Development	17,368	1,598	509	173	19,649
	Total	58,231	5,502	2,042	1,061	66,835

Source : SETDITJEN, DGWRD

Table 6.5 Irrigated Area Managed by Government from 1982 to 1989

Cord No.	Province	Unit : ha				
		1982	1985	1988	1989	Difference (1989-1982)
11	D.I.Aceh	131,731	107,105	107,280	107,280	-24,451
12	Sumatera Utara	163,167	153,922	159,994	158,232	-4,935
13	Sumatera Barat	155,646	161,319	161,319	158,142	2,496
14	Riau	9,258	8,010	8,828	8,307	-951
15	Jambi	7,781	12,037	13,886	14,288	6,507
16	Sumatera Selatan	31,350	34,009	47,325	48,467	17,117
17	Bengkulu	38,280	36,706	36,706	46,317	8,037
18	Lampung	75,434	82,929	86,253	86,253	10,819
	Sumatera	612,647	596,037	621,591	627,286	14,639
31	D.K.I.Jakarta	8,483	8,945	8,945	8,945	462
32	Jawa Barat	794,619	842,522	817,969	830,055	35,436
33	Jawa Tengah	704,465	700,830	781,900	790,709	86,244
34	D.I.Jogyakarta	59,143	59,789	52,550	54,873	-4,270
35	Jawa Timur	933,288	924,919	925,418	930,449	-2,839
	Jawa	2,499,998	2,537,005	2,586,782	2,615,031	115,033
51	Bali	57,218	75,243	79,319	82,612	25,394
52	Nusa Tenggara Barat	125,266	146,356	148,403	149,546	24,280
53	Nusa Tenggara Timur	17,594	19,339	21,415	22,456	4,862
54	Timor Timur	1,820	3,854	6,042	6,042	4,222
	Bali/Nusa Tenggara	201,898	244,792	255,179	260,656	58,758
61	Kalimantan Barat	6,777	9,104	9,104	9,038	2,261
62	Kalimantan Tengah	1,145	1,937	2,139	1,896	751
63	Kalimantan Selatan	9,043	8,558	10,729	11,214	2,171
64	Kalimantan Timur	13,606	5,164	5,619	5,619	-7,987
	Kalimantan	30,571	24,763	27,591	27,767	-2,804
71	Sulawesi Utara	37,491	44,960	48,149	48,984	11,493
72	Sulawesi Tengah	27,733	34,690	40,884	51,159	23,426
73	Sulawesi Selatan	176,260	181,485	210,244	210,641	34,381
74	Sulawesi Tenggara	6,906	11,311	16,098	19,679	12,773
	Sulawesi	248,390	272,446	315,375	330,463	82,073
81	Maluku	4,929	6,178	9,848	9,848	4,919
82	Irian Jaya	1,424	1,190	2,291	2,122	698
	Maluku/Irian Jaya	6,353	7,368	12,139	11,970	5,617
	INDONESIA	3,599,857	3,682,411	3,818,657	3,873,173	273,316

Source : Rekapitulasi Daerah Irigasi PU

Table 6.6 Physical Progress of New Construction Projects during Repelita V

Code	Province	Unit : ha					Total
		1989/90 Progress	1990/91 Progress	1991/92 Progress	1992/93 Prgress	1993/94 Target	
11	Dista Aceh	3,333	4,301	7,432	10,706	13,568	39,340
12	Sumatera Utara	7,250	17,965	2,250	0	17,456	44,921
13	Sumatera Barat	10,556	1,619	0	2,267	7,199	21,641
14	Riau	0	0	0	397	196	593
15	Jambi	0	93	0	0	113	206
16	Sumatera Selatan	1,003	0	1,122	2,386	0	4,511
17	Bengkulu	3,777	2,469	1,303	0	2,234	9,783
18	Lampung	15,700	5,005	7,005	0	328	28,038
	Sumatera	41,619	31,452	19,112	15,756	41,094	149,033
31	DKI Jakarta	0	0	0	0	0	0
32	Jawa Barat	11,464	7,133	3,867	46	0	22,510
33	Jawa Tengah	25,228	23,889	25,599	15,005	10,199	99,920
34	D.I. Yogyakarta	0	0	0	0	0	0
35	Jawa Timur	0	0	0	0	0	0
	Jawa	36,692	31,022	29,466	15,051	10,199	122,430
51	Bali	0	0	1,541	0	1,068	2,609
52	Nusa Tenggara Barat	2,671	2,686	6,570	3,388	12,280	27,595
53	Nusa Tenggara Timur	0	0	858	1,845	3,624	6,327
54	Timor Timur	0	0	31	1,006	1,587	2,624
	Bali/ Nusa Tenggara	2,671	2,686	9,000	6,239	18,559	39,155
61	Kalimantan Barat	0	0	0	4,703	2,610	7,313
62	Kalimantan Tengah	687	12	149	310	542	1,700
63	Kalimantan Selatan	207	659	2,469	6,219	6,700	16,254
64	Kalimantan Timur	368	0	302	0	0	670
	Kalimantan	1,262	671	2,920	11,232	9,852	25,937
71	Sulawesi Utara	0	620	2,220	518	801	4,159
72	Sulawesi Tengah	11,500	13,400	3,771	5,255	0	33,926
73	Sulawesi Selatan	1,955	375	4,114	4,234	13,402	24,080
74	Sulawesi Tenggara	0	0	1,017	0	801	1,818
	Sulawesi	13,455	14,395	11,122	10,007	15,004	63,983
81	Maluku	0	133	67	512	0	712
82	Irian Jaya	558	650	1,732	1,008	896	4,844
	Maluku/Irian Jaya	558	783	1,799	1,520	896	5,556
Total		96,257	81,009	73,419	59,805	95,604	406,094

Source : Mid Term Review, DOI-I and II for 1992/93 and DIP 1993/94

Table 6.7 Physical Progress of Rehabilitation Projects during Repelita V

Code	Province	Unit : ha					Total
		1989/90 Progress	1990/91 Progress	1991/92 Progress	1992/93 Prgress	1993/94 Target	
11	Dista Aceh	2,774	2,000	5,614	4,304	55	14,747
12	Sumatera Utara	16,695	12,845	6,453	454	0	36,447
13	Sumatera Barat	8,728	6,291	5,524	8,131	5,940	34,614
14	Riau	0	0	401	0	1,010	1,411
15	Jambi	775	862	0	171	400	2,208
16	Sumatera Selatan	4,928	1,953	1,232	1,174	10,135	19,422
17	Bengkulu	924	0	478	1,326	1,249	3,977
18	Lampung	6,218	6,017	16,984	29,446	21,179	79,844
	Sumatera	41,042	29,968	36,686	45,006	39,968	192,670
31	DKI Jakarta	0	0	0	0	0	0
32	Jawa Barat	45,738	39,069	78,605	64,340	30,390	258,142
33	Jawa Tengah	38,820	64,073	45,033	62,627	56,116	266,669
34	D.I. Yogyakarta	4,378	1,136	11,306	12,986	6,884	36,690
35	Jawa Timur	11,583	49,271	53,506	43,652	52,005	210,017
	Jawa	100,519	153,549	188,450	183,605	145,395	771,518
51	Bali	0	1,915	1,438	873	0	4,226
52	Nusa Tenggara Barat	4,785	1,225	5,896	0	7,329	19,235
53	Nusa Tenggara Timur	2,118	41	440	4,166	0	6,765
54	Timor Timur	980	1,080	982	792	0	3,834
	Bali/ Nusa Tenggara	7,883	4,261	8,756	5,831	7,329	34,060
61	Kalimantan Barat	892	1,343	1,352	0	0	3,587
62	Kalimantan Tengah	0	467	0	108	33	608
63	Kalimantan Selatan	0	0	0	0	0	0
64	Kalimantan Timur	0	0	0	0	0	0
	Kalimantan	892	1,810	1,352	108	33	4,195
71	Sulawesi Utara	0	1,100	1,759	0	0	2,859
72	Sulawesi Tengah	0	0	0	10,128	4,093	14,221
73	Sulawesi Selatan	20,396	42,682	21,709	34,081	10,184	129,052
74	Sulawesi Tenggara	336	0	2,613	3,689	2,027	8,665
	Sulawesi	20,732	43,782	26,081	47,898	16,304	154,797
81	Maluku	646	3,132	750	0	3,179	7,707
82	Irian Jaya	0	350	0	0	0	350
	Maluku/Irian Jaya	646	3,482	750	0	3,179	8,057
	Indonesia	171,714	236,852	262,075	282,448	212,208	1,165,297

Source: Mid Term Review, DOI-I and II for 1992/93 and DIP 1993/94

Table 6.8 Estimated Area of Village Irrigation Schemes by Province

Code	Province	Data in 1982 by PU			Data in 1993 by PU		Data in 1992 by JICA and IISP-II			Estimated Area (ha)
		Number of Scheme	Design Area	Area (ha)	Functional Field	Number of Scheme	Area (ha)	Number of Scheme	Designed Area (ha)	
11	D.I.Aceh	852	96,649	43,266	259	45,622 *	598	32,213	45,622	
12	Sumatera Utara	1,132	193,435	79,580 *	398	35,972	845	57,234	79,580	
13	Sumatera Barat	2,944	107,641	70,580	2,009	49,256 *			49,256	
14	Riau	99	25,813	2,491 *	n.a.	n.a.			2,491	
15	Jambi	333	66,719	18,957 *	n.a.	n.a.	398	28,754	18,957	
16	Sumatera Selatan	1,379	110,278	62,959	548	62,218 *			62,218	
17	Bengkulu	121	28,130	16,189	202	16,340 *			16,340	
18	Lampung	964	63,542	31,542	140	38,156 *	130	14,066	38,156	
	Sumatera	7,824	692,207	325,564	3,556	247,564	1,971	132,267	312,620	
31	D.K.I.Jakarta	29	4,868	1,607 *	n.a.	n.a.			1,607	
32	Jawa Barat	10,298	310,364	251,809 *	7,787	291,329	2,855	165,942	251,809	
33	Jawa Tengah	507	27,168	26,325 *	n.a.	n.a.			26,325	
34	D.I.Jogyakarta	0	0	0	1,080	14,713 *			14,713	
35	Jawa Timur	818	41,950	34,852 *	1,482	43,760			34,852	
	Jawa	11,652	384,350	314,593	10,349	349,802	2,855	165,942	329,306	
51	Bali	1,000	42,032	39,529	418	17,526 *	468	19,874	17,526	
52	Nusa Tenggara Barat	773	66,439	48,864	811	68,907 *	328	29,800	68,907	
53	Nusa Tenggara Timur	1,126	109,859	42,624 *	960	123,955	305	28,302	42,624	
54	Timor Timur	-	-	-	n.a.	n.a.	n.a.	10,000 *	10,000	
	Bali/Nusa Tenggara	2,899	218,330	131,017	2,189	210,388	1,101	87,976	139,057	
61	Kalimantan Barat	319	63,921	33,569	113	11,108 *			11,108	
62	Kalimantan Tengah	19	6,329	986	11	6,952 *			6,952	
63	Kalimantan Selatan	833	237,893	111,451	57	10,900 *			10,900	
64	Kalimantan Timur	124	31,593	11,601	58	11,925 *			11,925	
	Kalimantan	1,295	339,736	157,607	239	40,885			40,885	
71	Sulawesi Utara	483	26,138	12,252 *	n.a.	n.a.	240	19,086	12,252	
72	Sulawesi Tengah	139	17,809	10,361 *	41	7,762	110	12,438	10,361	
73	Sulawesi Selatan	842	182,380	75,084	679	125,046 *	959	155,912	125,046	
74	Sulawesi Tenggara	170	24,792	10,135 *	n.a.	n.a.	250	36,359	10,135	
	Sulawesi	1,634	251,119	107,832	720	132,808	1,559	101,937	157,794	
81	Maluku	0	0	0	n.a.	n.a.	-	6,000 *	6,000	
82	Irian Jaya	-	-	-	n.a.	n.a.	16	349 *	349	
	Maluku/Irian Jaya	0	0	0	n.a.	n.a.	16	6,349	6,349	
	INDONESIA	25,304	1,885,742	1,036,613	17,053	981,447	7,502	494,471	986,011	

Note: figures marked with * are taken as the estimated area for each province

Table 6.9 Numbers and Areas for Rehabilitation of Village Irrigation Schemes during Repelita V

No.	Province	Numbers of Schemes										Area (ha)									
		1989/90		1990/91		1991/92		1992/93		1993/94		1989/90		1990/91		1991/92		1992/93		1993/94	
		Actual	Program	Actual	Program	Actual	Program	Actual	Program	Actual	Program	Actual	Program	Actual	Program	Actual	Program	Actual	Program	Actual	Program
11	D.I.Aceh	1	5	3	4	3	4	3	4	3	4	16	90	325	180	300	n.a.				
12	Sumatera Utara	0	0	3	18	3	5	26	0	0	0	26	0	0	301	985	n.a.				
13	Sumatera Barat	0	1	2	6	2	0	9	0	0	0	9	0	70	150	412	n.a.				
14	Riau	0	0	0	4	0	1	5	0	0	0	5	0	0	0	230	n.a.				
15	Jambi	0	0	0	6	0	0	6	0	0	0	6	0	0	0	302	n.a.				
16	Sumatera Selatan	0	3	1	6	1	0	10	0	0	0	10	0	370	607	139	n.a.				
17	Bengkulu	0	0	3	6	3	0	9	0	0	0	9	0	0	155	313	n.a.				
18	Lampung	2	3	1	6	1	0	12	0	0	0	12	220	350	300	275	n.a.				
	Sumatera	3	12	13	56	9	9	93	310	1,115	1,693	2,956									
31	D.K.I.Jakarta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	n.a.				
32	Jawa Barat	3	5	1	8	1	0	17	255	370	150	614	n.a.								
33	Jawa Tengah	3	3	1	9	6	6	22	156	200	135	646	n.a.								
34	D.I.Jogyakarta	2	3	3	6	4	4	18	130	145	226	275	n.a.								
35	Jawa Timur	3	4	1	10	18	102	43	75	677	n.a.										
	Jawa	11	15	6	33	10	75	643	758	2,212											
51	Bali	2	3	4	6	5	5	20	80	119	126	230	n.a.								
52	Nusa Tenggara Barat	5	6	4	10	5	5	30	564	647	140	522	n.a.								
53	Nusa Tenggara Timur	0	0	3	12	1	16	0	0	0	2,010	412	n.a.								
54	Timor Timur	0	0	0	0	0	0	0	0	0	0	0	n.a.								
	Bali/Nusa Tenggara	7	9	11	28	11	66	644	766	1,164											
61	Kalimantan Barat	2	5	6	10	4	27	140	140	227	461	787	n.a.								
62	Kalimantan Tengah	0	0	0	6	1	7	0	0	0	0	412	n.a.								
63	Kalimantan Selatan	0	3	1	8	1	13	0	190	100	945	n.a.									
64	Kalimantan Timur	0	0	3	8	0	11	0	0	0	182	761	n.a.								
	Kalimantan	2	8	10	32	6	58	140	417	2,905											
71	Sulawesi Utara	2	2	4	20	4	32	210	210	130	167	930	n.a.								
72	Sulawesi Tengah	0	0	2	5	10	17	0	0	0	172	350	n.a.								
73	Sulawesi Selatan	3	4	1	4	3	15	229	245	245	50	335	n.a.								
74	Sulawesi Tenggara	0	0	0	10	5	15	0	0	0	0	1,718	n.a.								
	Sulawesi	5	6	7	39	22	79	439	375	3,333											
81	Maluku	0	0	0	0	4	4	0	0	0	0	0	n.a.								
82	Irian Jaya	0	0	0	0	1	1	0	0	0	0	0	n.a.								
	Maluku/Irian Jaya	0	0	0	0	5	5	0	0	0	0	0									
	INDONESIA	28	50	47	188	63	376	2,176	3,431	5,687	12,570	n.a.									

Source: Directorate of Land Rehabilitation and Development, DGFCA

Table 6.10 Government Expenditure for Rehabilitation of Village Irrigation Schemes

No.	Province	Unit: Rpl,000					Total
		1989/90 Actual	1990/91 Actual	1991/92 Actual	1992/93 Actual	1993/94 Program	
11	D.I.Aceh	3,100	18,875	14,100	9,200	20,740	66,015
12	Sumatera Utara	0	0	12,500	41,850	37,850	92,200
13	Sumatera Barat	0	3,775	9,400	15,000	0	28,175
14	Riau	0	0	0	12,000	11,899	23,899
15	Jambi	0	0	0	n.a.	0	0
16	Sumatera Selatan	0	10,800	5,390	15,475	0	31,665
17	Bengkulu	0	0	12,860	15,000	0	27,860
18	Lampung	6,200	11,325	5,300	22,900	0	45,725
	Sumatera	9,300	44,775	59,550	131,425	70,489	315,539
31	D.K.I.Jakarta	0	0	0	0	0	0
32	Jawa Barat	9,300	7,770	4,120	30,500	0	51,690
33	Jawa Tengah	9,300	14,670	5,200	28,500	48,180	105,850
34	D.I.Yogyakarta	5,800	10,400	9,450	18,500	29,090	73,240
35	Jawa Timur	9,300	15,100	4,000	35,000	0	63,400
	Jawa	33,700	47,940	22,770	112,500	77,270	294,180
51	Bali	620	5,100	12,450	18,000	41,800	77,970
52	Nusa Tenggara Barat	15,500	22,650	19,500	25,000	37,050	119,700
53	Nusa Tenggara Timur	0	7,550	14,100	30,000	7,575	59,225
54	Timor Timur	0	0	0	0	0	0
	Bali & Nusa Tenggara	16,120	35,300	46,050	73,000	86,425	256,895
61	Kalimantan Barat	0	22,650	26,730	23,000	29,200	101,580
62	Kalimantan Tengah	0	0	0	n.a.	9,870	9,870
63	Kalimantan Selatan	0	21,150	5,400	n.a.	7,020	33,570
64	Kalimantan Timur	0	0	14,100	n.a.	0	14,100
	Kalimantan	0	43,800	46,230	23,000	46,090	159,120
71	Sulawesi Utara	9,300	7,550	18,800	56,500	30,280	122,430
72	Sulawesi Tengah	0	0	16,380	12,500	0	28,880
73	Sulawesi Selatan	9,300	15,100	5,950	n.a.	32,970	63,320
74	Sulawesi Tenggara	0	0	0	n.a.	40,700	40,700
	Sulawesi	18,600	22,650	41,130	69,000	103,950	255,330
81	Maluku	0	0	0	0	28,250	28,250
82	Irian Jaya	0	0	0	0	8,060	8,060
	Maluku & Irian Jaya	0	0	0	0	36,310	36,310
	INDONESIA	77,720	194,465	215,730	408,925	420,534	1,317,374

Source : Directorate of Land Rehabilitation and Development, DGFCFA

Table 6.11 Physical Progress of Land Development during Repelita V

No.	Province	Unit : ha					Total
		1989/90	1990/91	1991/92	1992/93	1993/94	
11	D.I.Aceh	4,051	8,060	2,606	4,034	3,973	22,723
12	Sumatera Utara	2,892	1,852	5,513	2,788	2,000	15,045
13	Sumatera Barat	3,454	1,734	268	372	2,000	7,827
14	Riau	423	339	3,798	500	1,400	6,460
15	Jambi	4,749	3,597	2,205	797	1,980	13,328
16	Sumatera Selatan	4,605	790	3,273	1,000	3,500	13,169
17	Bengkulu	2,533	3,037	828	0	2,500	8,897
18	Lampung	5,181	9,203	9,976	8,543	4,648	37,552
	Sumatera	27,889	28,612	28,468	18,033	22,001	125,002
31	D.K.I.Jakarta	0	0	0	0	0	0
32	Jawa Barat	10,716	4,218	3,490	0	2,500	20,925
33	Jawa Tengah	2,620	4,734	3,012	3,387	1,225	14,979
34	D.I.Jogyakarta	55	1,206	0	0	0	1,261
35	Jawa Timur	3,854	5,125	3,000	2,250	2,500	16,729
	Jawa	17,245	15,284	9,503	5,637	6,225	53,894
51	Bali	262	379	102	0	0	744
52	NTB	1,710	2,992	1,266	1,249	600	7,816
53	NTT	735	3,111	1,879	853	1,000	7,578
54	Timor Timur	0	0	1,132	500	1,000	2,632
	Bali/Nusa Tenggara	747	6,483	4,379	2,602	2,600	18,771
61	Kalimantan Barat	1,221	1,217	1,621	1,023	1,095	6,177
62	Kalimantan Tengah	2,919	4,593	5,136	2,682	2,500	17,829
63	Kalimantan Selatan	2,652	4,012	759	2,113	2,000	11,535
64	Kalimantan Timur	1,464	862	243	0	1,000	3,569
	Kalimantan	8,255	10,684	7,758	5,818	6,595	39,110
71	Sulawesi Utara	1,114	16	2,784	625	1,500	6,040
72	Sulawesi Tengah	8,216	1,950	634	1,973	1,800	14,573
73	Sulawesi Selatan	5,522	3,574	8,435	825	1,500	19,856
74	Sulawesi Tenggara	5,606	6,988	4,261	1,293	1,500	19,647
	Sulawesi	20,458	12,527	16,115	4,715	6,300	60,115
81	Maluku	1,050	770	0	0	1,140	2,960
82	Irian Jaya	849	0	667	277	1,000	2,793
	Maluku/Irian Jaya	3,859	770	667	277	2,140	5,753
	INDONESIA	78,454	74,359	66,889	37,082	45,861	302,645

Source : Directorate of Land Rehabilitation & Development , DGPCA, March 15, 1993

Table 6.12 Physical Progress of Land Development Excluding Farmers' Development in Repelita V

No.	Province	1989/90		1990/91		1991/92		1992/93		1993/94		Unit: ha		
		APBD	Loan	APBD	Loan	APBD	Loan	APBD	Loan	APBD	Loan	APBD	Loan	Total
11	D.I.Aceh	0	4,051	5,808	2,252	1,118	1,488	1,534	2,500	3,973	n.a.	12,433	10,291	22,723
12	Sumatera Utara	0	1,552	1,852	0	1,650	0	0	500	2,000	n.a.	5,502	2,052	7,555
13	Sumatera Barat	0	2,784	1,734	0	268	0	372	0	2,000	n.a.	4,373	2,784	7,157
14	Riau	0	408	339	0	3,798	0	0	500	1,400	n.a.	5,537	908	6,445
15	Jambi	83	2,064	1,025	65	1,076	0	0	1,000	1,980	n.a.	4,165	2,129	6,293
16	Sumatera Selatan	83	1,806	0	0	3,118	0	0	0	3,500	n.a.	6,701	2,806	9,507
17	Bengkulu	0	2,337	2,336	655	521	0	0	0	2,500	n.a.	5,357	2,992	8,349
18	Lampung	155	2,440	5,999	2,100	5,434	4,279	5,357	2,800	4,648	n.a.	21,592	11,619	33,211
	Sumatera	322	17,442	19,092	5,072	16,984	5,767	7,262	7,300	22,001	n.a.	65,660	35,580	101,241
31	D.K.I.Jakarta													
32	Jawa Barat	0	10,389	4,218	0	3,490	0	0	0	2,500	n.a.	10,209	10,389	20,598
33	Jawa Tengah	0	1,192	0	1,499	2,330	0	0	0	1,225	n.a.	3,555	2,691	6,246
34	D.I.Jogyakarta	0	0	55	1,041	0	0	0	0	0	n.a.	55	1,041	1,096
35	Jawa Timur	0	3,500	3,250	1,875	3,000	0	2,250	0	2,500	n.a.	11,000	5,375	16,375
	Jawa	0	15,081	7,523	4,415	8,820	0	2,250	0	6,225	n.a.	24,819	19,496	44,315
51	Bali	0	102	300	0	102	0	0	0	600	n.a.	1,057	0	1,057
52	NTB	0	0	0	0	457	0	0	0	0	n.a.	4,445	3,133	7,578
53	NTT	0	735	1,082	2,029	1,510	369	853	0	1,000	n.a.	2,132	500	2,632
54	Timor Timur	0	0	0	0	1,132	0	0	500	1,000	n.a.	8,036	3,736	11,772
	Bali/Nusa Tenggara	0	837	1,382	2,029	3,202	369	853	500	2,600	n.a.	3,448	992	4,440
61	Kalimantan Barat	83	492	0	500	1,246	0	1,023	0	1,095	n.a.	7,614	6,584	14,197
62	Kalimantan Tengah	0	2,619	1,075	1,257	2,997	1,068	1,042	1,640	2,500	n.a.	4,277	2,600	6,877
63	Kalimantan Selatan	167	800	2,110	0	0	0	0	1,800	2,000	n.a.	1,976	697	2,673
64	Kalimantan Timur	0	697	733	0	243	0	0	0	1,000	n.a.	17,314	10,873	28,187
	Kalimantan	250	4,609	3,918	1,757	4,486	1,068	2,065	3,440	6,595	n.a.	4,772	0	4,772
71	Sulawesi Utara	0	0	0	0	2,647	0	625	0	1,500	n.a.	2,907	8,831	11,738
72	Sulawesi Tengah	0	5,381	0	1,950	634	0	473	1,500	1,800	n.a.	3,277	3,884	7,162
73	Sulawesi Selatan	0	3,884	0	0	952	0	825	0	1,500	n.a.	8,701	6,016	14,718
74	Sulawesi Tenggara	0	4,130	2,940	886	4,261	0	0	1,000	1,500	n.a.	19,658	18,732	38,389
	Sulawesi	0	13,396	2,940	2,836	8,494	0	1,923	2,500	6,300	n.a.	1,140	1,000	2,910
81	Maluku	0	1,000	770	0	467	0	277	0	1,000	n.a.	1,744	308	2,052
82	Irian Jaya	0	308	0	0	467	0	0	0	0	n.a.	3,654	1,308	4,962
	Maluku/Irian Jaya	0	1,308	770	0	467	0	277	0	2,140	n.a.	139,141	89,725	228,866
	INDONESIA	571	52,673	35,626	16,108	42,453	7,203	14,630	13,740	45,861	n.a.	139,141	89,725	228,866

Source: Directorate of Land Rehabilitation & Development, DGFCA, March 15, 1993

Table 6.13 Terminology of Irrigation Scheme

- **Luas Rencana (Designed Area):**
Designed area of the scheme; except for the area occupied by roads, villages, house yard etc., the luas can be converted to irrigated paddy field (Sawah);
- **Luas Potensial:**
Area for which main and secondary canals have been constructed;
- **Luas Belum Potensial:**
Area for which main and secondary canals have been not yet constructed;
- **Sawah (Paddy Field):**
Area which has been developed for paddy cultivation;
- **Belum Sawah (Not yet Paddy Field):**
Area for which the land development, such as land clearing, land leveling and sawah formation, has not yet been completed in spite of construction of main and secondary canals;
- **Luas Potensial Sawah Irigasi:**
Irrigated paddy field;
- **Sawah Belum Irigasi:**
Paddy field for which main and secondary canals have been constructed but irrigation was not made so far for some reason.
- **Petak Tersier Sudah Dikembangkan:**
Area for which tertiary canals have been constructed;
- **Petak Tersier Belum Dikembangkan :**
Area for which tertiary canals have been not yet constructed;
- **Lahan Alih Fungsi :**
Area that has been converted other purpose, such as public facility and is not changeable to paddy field.

Table 6.14 Breakdown of Confirmed Surface Irrigation Schemes

Province	Existing Scheme						New Construction			Total		
	Current O/M		Rehabilitation		Extension		Scheme					
	Nos. of Designed Schemes: Area	Nos. of Designed Schemes: Area	Nos. of Designed Schemes: Area	Nos. of Designed Schemes: Area	Nos. of Designed Schemes: Area	Nos. of Designed Schemes: Area	Nos. of Designed Schemes: Area	Nos. of Designed Schemes: Area	Nos. of Designed Schemes: Area			
11 D.I.Aceh	157	115,946	32	55,652	77	147,938	266	319,536	51	126,310	317	445,846
12 Sumatera Utara	232	92,409	179	130,519	39	50,684	450	273,612	240	186,093	690	459,705
13 Sumatera Barat	207	62,435	114	107,563	91	86,399	412	256,397	29	29,884	441	286,281
14 Riau	45	19,886	1	830	10	19,898	56	40,614	23	244,128	79	284,742
15 Jambi	35	10,390	2	1,982	20	34,436	57	46,808	5	18,937	62	65,745
16 Sumatera Selatan	52	58,987	3	3,063	11	30,613	66	92,663	15	69,001	81	161,664
17 Bengkulu	79	30,881	19	24,850	5	9,595	103	65,326	7	17,587	110	82,913
18 Lampung	39	20,710	24	96,167	16	53,725	79	170,602	45	26,389	124	196,991
Sumatera	846	411,644	374	420,626	269	433,288	1,489	1,265,558	415	718,329	1,904	1,983,887
31 D.K.I.Jakarta	7	3,244	18	7,783	2	750	27	11,777	0	0	27	11,777
32 Jawa Barat	626	670,729	32	48,412	7	11,458	665	730,599	15	16,716	680	747,315
33 Jawa Tengah	563	339,705	168	243,907	2	59,479	733	643,091	1	2,000	734	645,091
34 D.I.Jogyakarta	28	6,364	33	22,349	3	1,882	64	30,595	0	0	64	30,595
35 Jawa Timur	506	234,043	480	499,659	0	0	986	733,702	3	618	989	734,320
Jawa	1,730	1,254,085	731	822,110	14	73,569	2,475	2,149,764	19	19,334	2,494	2,169,098
51 Bali	106	53,841	50	18,768	0	0	156	72,609	67	26,879	223	99,488
52 Nusa Tenggara Barat	223	137,788	13	33,640	9	11,920	245	183,348	12	17,368	257	200,716
53 Nusa Tenggara Timur	32	17,152	58	33,949	9	9,815	99	60,916	65	27,428	164	88,344
54 Timor Timur	13	9,985	1	1,400	1	700	15	12,085	10	14,900	25	26,985
Bali & Nusa Tenggara	374	218,766	122	87,757	19	22,435	515	328,958	154	86,575	669	415,533
61 Kalimantan Barat	37	11,090	5	2,163	8	3,821	50	17,074	9	16,323	59	33,397
62 Kalimantan Tengah	7	4,719	2	1,398	2	1,279	11	7,396	6	15,240	17	22,636
63 Kalimantan Selatan	37	19,653	2	249	6	41,769	45	61,671	32	37,612	77	99,283
64 Kalimantan Timur	55	24,757	6	4,483	0	0	61	29,240	4	4,045	65	33,285
Kalimantan	136	60,219	15	8,293	16	46,869	167	115,381	51	73,220	218	188,601
71 Sulawesi Utara	61	33,240	34	30,783	3	15,817	98	79,840	12	24,075	110	103,915
72 Sulawesi Tengah	71	29,121	53	62,825	11	51,559	135	143,505	67	77,019	202	220,524
73 Sulawesi Selatan	137	103,820	55	198,359	6	19,724	198	321,903	39	274,529	237	596,432
74 Sulawesi Tenggara	7	19,083	46	30,542	7	4,673	60	54,298	33	29,773	93	84,071
Sulawesi	276	185,264	188	322,509	27	91,773	491	599,546	151	405,396	642	1,004,942
81 Maluku	3	1,090	7	3,434	5	9,288	15	13,812	10	25,223	25	39,035
82 Irian Jaya	6	3,081	12	14,797	3	6,209	21	24,087	20	11,983	41	36,070
Maluku & Irian Jaya	9	4,171	19	18,231	8	15,497	36	37,859	30	37,206	66	75,105
Indonesia	3,371	2,134,149	1,449	1,679,526	353	683,431	5,173	4,497,105	820	1,340,060	5,993	5,837,166

Source : Result of Inventory Survey Conducted by JICA FIDP Team

Table 6.15 Breakdown of Confirmed Swamp Irrigation Schemes

Unit : ha

Province	Existing Scheme						New Construction						Total
	Current O/M		Rehabilitation		Extension		Total		Scheme		Total		
	Nos. of Schemes	Area	Nos. of Schemes	Area	Nos. of Schemes	Area	Nos. of Schemes	Area	Nos. of Schemes	Area	Nos. of Schemes	Area	
11 D.I. Aceh	0	0	0	0	0	0	0	0	0	16	30,550	16	30,550
12 Sumatera Utara	81	174,215	12	44,616	1	6,000	94	224,831	11	85,555	105	310,386	
13 Sumatera Barat	0	0	3	23,341	3	6,400	6	29,741	3	11,350	9	41,091	
14 Riau	160	287,353	6	26,005	0	0	166	313,358	2	13,900	168	327,258	
15 Jambi	0	0	13	74,756	0	0	13	74,756	2	489	15	75,245	
16 Sumatera Selatan	39	167,261	6	93,190	0	0	45	260,451	2	11,865	47	272,316	
17 Bengkulu	0	0	0	0	2	8,755	2	8,755	4	4,200	6	12,955	
18 Lampung	2	20,900	5	53,220	0	0	7	74,120	0	0	7	74,120	
Sumatera	282	649,729	45	315,128	6	21,155	333	986,012	40	157,909	373	1,143,921	
31 D.K.I. Jakarta	0	0	0	0	0	0	0	0	0	0	0	0	
32 Jawa Barat	0	0	0	0	0	0	0	0	0	0	0	0	
33 Jawa Tengah	0	0	0	0	0	0	0	0	0	0	0	0	
34 D.I. Jogjakarta	0	0	0	0	0	0	0	0	0	0	0	0	
35 Jawa Timur	0	0	0	0	0	0	0	0	0	0	0	0	
Jawa	0	0	0	0	0	0	0	0	0	0	0	0	
51 Bali	0	0	0	0	0	0	0	0	0	0	0	0	
52 Nusa Tenggara Barat	0	0	0	0	0	0	0	0	0	0	0	0	
53 Nusa Tenggara Timur	0	0	0	0	0	0	0	0	0	0	0	0	
54 Timor Timur	0	0	0	0	0	0	0	0	0	0	0	0	
Bali & Nusa Tenggara	0	0	0	0	0	0	0	0	0	0	0	0	
61 Kalimantan Barat	36	84,186	7	8,440	18	45,394	61	138,020	2	6,863	63	144,883	
62 Kalimantan Tengah	107	260,940	2	2,011	6	9,456	115	272,407	1	1,000	116	273,407	
63 Kalimantan Selatan	78	131,420	5	19,200	4	14,550	87	165,170	1	1,500	88	166,670	
64 Kalimantan Timur	10	9,595	2	7,685	0	0	12	17,280	0	0	12	17,280	
Kalimantan	231	486,141	16	37,336	28	69,400	275	592,877	4	9,363	279	602,240	
71 Sulawesi Utara	34	1,122	0	0	0	0	34	1,122	0	0	34	1,122	
72 Sulawesi Tengah	10	9,400	5	17,618	1	10,000	16	37,018	5	3,000	21	40,018	
73 Sulawesi Selatan	44	430,574	0	0	0	0	44	430,574	21	41,941	65	472,515	
74 Sulawesi Tenggara	0	0	0	0	0	0	0	0	3	7,405	3	7,405	
Sulawesi	88	441,096	5	17,618	1	10,000	94	468,714	29	52,346	123	521,060	
81 Maluku	0	0	0	0	0	0	0	0	0	0	0	0	
82 Irian Jaya	0	0	0	0	1	6,000	1	6,000	7	52,470	8	58,470	
Maluku & Irian Jaya	0	0	0	0	1	6,000	1	6,000	7	52,470	8	58,470	
Indonesia	601	1,576,966	66	370,082	36	106,555	703	2,053,603	80	272,088	783	2,325,691	

Source : Result of Inventory Survey Conducted by JICA FIDP Team

Table 6.16 Present Status of Surface Irrigation Scheme (Current O/M)

Unit : ha

Province	Nos. of Schemes	Designed Area Irrigated Paddy Field (1)	Irrigated Paddy Field (2)	(3)=(2)/(1)	Total (%)	Not Irrigated Area				Paddy field for (9)
						Main/Secondary canal is constructed (4)=(5)+(6)+ (7)+(8)+(9)	Main/Secondary canal is not constructed (5)	Main/Secondary canal is constructed (6)	Main/Secondary canal is not constructed (7)	
11 D.I.Aceh	157	115,946	80,377	(69%)	35,569	14,273	3,270	12,763	4,002	1,261
12 Sumatera Utara	232	92,409	52,164	(56%)	40,245	9,722	9,151	4,019	16,399	954
13 Sumatera Barat	207	62,435	35,974	(58%)	26,461	8,220	6,010	1,056	9,936	1,239
14 Riau	45	19,886	6,632	(33%)	13,254	2,131	9,085	272	1,442	324
15 Jambi	35	10,390	6,754	(65%)	3,636	625	2,513	0	0	498
16 Sumatera Selatan	52	58,987	31,600	(54%)	27,387	1,900	6,523	225	18,399	340
17 Bengkulu	79	30,881	23,452	(76%)	7,429	825	3,407	1,759	1,213	225
18 Lampung	39	20,710	14,658	(71%)	6,052	678	3,226	0	457	1,691
Sumatera	846	411,644	251,611	(61%)	160,033	38,374	43,185	20,094	51,848	6,532
31 D.K.I.Jakarta	7	3,244	2,631	(81%)	613	53	126	234	110	90
32 Jawa Barat	626	670,729	601,616	(90%)	69,113	19,039	15,528	9,572	3,356	21,618
33 Jawa Tengah	563	339,705	327,224	(96%)	12,481	4,786	1,938	3,480	0	2,277
34 D.I.Jogyakarta	28	6,364	5,746	(90%)	618	349	121	147	0	1
35 Jawa Timur	506	234,043	216,171	(92%)	17,872	1,201	277	0	2,819	13,575
Jawa	1,730	1,254,085	1,153,388	(92%)	100,697	25,428	17,990	13,433	6,285	37,561
51 Bali	106	53,841	49,155	(91%)	4,706	0	4,518	0	0	188
52 Nusa Tenggara Barat	223	137,788	112,347	(82%)	25,441	2,660	14,878	1,695	4,446	1,762
53 Nusa Tenggara Timur	32	17,152	10,152	(59%)	7,000	1,701	3,644	0	1,332	323
54 Timor Timur	13	9,985	6,896	(69%)	3,089	0	0	589	2,500	0
Bali & Nusa Tenggara	374	218,766	178,530	(82%)	40,236	4,361	23,040	2,284	8,278	2,273
61 Kalimantan Barat	37	11,090	6,599	(60%)	4,491	1,681	815	1,166	794	35
62 Kalimantan Tengah	7	4,719	1,297	(27%)	3,422	1,420	184	189	1,628	1
63 Kalimantan Selatan	37	19,653	9,142	(47%)	10,511	3,431	5,211	780	365	724
64 Kalimantan Timur	55	24,757	4,069	(16%)	20,688	4,321	5,158	3,150	6,753	1,306
Kalimantan	136	60,219	21,107	(35%)	39,112	10,853	11,368	5,285	9,540	2,066
71 Sulawesi Utara	61	33,240	25,339	(76%)	7,901	1,183	5,480	26	719	493
72 Sulawesi Tengah	71	29,121	16,239	(56%)	12,882	693	7,473	1,392	1,500	1,824
73 Sulawesi Selatan	137	103,820	61,115	(59%)	42,705	11,415	3,434	12,803	10,794	4,259
74 Sulawesi Tenggara	7	19,083	5,290	(28%)	13,793	0	8,719	0	4,783	291
Sulawesi	276	185,264	107,963	(58%)	77,281	13,291	25,106	14,221	17,796	6,867
81 Maluku	3	1,090	1,090	(100%)	0	0	0	0	0	0
82 Irian Jaya	6	3,081	1,440	(47%)	1,641	40	1,301	0	300	0
Maluku & Irian Jaya	9	4,171	2,530	(61%)	1,641	40	1,301	0	300	0
Indonesia	3,371	2,134,149	1,715,149	(80%)	419,000	92,347	121,990	55,317	94,047	55,299

Source : Result of Inventory Survey Conducted by JICA FIDP Team

Table 6.17 Present Status of Surface Irrigation Scheme (Rehabilitation)

Province	Nos. of Schemes	Designed Area Irrigated		(%)	Not Irrigated Area				Unit : ha	
		Paddy Field			Main/Secondary canal is not constructed					
		(1)	(2)		(3)=(2)/(1)	constructed		for		
						(4)=(5)+(6)+ (7)+(8)+(9)	(5) Irrigated	(6) Not yet Paddy Field		(7) Rained Non-Paddy Field
11 D.I.Aceh	32	55,652	55,096	(99%)	556	260	244	0	0	52
12 Sumatera Utara	179	130,519	98,958	(76%)	31,561	8,869	10,288	5,624	5,644	1,136
13 Sumatera Barat	114	107,563	94,511	(88%)	13,052	8,463	3,759	41	80	709
14 Riau	1	830	830	(100%)	0	0	0	0	0	0
15 Jambi	2	1,982	1,982	(100%)	0	0	0	0	0	0
16 Sumatera Selatan	3	3,063	2,722	(89%)	341	291	0	0	0	0
17 Bengkulu	19	24,850	13,800	(56%)	11,050	2,254	3,768	910	3,295	823
18 Lampung	24	96,167	66,871	(70%)	29,288	2,052	23,583	0	115	3,538
Sumatera	374	420,626	334,770	(80%)	85,848	22,189	41,642	6,575	9,184	6,258
31 D.K.I.Jakarta	18	7,783	5,955	(77%)	1,828	984	75	315	170	284
32 Jawa Barat	32	48,412	45,268	(94%)	3,144	824	660	218	0	1,442
33 Jawa Tengah	168	243,907	238,830	(98%)	5,077	1,206	835	556	255	2,225
34 D.I.Jogyakarta	33	22,349	19,345	(87%)	3,004	795	2,092	76	0	41
35 Jawa Timur	480	499,659	493,222	(99%)	6,437	967	305	137	70	4,958
Jawa	731	822,110	802,620	(98%)	19,490	4,776	3,967	1,302	495	8,950
51 Bali	50	18,768	16,732	(89%)	2,036	0	1,859	0	0	177
52 Nusa Tenggara Barat	13	33,640	33,631	(100%)	9	0	0	0	0	9
53 Nusa Tenggara Timur	58	33,949	20,550	(61%)	13,399	1,831	8,738	1,142	1,284	404
54 Timor Timur	1	1,400	710	(51%)	690	0	0	0	0	690
Bali & Nusa Tenggara	122	87,757	71,623	(82%)	16,134	1,831	10,597	1,142	1,284	1,280
61 Kalimantan Barat	5	2,163	673	(31%)	1,490	874	80	0	536	0
62 Kalimantan Tengah	2	1,398	788	(56%)	610	0	349	0	261	0
63 Kalimantan Selatan	2	249	196	(79%)	53	8	44	0	0	1
64 Kalimantan Timur	6	4,483	1,314	(29%)	3,169	650	1,160	648	325	386
Kalimantan	15	8,293	2,971	(36%)	5,322	1,532	1,633	648	1,122	387
71 Sulawesi Utara	34	30,783	21,692	(70%)	9,091	1,046	7,028	30	22	965
72 Sulawesi Tengah	53	62,825	35,943	(57%)	26,482	279	19,184	1,431	1,184	4,404
73 Sulawesi Selatan	55	198,359	145,513	(73%)	52,846	15,706	6,999	4,697	20,461	4,983
74 Sulawesi Tenggara	46	30,542	17,727	(58%)	12,815	0	8,035	831	1,318	2,631
Sulawesi	188	322,509	220,875	(68%)	101,234	17,031	41,246	6,989	22,985	12,983
81 Maluku	7	3,434	3,211	(94%)	223	223	0	0	0	0
82 Irian Jaya	12	14,797	2,817	(19%)	11,980	850	8,502	303	2,180	145
Maluku & Irian Jaya	19	18,231	6,028	(33%)	12,203	1,073	8,502	303	2,180	145
Indonesia	1,449	1,679,526	1,438,887	(86%)	240,231	48,432	107,587	16,959	37,250	30,003

Source : Result of Inventory Survey Conducted by JICA FIDP Team

Table 6.18 Present Status of Surface Irrigation Scheme (Extension)

Unit : ha

Province	Nos. of Schemes	Designed Area Irrigated Paddy Field	(%)	Total	Not Irrigated Area				No longer available for Paddy field	
					Main/Secondary canal is constructed		Main/Secondary canal is not constructed			
					(4)=(5)+(6)+ (7)+(8)+(9)	(5)	(6)	(7)		(8)
		(1)	(2)	(3)=(2)/(1)	(4)	(5)	(6)	(7)	(8)	(9)
11 D.I.Aceh	77	147,938	68,910	(47%)	79,028	25,029	4,709	35,060	5,970	8,260
12 Sumatera Utara	39	50,684	24,315	(48%)	26,369	7,597	7,397	1,036	9,710	629
13 Sumatera Barat	91	86,399	33,208	(38%)	53,191	17,092	25,493	625	8,733	1,248
14 Riau	10	19,898	8,059	(41%)	11,839	7,648	2,328	678	590	595
15 Jambi	20	34,436	10,571	(31%)	23,865	7,627	2,974	13,000	0	264
16 Sumatera Selatan	11	30,613	21,149	(69%)	9,464	2,396	4,461	0	2,607	0
17 Bengkulu	5	9,595	8,370	(87%)	1,225	76	1,129	0	0	20
18 Lampung	16	53,725	31,188	(58%)	22,537	319	15,154	0	3,673	3,391
Sumatera	269	433,288	205,770	(47%)	227,518	67,784	63,645	50,399	31,283	14,407
31 D.K.I.Jakarta	2	750	655	(87%)	95	35	60	0	0	0
32 Jawa Barat	7	11,458	8,197	(72%)	3,261	128	167	1,551	1,388	27
33 Jawa Tengah	2	59,479	59,134	(99%)	345	320	0	25	0	0
34 D.I.Jogyakarta	3	1,882	534	(28%)	1,348	0	150	1,198	0	0
35 Jawa Timur	0	0	0	(0%)	0	0	0	0	0	0
Jawa	14	73,569	68,520	(93%)	5,049	483	377	2,774	1,388	27
51 Bali	0	0	0	(0%)	0	0	0	0	0	0
52 Nusa Tenggara Barat	9	11,920	6,823	(57%)	5,097	120	3,596	875	506	0
53 Nusa Tenggara Timur	9	9,815	4,068	(41%)	5,747	1,896	3,165	0	668	18
54 Timor Timur	1	700	386	(55%)	314	0	0	0	314	0
Bali & Nusa Tenggara	19	22,435	11,277	(50%)	11,158	2,016	6,761	875	1,488	18
61 Kalimantan Barat	8	3,821	1,428	(37%)	2,393	897	232	1,080	164	20
62 Kalimantan Tengah	2	1,279	922	(72%)	357	125	227	0	0	5
63 Kalimantan Selatan	6	41,769	2,595	(6%)	39,174	1,377	535	28,341	8,921	0
64 Kalimantan Timur	0	0	0	(0%)	0	0	0	0	0	0
Kalimantan	16	46,869	4,945	(11%)	41,924	2,399	994	29,421	9,085	25
71 Sulawesi Utara	3	15,817	6,709	(42%)	9,108	858	600	4,795	2,855	0
72 Sulawesi Tengah	11	51,559	33,068	(64%)	18,491	244	3,581	11,828	2,620	218
73 Sulawesi Selatan	6	19,724	10,671	(54%)	9,053	5,104	0	2,740	634	575
74 Sulawesi Tenggara	7	4,673	1,386	(30%)	3,287	0	2,517	116	268	386
Sulawesi	27	91,773	51,834	(56%)	39,939	6,206	6,698	19,479	6,377	1,179
81 Maluku	5	9,288	1,712	(18%)	7,576	5,511	1,534	0	0	531
82 Irian Jaya	3	6,209	1,040	(17%)	5,169	75	35	0	5,059	0
Maluku & Irian Jaya	8	15,497	2,752	(18%)	12,745	5,586	1,569	0	5,059	531
Indonesia	353	683,431	345,098	(50%)	338,333	84,474	80,044	102,948	54,680	16,187

Source : Result of Inventory Survey Conducted by JICA FIDP Team

Table 6.20 Present Status of Surface Irrigation Scheme (New Construction)

Unit : ha

Province	Nos. of scheme	Designed Area	Area for which main & secondary canal have been constructed				Area for which main & secondary canals have not yet been constructed					
			Total		No longer available for paddy field		Total		Paddy		Non-paddy	
			(1)=(2)+(10)	(2)=(3)+(6)+(7)	(3)=(4)+(5)	(4)	(5)	(6)	(7)=(8)+(9)	(8)	(9)	(10)=(11)+(12)
			Total	Paddy Field Irrigated	Not yet Irrigated	Paddy Field	Total	From Paddy Field	From Non-Paddy Field	Total	Paddy	Non-paddy
11 D.I.Aceh	51	126,310	14,792	14,792	0	14,792	0	0	0	111,518	36,190	75,328
12 Sumatera Utara	240	186,093	4,247	4,127	0	4,127	120	0	0	181,846	74,571	107,275
13 Sumatera Barat	29	29,884	7,593	6,723	0	6,723	840	30	0	22,291	3,449	18,842
14 Riau	23	244,128	8,770	8,067	0	8,067	703	0	0	235,358	86,153	149,205
15 Jambi	5	18,937	150	0	0	150	0	0	0	18,787	5,636	13,151
16 Sumatera Selatan	15	69,001	0	0	0	0	0	0	0	69,001	20,702	48,299
17 Bengkulu	7	17,587	396	0	0	380	16	0	0	17,191	3,873	13,318
18 Lampung	45	26,389	1,532	750	0	750	502	280	0	24,857	7,744	17,113
Sumatera	415	718,329	37,480	34,459	0	34,459	2,695	326	46	680,849	238,318	442,531
31 D.K.I.Jakarta	0	0	0	0	0	0	0	0	0	0	0	0
32 Jawa Barat	15	16,716	4,996	4,180	0	4,180	801	15	0	11,720	4,324	7,396
33 Jawa Tengah	1	2,000	0	0	0	0	0	0	0	2,000	600	1,400
34 D.I.Jogyakarta	0	0	0	0	0	0	0	0	0	0	0	0
35 Jawa Timur	3	618	618	618	0	618	0	0	0	0	0	0
Jawa	19	19,334	5,614	4,798	0	4,798	801	15	0	13,720	4,924	8,796
51 Bali	67	26,879	1,246	1,246	0	1,246	0	0	0	25,633	7,695	17,938
52 Nusa Tenggara Barat	12	17,368	0	0	0	0	0	0	0	17,368	5,096	12,272
53 Nusa Tenggara Timur	65	27,428	2,834	2,542	0	2,542	267	25	7	24,594	7,950	16,644
54 Timor Timur	10	14,900	3,450	950	0	950	2,500	0	0	11,450	2,265	9,185
Bali & Nusa Tenggara	154	86,575	7,530	4,738	0	4,738	2,767	25	7	79,045	23,006	56,039
61 Kalimantan Barat	9	16,323	3,010	2,820	0	2,820	190	0	0	13,313	4,133	9,180
62 Kalimantan Tengah	6	15,240	840	829	0	829	11	0	0	14,400	3,960	10,440
63 Kalimantan Selatan	32	37,612	0	0	0	0	0	0	0	37,612	11,206	26,406
64 Kalimantan Timur	4	4,045	500	175	0	175	255	70	0	3,545	795	2,750
Kalimantan	51	73,220	4,350	3,824	0	3,824	456	70	0	68,870	20,094	48,776
71 Sulawesi Utara	12	24,075	0	0	0	0	0	0	0	24,075	5,431	18,644
72 Sulawesi Tengah	67	77,019	3,400	2,400	0	2,400	1,000	0	0	73,619	22,470	51,149
73 Sulawesi Selatan	39	274,529	1,935	1,150	0	1,150	785	0	0	272,594	210,320	62,274
74 Sulawesi Tenggara	33	29,773	0	0	0	0	0	0	0	29,773	9,003	20,770
Sulawesi	151	405,396	5,335	3,550	0	3,550	1,785	0	0	400,061	247,224	152,837
81 Maluku	10	25,223	0	0	0	0	0	0	0	25,223	7,567	17,656
82 Irian Jaya	20	11,983	0	0	0	0	0	0	0	11,983	3,597	8,386
Maluku & Irian Jaya	30	37,206	0	0	0	0	0	0	0	37,206	11,164	26,042
Indonesia	820	1,340,060	60,309	51,369	0	51,369	8,504	436	68	1,279,751	544,730	735,021

Source : Result of Inventory Survey Conducted by JICA FIDP Team

Table 6.22 Present Satus of Swamp Irrigation Scheme (New Construction)

Unit: ha

Nos. of Scheme	Province	Area functional						Area not yet functional						Total Area							
		Agriculture			Fish Pond	Others	Total	Agriculture			Fish Pond	Others	Total	Agriculture			Fish Pond	Others	Total		
		Paddy	Upland	Garden				Paddy	Upland	Garden				Paddy	Upland	Garden					
16	D.I.Aceh	0	0	0	800	0	800	26,100	13,300	6,300	6,500	3,450	200	29,750	26,100	13,300	6,300	6,500	4,250	200	30,550
11	Sumatera Utara	0	0	0	0	0	0	29,686	9,601	1,658	18,427	50	45,969	85,555	29,686	9,601	1,658	18,427	50	45,969	85,555
3	Sumatera Barat	0	0	0	0	0	0	11,350	11,350	0	0	0	11,350	11,350	11,350	0	0	0	0	0	11,350
2	Riau	200	0	200	0	10,700	13,900	0	0	0	0	0	0	0	200	0	200	0	0	10,700	13,900
2	Jambi	0	0	0	0	0	0	489	377	0	112	0	489	377	0	0	112	0	0	489	377
2	Sumatera Selatan	0	0	0	0	0	0	11,290	6,600	3,740	950	0	575	11,865	11,290	6,600	3,740	950	0	575	11,865
4	Bengkulu	0	0	0	0	0	0	2,935	2,300	600	35	0	1,265	4,200	2,935	2,300	600	35	0	1,265	4,200
0	Lampung	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	Sumatera	200	0	200	0	800	10,700	14,700	81,850	43,528	12,298	26,024	3,500	48,009	143,209	82,050	43,528	12,498	26,024	4,300	58,709
0	D.K.I.Jakarta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	Jawa Barat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	Jawa Tengah	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	D.I.Jogyakarta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	Jawa Timur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	Jawa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	Bali	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	Nusa Tenggara Barat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	Nusa Tenggara Timur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	Timor Timur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	Bali & Nusa Tenggara	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Kalimantan Barat	0	0	0	0	0	0	5,775	5,775	0	0	0	200	5,975	5,775	5,775	0	0	0	1,088	6,863
1	Kalimantan Tengah	0	0	0	0	0	0	1,000	600	225	175	0	1,000	1,000	1,000	600	225	175	0	0	1,000
1	Kalimantan Selatan	0	0	0	0	0	0	1,350	1,350	0	0	0	150	1,500	1,350	1,350	0	0	150	0	1,500
0	Kalimantan Timur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Kalimantan	0	0	0	0	0	0	8,125	7,725	225	175	0	350	8,475	8,125	7,725	225	175	0	1,238	9,363
0	Sulawesi Utara	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Sulawesi Tengah	0	0	0	0	322	0	0	0	0	0	0	678	678	0	0	0	0	322	678	3,000
21	Sulawesi Selatan	0	0	0	0	150	0	150	3,843	1,947	1,896	0	764	3,964	8,571	3,843	1,947	1,896	0	914	3,964
3	Sulawesi Tenggara	0	0	0	0	690	0	690	957	40	450	467	3,038	6,715	957	40	450	467	3,690	2,758	7,405
29	Sulawesi	0	0	0	0	1,162	0	1,162	4,800	1,987	2,346	467	3,764	7,700	15,964	4,800	1,987	2,346	467	4,926	7,400
0	Maluku	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Irian Jaya	20,000	0	20,000	0	0	0	20,000	2,000	0	2,000	0	2,000	2,000	52,470	27,970	2,000	0	0	0	52,470
7	Maluku & Irian Jaya	20,000	0	20,000	0	0	0	20,000	2,000	0	2,000	0	2,000	2,000	52,470	27,970	2,000	0	0	0	52,470
80	Indonesia	20,200	0	20,200	0	1,962	10,700	35,862	96,775	53,240	16,869	26,666	7,264	56,059	169,648	147,445	81,210	17,069	26,666	9,226	67,347

Source: Result of Inventory Survey Conducted by JICA FIDP Team

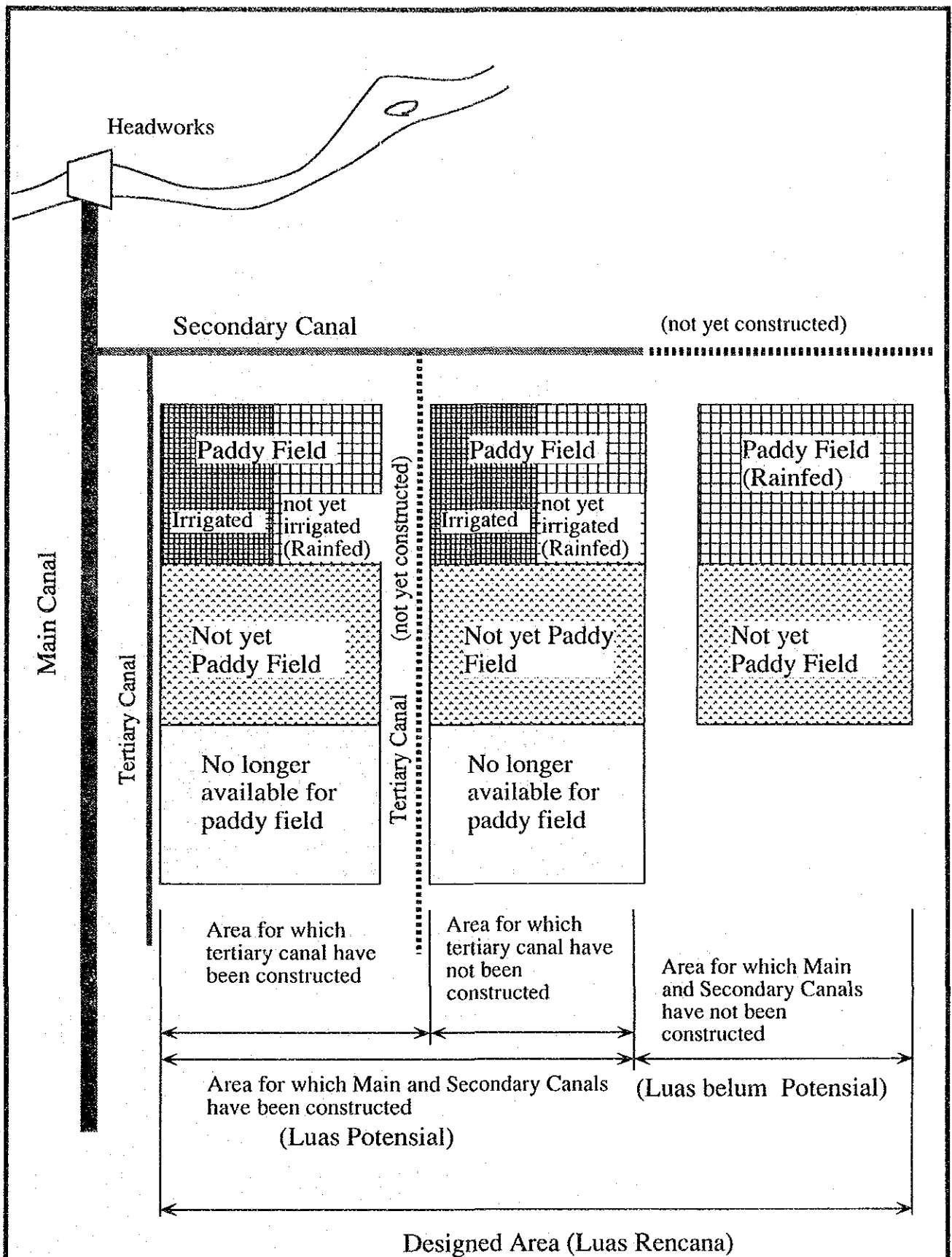


Figure 6.1 Definition of Area in PU Irrigation Scheme

MINISTRY OF PUBLIC WORKS
FORMULATION OF IRRIGATION DEVELOPMENT PROGRAM
JAPAN INTERNATIONAL COOPERATION AGENCY

Chapter 7

7. JUSTIFICATION OF IRRIGATION DEVELOPMENT IN PJPT II

As described in Chapter 4, total paddy demand in Indonesia at 2018, the last year of PJPT II, is projected to reach to 66.2 million tons.

	<u>Total Paddy Balance</u>				Unit: rough rice, thousand ton		
	1990	1993	1998	2003	2008	2013	2018
Indonesia	45,516	48,680	53,656	58,085	61,872	64,672	66,232

Source: Projected by JICA-FIDP team. For details see Chapter 4.

From 1990 as a base year, 21 million tons of paddy should be produced more in 28 years. The necessity of further irrigation development to achieve the above production increase is examined hereunder.

7.1 Factors Affecting Paddy Production

Expected deficit amount of paddy in the future must be filled by certain measures. Because of the present government policy on self-sufficiency in basic commodities including rice, the measure should be increased production. As seen in Chapter 5, two basic ways to increase production are envisaged; (i) to increase harvested area and (ii) to increase yield of paddy. Another way to increase paddy is to decrease losses after harvest such as harvesting loss, storage loss and milling loss. However, this post-harvest losses will not be considered here since no precise data on the loss is available. Paddy production may be affected by the following factors:

(1) Factors affecting Cropped (Harvested) area

(a) Farmers' incentive to cultivate paddy

The government intervention on crop price and fertilizer price will much affect farmers' incentive to cultivate paddy. Profitability is the largest incentive for farmers to select crops.

(b) Land conversion as negative factor

As a result of economic development, new land for residence and industrial use will more be required. Hence, existing paddy field near urban area will be converted into such purposes. This is inevitable change unless any regulation on land use of paddy field is forced by law.

(c) Irrigation development

On-going irrigation development will contribute to area expansion by opening new paddy area or helping increase yield and/or cropping intensity. Irrigation development will be divided into several categories by its purposes:

- Rehabilitation and upgrading of existing schemes
- Extension of existing schemes
- New construction
- Groundwater development
- Upgrading of swamp schemes
- Special Maintenance of existing surface irrigation and swamp schemes
- Rehabilitation of existing village irrigation schemes
- Efficient O&M of existing irrigation schemes

(d) Land development

Through irrigation development, new paddy area will be formed. It requires land clearing, land levelling, etc. This land development is divided into two categories whether it requires the construction of irrigation facilities.

(e) Sugarcane and tobacco cultivation area in Jawa

Sugarcane area cultivated in lowland of Jawa Tengah and Jawa Timur will shift to upland area, and the lowland will be planted with paddy. cultivated mainly on irrigated paddy field by contract lease basis. However, due to the low profitability, this contract adversely affect farmers' economy.

(2) Increase Productivity

(a) Improve farming practice (extension of new varieties, fertilizer application, etc.)

Through the extension of intensification program, among others high level of fertilizer dosage along with the introduction of HYVs, yield level of paddy has much increased centering Jawa/Bali. There should still be a room to increase yield if much improved farming practiced are diffused.

(b) Irrigation development

As seen in the Chapter 5, irrigation development itself contributes to the yield increase, although the increase amount varies among island groups as well as irrigation level.

Firstly paddy production increase will be estimated without thinking of new irrigation development (but include on-going projects). The necessity of Irrigation development will be

justified in case other measures to increase paddy production than irrigation development are not able to meet the increased demand of rice.

7.2 Quantification of Effects of Each Factor on Paddy Production

(1) Area Expansion

Farmers' incentive

Rice policy sought by the Government will directly affect farmers' incentive to cultivate paddy. High rice price will give farmers more incentive to grow paddy to increase income while phasing out of fertilizer subsidy will have a negative impact on the incentive. The government has announced that the floor price of paddy as well as fertilizer will be increased in 1993 as follows:

Change in Prices of Rice and Fertilizer

Commodity	Price (Rp./kg)		Increase rate (%)
	1992	1993	
Rough rice at farmgate	330	340	3.03
Fertilizer			
- Urea	220	240	9.09
- ZA	220	240	9.09
- TSP	280	350	25.00
- KCl	280	350	25.00
- KNO ₃	355	450	26.76

Source: Kompas, October 8, 1992.

If production cost increase is higher than gross income increase, farmers' incentive to grow paddy will decrease, or at least the dosage of fertilizer application will decrease, which is one of the key factors to increase crop yield. Impact of these price escalation on farm economy was analyzed using past data on farm budget. The result shows (see Table 7.1) that since fertilizer cost accounts for only several per cent of total production cost, effect of rice price increase will bring about increase of net income. Although the price increase rate of fertilizer is higher than that of paddy, gross benefit increase surpasses fertilizer cost increase. The effect of fertilizer price increase on net income increase is less than 1%. Considering the likely increase of other costs such as labor wages and seed, it is judged that phasing out of fertilizer subsidy policy will not affect farmers' incentive to cultivate paddy.

Ministry of Agriculture evaluated that recent heavy dosage of fertilizer had not resulted in the yield increase, and that decrease of fertilizer dosage due to price increase would not affect the yield but decrease

Land Conversion

According to the recent study on land conversion from lowland paddy field (sawah) to other purposes at ten provinces by P.T.Indeco data utama, annual average converted area is estimated at about 20,000 ha in Jawa and Bali islands, and 3,000 ha for five provinces of outside of Jawa. Based on the study results by P.T.Indeco data utama, the extent of future land conversion is projected considering the future economic development. The result is shown on Table 7.2 and summarized below:

Projected future land conversion (annual average)

Unit: ha

Year	Jawa		Bali		Sumatera		Sulawesi		Total	
	Irrig.	Non-irrig.	Irrig.	Non-irrig.	Irrig.	Non-irrig.	Irrig.	Non-irrig.	Irrig.	Non-irrig.
1991-1995	20,000	2,600	1,000	0	1,000	1,000	500	500	22,500	4,100
1996-2000	22,000	2,560	1,000	0	1,500	1,500	500	500	25,000	4,560
2001-2010	22,000	4,200	1,000	0	2,000	2,000	1,000	1,000	26,000	7,200
2011-2020	25,000	5,200	1,000	0	3,000	3,000	2,000	1,000	31,000	9,200
Total Accum.	680,000	119,800	30,000	0	62,500	62,500	35,000	20,000	807,500	207,300

Source: JICA-FIDP Team estimates.

In Jawa, economic development will proceed at higher rate especially in manufacturing and service sectors, which will bring about the increase of income centering urban area. In accordance with the economic development, infrastructural development including housing, road and communication facilities will be accelerated. Besides tastes for food will also be diversified, which will increase the demand for high value crops such as vegetables and fruits. Land conversion area from paddy field is assumed to increase in later stage of the period since the projected economic development is accelerated in later stage of the PJP II. Other islands will also increase land conversion area following Jawa. Accumulated conversion area in 30 years from 1990 to 2020 is projected at 1.02 million ha, 0.81 million ha of which accounts for irrigated paddy area. The rest or 0.21 million ha will be from rainfed or non-irrigated paddy field. Land conversion will proceed mainly in Jawa, which will account for 80% of total conversion area.

Irrigation development and land development

(i) Area Expansion

As seen in the Chapter 6, many irrigation development projects are under construction. From the viewpoint of paddy area expansion, aside from new irrigation development and extension of existing facilities under Ministry of Public Works, land development under Ministry of Agriculture contributes to the increase of paddy field. Besides, rehabilitation projects may also

increase planted area through expansion of irrigated area which enables to plant paddy more than one time per year. Currently on-going projects are supposed to be completed by 1998. Proposed beneficial area by those projects are presented on Table 7.3 and summarized below:

Proposed Beneficial Area by On-going Development Projects

	Unit : 1,000 ha				
	New Construction*1	Rehabilitation*2	Village Irrigation	Groundwater Development	Swamp Development*3
Sumatera	96.5	42.5	1.6	0	168.9
Jawa	46.5	111.9	1.0	2.5	0
Bali & Nusa Tenggara	28.3	12.2	1.2	1.4	0
Kalimantan	41.7	0.4	1.2	0	47.7
Sulawesi	50.2	16.5	1.7	0	1.3
Maluku & Irian Jaya	4.0	0.4	0.1	0	4.6
Indonesia	267.2	184.0	6.8	3.9	222.5

Remarks : *1: New Construction includes extension and land development; *2 Rehabilitation includes special maintenance; *3 Swamp development includes rehabilitation and upgrading.

Source: JICA-FIDP team's estimates.

New construction projects covers 267 thousand ha, most of which exists in Sumatera, Sulawesi, Jawa and Kalimantan. As for rehabilitation projects which covers 184 thousand ha, 60% of which or 112 thousand ha are concentrated in Jawa. Village irrigation projects with total area of 6,800 ha, spread over the country. Groundwater development projects are undertaken only in Jawa and Bali/Nusa Tenggara, with total area of 3,900 ha. While swamp development projects cover 223 thousand ha, 95% of which or 217 thousand ha is under construction in Kalimantan and Sumatera.

(ii) Cropping Intensity

There is no trustful data available on cropping intensity by eco-type. Overall cropping intensity of lowland paddy fluctuates between 1.0 and 1.2 in last eight years for whole Indonesia, varying from 1.3 to 1.6 in Jawa to 0.3 to 0.7 in Kalimantan. The difference of cropping intensity can largely be explained by the difference of the rate of irrigation area and swamp area to whole wetland paddy area. Irrigation can increase cropping intensity while swamp tends to decrease it due to uncontrolled water condition. Cropping intensity has changed little within each island, and hence whole Indonesia over the years as shown on Table 7.4, suggesting that net irrigated paddy field has not increased much. Irrigation does not necessarily assure two times cropping a year in the irrigated area since most irrigation schemes in Indonesia draw water from headworks with which the availability of irrigation water depends upon seasonally fluctuating river flow.

We assume, from the above consideration, that increase of cropping intensity occurred only as a result of the change of the ratio of irrigated wetland area to total wetland area, and present cropping intensity will not change in future. Based on the estimated cropping intensity by eco-

type in recent three years (Refer to Tables 5.15 to 5.17 in Chapter 5), paddy cropping intensity by ecotype is estimated by province as follows.

Estimated Cropping Intensity by Ecotype and Province

No.	Province	Irrigation Paddy		Non-irrigated Paddy		Swamp and Others	
		1990	2018	1990	2018	1990	2018
11.	D.I. Aceh	1.0	1.0	1.0	1.0	0.5	0.5
12.	Sumatera Utara	1.5	1.5	1.0	1.0	0.5	0.5
13.	Sumatera Barat	1.8	1.8	1.0	1.0	0.5	0.5
14.	Riau	1.6	1.6	0.8	0.8	0.5	0.5
15.	Jambi	1.6	1.6	1.0	1.0	0.7	0.7
16.	Sumatera Selatan	1.6	1.6	1.0	1.0	0.9	0.9
17.	Bengkulu	1.2	1.2	0.5	0.5	0.5	0.5
18.	Lampung	1.5	1.5	1.0	1.0	0.5	0.5
31.	DKI Jakarta	1.8	-	1.0	-	0.5	-
32.	Jawa Barat	1.7	1.7	1.0	1.0	0.5	0.5
33.	Jawa Tengah	1.7	1.7	1.0	1.0	0.5	0.5
34.	Yogyakarta	1.7	1.7	1.0	1.0	0.5	0.5
35.	Jawa Timur	1.4	1.4	0.9	0.9	0.5	0.5
51.	Bali	1.8	1.8	1.0	1.0	0.5	0.5
52.	Nusa Tenggara Barat	1.4	1.4	0.9	0.9	0.5	0.5
53.	Nusa Tenggara Timur	0.8	0.8	0.5	0.5	0.5	0.5
54.	Timor Timur	0.7	0.7	0.7	0.7	0.7	0.7
61.	Kalimantan Barat	0.7	0.7	0.5	0.5	0.4	0.4
62.	Kalimantan Tengah	0.9	0.9	0.6	0.6	0.5	0.5
63.	Kalimantan Selatan	1.3	1.3	1.0	1.0	0.8	0.8
64.	Kalimantan Timur	1.0	1.0	0.5	0.5	0.4	0.4
71.	Sulawesi Utara	1.4	1.4	0.9	0.9	0.5	0.5
72.	Sulawesi Tengah	1.1	1.1	0.7	0.7	0.7	0.7
73.	Sulawesi Selatan	1.6	1.6	1.0	1.0	0.5	0.5
74.	Sulawesi Tenggara	1.2	1.2	0.8	0.8	0.5	0.5
81.	Maluku	1.3	1.3	1.0	1.0	0.5	0.5
82.	Irian Jaya	1.3	1.3	1.0	1.0	0.5	0.5

Source: JICA-FIDP team estimates.

Sugar and tobacco area

In accordance with the Government policy, existing sugarcane area with total of 150,000 ha in irrigated lowland in Jawa Tengah and Jawa Timur will be converted back into paddy field. Moreover, tobacco planted area of about 100,000 ha, which is leased to the government owned companies by contract basis, will also be returned to farmers, due to lower profitability. Low profitability of these two commodities, which do not improve income level of farmers and thereby brings about the increase of poor farmers, resulted in this policy change. Although the situation may change in future in case world market price of these commodities increase, farmers do not have incentive to cultivate these crops voluntarily at least at present. It is assumed all of 250,000 ha will be converted back into paddy area in ten years.

From the above consideration, future change in paddy area until 2020 are projected. This projection includes only currently on-going irrigation projects, and committed or proposed projects are excluded. The results are shown on Table 7.5 and summarized below:

Estimated Change in Area of Lowland Paddy Field

	Unit: 1,000 ha						
	1990	1993	1998	2003	2008	2013	2018
Sumatera	1,899	1,906	1,945	1,945	1,912	1,886	1,856
Jawa	3,406	3,378	3,405	3,378	3,247	3,105	2,955
Bali & Nusa Tenggara	409	411	422	418	413	408	403
Kalimantan	950	955	966	967	967	967	967
Sulawesi	768	770	785	784	774	761	746
Maluku & Irian Jaya*	8	9	11	11	11	11	11
Indonesia	7,441	7,428	7,534	7,490	7,324	7,138	6,938

Source: JICA-FIDP team estimate.

The paddy field area is estimated to increase until 1998 due to the completion of on-going irrigation development and expected conversion of sugarcane and tobacco field back into paddy field. Then it decreases steadily by the effect of converting paddy field to other purposes. In 2018, estimated wetland paddy field area will be 6,938 thousand ha, which is 503 thousand ha less than 1990 level.

Considering cropping intensity, change in harvested area is also projected. The results are shown on Table 7.6, and summarized as below:

Estimated Change in Harvested Area of Lowland Paddy Field

	Unit: 1,000 ha						
	1990	1993	1998	2003	2008	2013	2018
Sumatera	2,181	2,204	2,277	2,262	2,237	2,205	2,167
Jawa	4,972	4,980	5,060	5,019	4,822	4,605	4,377
Bali & Nusa Tenggara	504	511	525	517	508	499	490
Kalimantan	652	661	679	679	679	679	679
Sulawesi	987	998	1,023	1,025	1,012	994	973
Maluku & Irian Jaya	9	10	13	13	13	13	13
Indonesia	9,306	9,868.7	9,578	9,516	9,272	8,996	8,700

Source: JICA-FIDP team estimate.

Change in harvested area shows similar tendency as field area estimate. Estimated harvested area in 2018 is 8.7 million ha, being 600 thousand ha less than that in 1990. Reflecting big land conversion of irrigated area in Jawa, the decrease of harvested area in Jawa exceeds the total decrease in Indonesia.

(2) Increase in Yield

Variety

Having started with IR8, introduction of modern varieties (or high yielding varieties; HYVs) has made yield jump up possible in tropical regions. The most obvious characteristics of HYVs is to respond its yield to the amount of fertilizer application, among others nitrogen fertilizer, through improvement of plant type so that they can fully utilize solar energy for carbon fixation (photosynthesis). Potential for further yield increase is how to maximize solar energy utilization efficiency. The first modern variety IR8 (produced by International Rice Research Institute in the Philippines), however, showed sensitiveness to diseases, which made researchers change research objectives not only on yield increase but also on pest resistance. At present, as mentioned in the Chapter 5, many HYVs are planted in Indonesia, yield of which are not much different among varieties as seen in Table 5.24. In experimental field level in Indonesia, maximum yield is recorded at about 8 to 9 ton/ha on rough rice basis. Probable maximum yield, then, may be 6.5 to 7.0 ton/ha on rough rice basis in practical farm level, considering the different farm condition, level of farming practice, water management level, etc., providing no big change in the potential productivity of new varieties to be introduced. This potential maximum yield level will not differ among island groups because paddy yield under non-intensification program shows no difference among island groups, which suggests soil productivity of present paddy field is not so different among island groups. The dominant factors to increase paddy yield is then judged to be human intervention on cultivation of paddy such as irrigation, fertilizer application, pest management, weeding, etc.

Development of hybrid (F₁) rice is now being one the center of research objectives as to yield increase. Maize and other crops showed successful results in developing hybrid seeds. Although theoretically possible, there will be several barriers to succeed in extending hybrid paddy seed. Seed multiplication may be one limiting factor for extension due to low fertility rate, and thereby high cost. Taste characteristics is an another factor to be considered for extension. The strategy of research in IRRI and CGIAR have recently shifted from production increase to sustainable production with low input. Considering those environment, it is not known if hybrid seeds can be produced and bring about second "green revolution" at this moment, although recent World Bank report¹ expects such varietal change along with improved farming practice, which brings about drastic increase of yield.

Improvement of farming practice

Improvement of farming practice is expected to contribute to paddy yield increase. Various constraints to increase yield have been reported including water management, pest control, fertilizer application, etc. Water management is related with irrigation and drainage. As seen in

¹ World Bank. *Indonesia: Agricultural Transformation Challenges and Opportunities*, September 1, 1992.

Chapter 5, higher yield is attained under the condition of higher irrigation level when fertilizer dosage is also higher. Timely watering to and draining from paddy field will be a key to enhance root activity.

As for fertilizer, since it is one of the key factors to yield increase, increased dosage of fertilizer application is a must. Although BIMAS program has already been extended to most areas in the country, upgrading of the program should be promoted; e.g. from Innum to Insus. Combined use of fertilizers with different nutrient origin will also be promoted. In experimental level, the positive effect of potassium fertilizer application on yield increase has been recognized. In high level of fertilizer application, yield limiting factor may already be changed from nitrogen and/or phosphorus to other nutrients. Continuous research work is expected to contribute to further yield increase of rice.

Since yield of paddy already reached to the highest level in Jawa and Bali, extension efforts should be directed to other areas including Sumatera and Sulawesi where there are still more space for yield increase.

Irrigation development

As seen in the Chapter 5, irrigation development contributes to yield increase. However it is difficult to estimate the single effect of irrigation development on yield increase since yield increase is also attributed to the increase level of fertilizer application which is always accompanied by irrigation development.

Future yield estimate

Based on the past change in yield level, crop cutting data, the above consideration, likely change in the direction of BIMAS program extension (more emphasis put on off-Jawa), etc., future yield of wetland paddy is estimated. As mentioned earlier, average maximum yield at practical irrigated farming level of 6.5 ton/ha is set. The results are shown on Table 7.7 and summarized below:

Estimated Yield of Lowland Paddy by Ecotype and Province

No.	Province	Irrigation Paddy		Non-irrigated Paddy		Swamp and Others	
		1990	2018	1990	2018	1990	2018
11.	D.I. Aceh	4.40	6.12	3.20	4.16	2.80	3.00
12.	Sumatera Utara	4.40	6.12	3.20	4.16	2.80	3.00
13.	Sumatera Barat	5.00	6.32	4.00	4.86	2.80	3.00
14.	Riau	4.40	6.12	3.20	4.16	2.80	3.00
15.	Jambi	4.40	6.12	3.20	4.16	2.80	3.00
16.	Sumatera Selatan	4.40	6.12	3.20	4.16	2.80	3.00
17.	Bengkulu	4.40	6.12	3.20	4.16	2.80	3.00
18.	Lampung	4.40	6.12	3.20	4.16	2.80	3.00
31.	DKI Jakarta	5.40	-	4.60	-	2.80	-
32.	Jawa Barat	5.40	6.50	4.60	5.46	2.80	3.00
33.	Jawa Tengah	5.40	6.50	4.60	5.46	2.80	3.00
34.	Yogyakarta	5.40	6.50	4.60	5.46	2.80	3.00
35.	Jawa Timur	5.40	6.50	4.60	5.46	2.80	3.00
51.	Bali	5.40	6.50	4.60	5.46	2.80	3.00
52.	Nusa Tenggara Barat	4.80	5.92	3.30	4.42	2.80	3.00
53.	Nusa Tenggara Timur	3.30	4.98	2.80	3.46	2.80	3.00
54.	Timor Timur	2.80	4.64	2.40	3.22	2.20	2.40
61.	Kalimantan Barat	2.80	4.38	2.70	3.42	2.50	2.70
62.	Kalimantan Tengah	2.30	3.68	2.10	3.02	1.80	2.00
63.	Kalimantan Selatan	3.00	4.68	2.80	3.46	2.80	3.00
64.	Kalimantan Timur	2.80	4.38	2.70	3.42	2.50	2.70
71.	Sulawesi Utara	4.50	6.32	3.50	4.46	2.80	3.00
72.	Sulawesi Tengah	3.40	5.68	2.80	3.92	2.80	3.00
73.	Sulawesi Selatan	4.50	6.32	3.50	4.46	2.80	3.00
74.	Sulawesi Tenggara	3.40	5.68	2.80	3.92	2.80	3.00
81.	Maluku	2.80	4.38	2.80	3.46	2.80	3.00
82.	Irian Jaya	2.80	4.38	2.80	3.46	2.80	3.00

Source: JICA-FIDP team estimates.

7.3 Supply Capacity without New Irrigation Development

Based upon the above estimates, supply capacity of paddy is projected until the year 2020. No new irrigation development except currently on-going ones is considered. The results are presented on Table 7.8 and summarized below:

Estimated Change in Production of Wetland Paddy without New Irrigation until 2020

	Unit: 1,000 ton						
	1990	1993	1998	2003	2008	2013	2018
Sumatera	8,636	9,138	10,203	10,747	11,123	11,385	11,517
Jawa	26,171	27,130	29,085	29,996	29,747	29,051	27,812
Bali & Nusa Tenggara	2,310	2,421	2,608	2,674	2,726	2,766	2,791
Kalimantan	1,734	1,798	1,933	2,040	2,144	2,267	2,362
Sulawesi	4,008	4,281	4,774	5,146	5,403	5,556	5,637
Maluku & Irian Jaya	25	29	41	45	49	52	56
Indonesia	42,884	44,797	48,644	50,648	51,192	51,077	50,174

Source: JICA-FIDP team estimate.

Production increases until about 2008 and then start decrease. Total expected production in 2018 is 50.2 million tons on rough rice basis.

Four alternative projections are also made to examine the sensitivity of base case projection to parameter change.

- Alternative case (1) Lower land conversion scenario
Use moderate land conversion area which is 10% less than base case.
- Alternative case (2) Higher yield scenario
Yield will increase 10% higher in 2020 than base case for irrigated field only.
- Alternative case (3) Lower cropping intensity scenario
Cropping intensity in irrigated paddy field will gradually decrease by 10% in 2018 for Sumatera Barat, All provinces in Jawa, Bali, Sulawesi Selatan only.
- Alternative case (4) Lower land conversion rate and higher yield scenario
Mixture of (1) and (2)

The results are shown on Tables 7.9 to 7.12 and summarized below:

Comparison of Production Projection among Alternative Cases

	Unit: rough rice, thousand ton						
	1990	1993	1998	2003	2008	2013	2018
Base case	42,884	44,797	48,644	50,648	51,192	51,077	50,174
Alternative (1)	42,884	44,862	48,835	50,982	51,683	51,750	51,038
Alternative (2)	42,884	44,667	48,435	50,847	52,213	53,386	54,310
Alternative (3)	42,884	44,450	47,749	49,069	49,101	48,434	47,132
Alternative (4)	42,884	44,732	48,626	51,182	52,714	54,092	55,251

Source: JICA-FIDP team estimate.

Most optimistic supply projection in alternative case (4) gives the largest value of 55.3 million ton in 2018. On the other hand, most pessimistic projection in alternative case (3) shows the declining trend after 2008, reach to 47.1 million ton in 2018.

Besides the above lowland paddy production, we must think upland paddy production increase when project all supply capacity. Upland paddy production is projected assuming that it will change following the past 13 years trend (for details refer to Annex B). The result is presented on Table 7.13 and summarized below:

Trend Growth Projection of Dry Paddy Production

	Unit: ton						
	1990	1993	1998	2003	2008	2013	2018
Sumatera	833	862	903	938	969	997	1,022
Jawa	861	938	1,046	1,137	1,217	1,288	1,353
Bali & NT	134	136	138	140	141	142	143
Kalimantan	413	431	454	473	489	503	516
Sulawesi	108	104	99	96	94	92	90
Maluku & IJ	11	11	10	10	10	10	10
Indonesia	2,360	2,481	2,651	2,794	2,919	3,031	3,134

Source: JICA-FIDP team estimate.

The total paddy supply amount at 2018 is then estimated at 55 million to 61 million tons depending on the scenarios. All figures are far below the demand projection value shown below:

Projection of Total Paddy Production

	Unit : 1,000 ton						
	1990	1993	1998	2003	2008	2013	2018
Base Line Scenario							
Sumatera	9,469	10,000	11,106	11,685	12,092	12,382	12,539
Jawa	27,032	28,068	30,130	31,133	30,964	30,338	29,164
Bali/Nusa Tenggara	2,444	2,557	2,746	2,814	2,866	2,908	2,934
Kalimantan	2,147	2,229	2,387	2,513	2,6633	2,770	2,878
Sulawesi	4,116	4,384	4,873	5,242	5,497	5,647	5,727
Maluku/Irian Jaya	36	40	52	55	59	62	66
Indonesia	45,243	47,278	51,294	53,442	54,111	54,109	53,308
Alternative (1)	45,243	47,343	51,486	53,776	54,602	54,781	54,172
Alternative (2)	45,243	47,148	51,086	53,641	55,132	56,417	57,444
Alternative (3)	45,243	46,931	50,400	51,863	52,020	51,465	50,266
Alternative (4)	45,243	47,213	51,277	53,976	55,633	57,123	58,385
Demand Amount	45,516	48,680	53,656	58,085	61,872	64,672	66,232

Source: JICA-FIDP team estimates.

The above result shows that paddy production will not meet the increase demand of paddy under without new irrigation development condition. It is concluded therefore that irrigation development is still necessary in the next national development stages.

Table 7.1 Impact of Increase in Prices of Rice and Fertilizer on Farm Budget

	Sumatera	Jawa	Bali & NT	Kalimantan	Sulawesi
Production value (Rp/ha)	1,133,310	1,366,860	1,095,646	802,247	1,011,534
Yield (kg/ha)	3,921	5,200	4,451	2,698	4,128
Unit Price (Rp/kg)	289	263	246	297	245
Cost (Rp/ha)	273,707	437,741	309,998	168,823	270,490
Seed	18,555	20,110	20,094	11,252	15,044
Pesticides	13,515	15,387	9,352	4,808	12,385
Fertilizer	55,697	86,618	60,955	33,170	48,571
Cost	47,604	51,537	56,133	30,723	76,216
Wage/Salaries	126,146	248,254	142,875	79,119	104,689
Other costs	12,189	15,834	20,589	9,750	13,585
Net Return (Rp/ha)	859,603	929,119	785,648	633,424	741,044
Increase in Gross Benefit (Rp./ha)	27,092	32,414	26,310	19,071	23,410
Share of Fertilizer in Gross Income (%)	4.64	6.43	5.38	3.46	4.51
Increase in Fertilizer cost (Rp./ha)	5,055	8,371	5,686	2,654	4,241
Net Increase in Benefit (Rp./ha)	22,037	24,042	20,625	16,417	19,169
Income increase rate (%)	2.46	2.25	2.38	2.61	2.48

Note: Increase in income and fertilizer cost is assumed based on the following condition.

Benefit and cost at base year : average of 1989 to 1991 (derived from Cost Structure of Farms Paddy and Palawija; CBS)

As for the increase of paddy and fertilizer prices, see Table in the text pp.7-2.

Yield of paddy : no change

Applied amount of fertilizer: no change; Urea : TSP : Others = 6:3:1

Price of fertilizer will rise: 9.09% for Urea, 25% for TSP and 9.09% for other fertilizer.

Table 7.2 Projection of Land Conversion from Lowland Paddy Field to Other Land Use

	Unit: ha/year											Total	
	Sumut	Lampung	Sumatera	Jakarta	Jawabar	Jawaten	Yogyakarta	Jawatin	Jawa	Bali	Sulsel		Sulawesi
1991-1995	Irrigated	0	1,000	1,000	300	8,500	3,000	200	8,000	20,000	1,000	500	22,500
	Rainfed	500	500	1,000	200	500	800	200	900	2,600	0	500	4,100
	Total	500	1,500	2,000	500	9,000	3,800	400	8,900	22,600	1,000	1,000	26,600
1996-2000	Irrigated	500	1,000	1,500	300	9,000	3,500	200	9,000	22,000	1,000	500	25,000
	Rainfed	1,000	500	1,500	160	500	800	200	900	2,560	0	500	4,560
	Total	1,500	1,500	3,000	460	9,500	4,300	400	9,900	24,560	1,000	1,000	29,560
2001-2010	Irrigated	800	1,200	2,000	120	9,000	3,500	380	9,000	22,000	1,000	1,000	26,000
	Rainfed	1,000	1,000	2,000	0	1,400	1,200	200	1,400	4,200	0	1,000	7,200
	Total	1,800	2,200	4,000	120	10,400	4,700	580	10,400	26,200	1,000	2,000	33,200
2011-2020	Irrigated	1,500	1,500	3,000	0	11,000	4,000	1,000	9,000	25,000	1,000	2,000	31,000
	Rainfed	1,500	1,500	3,000	0	1,800	1,400	200	1,800	5,200	0	2,000	9,200
	Total	3,000	3,000	6,000	0	12,800	5,400	1,200	10,800	30,200	1,000	4,000	41,200
Accumulated	Irrigated	25,500	37,000	62,500	4,200	287,500	107,500	15,800	265,000	680,000	30,000	35,000	807,500
	Rainfed	32,500	30,000	62,500	1,800	37,000	34,000	6,000	41,000	119,800	0	35,000	207,300
	Total*	58,000	67,000	125,000	6,000	324,500	141,500	21,800	306,000	799,800	30,000	70,000	1,014,800

Remarks: *: Accumulated Total is presented in ha.
Source: JICA-FIDP Team projection.

Table 7.3 Area of On-going Projects by Province and by Type

No.	Unit: ha						
	New Construction	Extension	Ground water	Rehabilitation and SM	Village Irrigation	Swamp Upgrading	Swamp EOM
11 D.I.Aceh	18,139	18,533	0	5,781	212	850	
12 Sumatera Utara	7,850	12,668	0	13,321	468	950	10,740
13 Sumatera Barat	2,267	12,195	0	13,263	169	3,000	15,900
14 Riau	397	1,184	0	48	86	5,440	0
15 Jambi	0	497	0	20	91	2,300	0
16 Sumatera Selatan	3,508	213	0	289	224	10,000	71,110
17 Bengkulu	1,303	0	0	611	141	3,000	0
18 Lampung	7,006	10,758	0	9,207	173	1,000	44,610
Sumatera	40,470	56,048	0	42,540	1,564	26,540	142,360
31 D.K.I.Jakarta	0	60	0	1,159	0	0	0
32 Jawa Barat	8,469	1,964	280	24,517	229	0	0
33 Jawa Tengah	35,468	325	470	37,801	364	0	0
34 D.I.Yogyakarta	0	209	300	5,630	206	0	0
35 Jawa Timur	0	0	1,450	42,775	226	0	0
Jawa	43,937	2,558	2,500	111,882	1,025	0	0
51 Bali	1,541	0	460	329	165	0	0
52 Nusa Tenggara Barat	13,676	5,252	345	9,164	277	0	0
53 Nusa Tenggara Timur	3,144	161	585	2,455	737	0	0
54 Timor Timur	4,237	314	0	298	0	0	0
Bali, NT & Timtim	22,598	5,727	1,390	12,246	1,179	0	0
61 Kalimantan Barat	5,547	470	0	353	469	7,644	0
62 Kalimantan Tengah	459	195	0	25	145	8,131	0
63 Kalimantan Selatan	9,017	25,711	0	0	349	7,537	23,700
64 Kalimantan Timur	302	0	0	0	283	700	0
Kalimantan	15,325	26,376	0	378	1,246	24,012	23,700
71 Sulawesi Utara	3,060	100	0	879	385	0	0
72 Sulawesi Tengah	17,276	10,020	0	3,818	367	500	0
73 Sulawesi Selatan	17,872	0	0	10,606	191	0	0
74 Sulawesi Tenggara	1,647	192	0	1,232	773	800	0
Sulawesi	39,855	10,312	0	16,535	1,716	1,300	0
81 Maluku	579	677	0	162	84	0	0
82 Irian Jaya	2,740	9	0	241	21	4,600	0
Maluku & Irian Jaya	3,319	686	0	403	105	4,600	0
Indonesia	165,504	101,707	3,890	183,984	6,835	56,452	166,060

Note: 1. Area as paddy field derived from ANNEX-E Table 4.2.

2. Area of New Construction includes expected area expansion of paddy field from those projects completed in 1990 & 1991, which are derived from Mid-Term Review.

3. Area of Extension as not yet completed in 1992.

4. Rehabilitation area shows actual beneficial area from the normal rehabilitation work, and not include area of special maintenance.

Source: Prepared by JICA-FIDP team based on hearing from PU staffs and Mid-term Review.

Table 7.4 Changes in the Area of Lowland Paddy Field by Irrigation Type

	Unit: 1,000ha								Planted area	C/p
	Irrigated				Rainfed	Tidal Swamp	Others	Total		
	Technical	Semi tech.	Simple	Sub total						
Sumatera										
1983	133.9	164.6	534.5	833.0	533.0	243.3	370.3	1,979.7	1,853.8	0.936
1984	130.4	159.2	506.6	796.2	538.0	220.1	430.3	1,984.7	1,845.4	0.930
1985	129.7	169.3	504.1	803.1	490.5	252.5	376.9	1,922.9	2,030.6	1.056
1986	136.6	190.4	481.7	808.6	533.1	213.7	438.9	1,994.4	1,995.8	1.001
1987	143.9	141.6	558.1	843.6	630.4	278.2	606.0	2,358.2	2,093.1	0.888
1988	146.9	192.5	521.2	860.6	619.0	228.3	520.6	2,228.6	2,075.9	0.931
1989	159.4	195.6	515.3	870.3	607.7	196.4	582.9	2,257.4	2,156.5	0.955
1990	167.0	209.6	523.4	899.9	571.7	223.5	519.4	2,214.5	2,154.9	0.973
Jawa										
1983	1,341.2	473.8	679.9	2,494.8	911.4	3.4	22.4	3,432.1	5,496.8	1.602
1984	1,342.3	471.0	688.0	2,501.3	937.0	1.6	16.1	3,456.0	5,128.4	1.484
1985	1,344.5	460.0	678.0	2,482.4	940.3	0.8	29.6	3,453.1	4,747.1	1.375
1986	1,353.9	472.3	653.0	2,479.3	933.1	3.1	29.1	3,444.5	5,197.2	1.509
1987	1,363.2	466.8	357.9	2,187.9	898.1	4.5	357.2	3,447.6	4,513.0	1.309
1988	1,369.7	455.0	698.4	2,523.2	893.6	1.2	25.4	3,443.4	5,375.3	1.561
1989	1,382.9	461.0	690.5	2,534.5	888.4	0.5	22.1	3,445.6	4,695.7	1.363
1990	1,389.1	458.6	688.0	2,535.7	863.5	3.6	17.8	3,420.5	4,770.3	1.395
B & NT										
1983	56.2	131.7	102.6	290.5	73.5	0.0	2.7	366.7	510.2	1.391
1984	41.4	146.4	108.3	296.1	77.1	0.0	0.0	373.2	486.6	1.304
1985	43.2	138.4	105.9	287.4	73.7	0.0	11.0	372.2	449.6	1.208
1986	39.4	159.1	103.8	302.3	74.2	0.0	23.6	400.1	423.0	1.057
1987	50.7	152.3	66.4	269.4	73.2	0.0	48.4	390.9	506.8	1.296
1988	45.1	159.6	100.7	305.4	73.2	0.1	33.1	411.8	517.4	1.256
1989	44.6	160.5	103.5	308.7	67.0	5.4	28.8	409.9	501.4	1.223
1990	43.3	167.4	97.7	308.4	75.3	0.0	29.7	413.4	480.0	1.161
Kalimantan										
1983	9.9	8.8	138.8	157.5	393.9	233.8	87.1	872.4	602.9	0.691
1984	5.9	10.8	138.3	155.0	419.6	242.9	122.6	940.1	583.1	0.620
1985	5.7	8.4	130.4	144.5	384.1	232.3	212.4	973.2	649.6	0.667
1986	10.6	12.2	146.6	169.4	334.3	247.6	395.0	1,146.4	590.3	0.515
1987	8.3	13.6	100.4	122.3	342.1	264.6	452.2	1,181.2	621.4	0.526
1988	9.4	24.0	140.6	174.0	351.0	264.7	445.5	1,235.3	370.3	0.300
1989	9.6	26.4	151.9	187.8	380.1	258.2	456.2	1,282.3	608.9	0.475
1990	12.7	27.1	128.8	168.6	410.7	249.9	482.8	1,311.9	587.4	0.448
Sulawesi										
1983	110.4	75.0	226.4	411.8	321.4	5.7	7.2	746.1	777.2	1.042
1984	113.5	60.7	235.7	409.9	300.4	1.8	12.0	724.2	797.3	1.101
1985	126.6	74.5	235.1	436.2	283.5	1.5	50.6	771.7	840.2	1.089
1986	127.6	75.5	230.3	433.4	292.8	2.3	55.2	783.7	894.4	1.141
1987	141.2	87.4	213.9	442.4	278.7	1.7	75.9	798.8	815.0	1.020
1988	143.8	82.8	225.6	452.2	278.4	1.4	49.7	781.6	1,056.9	1.352
1989	164.3	95.8	226.1	486.1	283.0	2.3	59.9	831.3	931.7	1.121
1990	174.0	95.0	227.9	496.9	265.9	4.1	50.0	817.0	966.0	1.182
Indonesia										
1983	1,651.7	853.9	1,682.1	4,187.7	2,233.3	486.3	489.7	7,396.9	9,240.9	1.249
1984	1,633.4	848.1	1,676.9	4,158.5	2,272.1	466.5	581.1	7,478.2	8,840.7	1.182
1985	1,649.6	850.5	1,653.5	4,153.6	2,172.1	487.1	680.4	7,493.2	8,717.1	1.163
1986	1,668.2	909.4	1,615.4	4,193.0	2,167.5	466.8	941.9	7,769.1	9,100.7	1.171
1987	1,707.3	861.7	1,296.6	3,865.6	2,222.5	549.0	1,539.7	8,176.9	8,549.3	1.046
1988	1,715.0	913.8	1,686.5	4,315.3	2,215.2	495.7	1,074.4	8,100.7	9,395.9	1.160
1989	1,760.8	939.4	1,687.3	4,387.4	2,226.2	462.8	1,150.0	8,226.4	8,894.1	1.081
1990	1,786.2	957.7	1,665.7	4,409.5	2,187.0	481.1	1,099.7	8,177.3	9,368.8	1.146

Note: Timor Timur, Maluku and Irian Jaya are not included.

Source: Land area by utilization in Indonesia and Production in cereals in Indonesia, CBS various years.

Table 7.5 Estimated Area of Lowland Paddy Field by Province up to 2018

	Unit: 1,000 ha						
	1990	1993	1998	2003	2008	2013	2018
11 D.I.Aceh	293	298	310	312	312	312	312
12 Sumatera Utara	498	499	507	500	491	478	463
13 Sumatera Barat	224	224	235	237	237	237	237
14 Riau	115	115	116	116	116	116	116
15 Jambi	157	157	157	158	158	158	158
16 Sumatera Selatan	332	333	335	335	335	335	335
17 Bengkulu	65	65	66	66	66	66	66
18 Lampung	215	214	218	209	198	184	169
Sumatera	1,899	1,906	1,945	1,932	1,912	1,886	1,856
31 D.K.I.Jakarta	5	4	2	1	1	1	1
32 Jawa Barat	1,165	1,140	1,098	1,048	996	937	873
33 Jawa Tengah	1,005	1,020	1,077	1,104	1,081	1,055	1,028
34 D.I.Yogyakarta	62	61	59	57	54	50	45
35 Jawa Timur	1,168	1,154	1,168	1,167	1,115	1,062	1,008
Jawa	3,406	3,378	3,405	3,378	3,247	3,105	2,955
51 Bali	93	90	86	81	76	71	66
52 Nusa Tenggara Barat	197	200	211	212	212	212	212
53 Nusa Tenggara Timur	94	95	96	96	96	96	96
54 Timor Timur	25	26	29	30	30	30	30
Bali, NT & Timtim	409	411	422	418	413	408	403
61 Kalimantan Barat	361	362	365	366	366	366	366
62 Kalimantan Tengah	159	160	160	160	160	160	160
63 Kalimantan Selatan	348	351	359	359	359	359	359
64 Kalimantan Timur	82	82	82	82	82	82	82
Kalimantan	950	955	966	967	967	967	967
71 Sulawesi Utara	59	60	62	62	62	62	62
72 Sulawesi Tengah	108	110	123	131	131	131	131
73 Sulawesi Selatan	561	560	559	551	541	528	513
74 Sulawesi Tenggara	39	39	40	40	40	40	40
Sulawesi	768	770	785	784	774	761	746
81 Maluku	3	3	4	4	4	4	4
82 Irian Jaya	5	6	7	7	7	7	7
Maluku & Irian Jaya	8	9	11	11	11	11	11
Indonesia	7,441	7,428	7,534	7,490	7,324	7,138	6,938

Source: JICA-FIDP team estimate.

Table 7.6 Estimated Harvested Area of Lowland Paddy up to 2018

	Unit: 1,000 ha						
	1990	1993	1998	2003	2008	2013	2018
11 D.I.Aceh	291	296	308	310	310	310	310
12 Sumatera Utara	617	623	642	633	622	607	588
13 Sumatera Barat	343	348	374	378	378	378	378
14 Riau	97	97	99	99	99	99	99
15 Jambi	144	144	145	145	145	145	145
16 Sumatera Selatan	352	354	357	357	357	357	357
17 Bengkulu	65	66	67	67	67	67	67
18 Lampung	272	275	285	273	259	242	223
Sumatera	2,181	2,204	2,277	2,262	2,237	2,205	2,167
31 D.K.I.Jakarta	8	6	4	0	0	0	0
32 Jawa Barat	1,885	1,859	1,791	1,705	1,617	1,517	1,409
33 Jawa Tengah	1,481	1,525	1,642	1,693	1,657	1,618	1,577
34 D.I.Yogyakarta	99	100	98	96	92	85	76
35 Jawa Timur	1,499	1,490	1,525	1,526	1,456	1,386	1,315
Jawa	4,972	4,980	5,060	5,019	4,822	4,606	4,377
51 Bali	166	162	154	145	136	127	118
52 Nusa Tenggara Barat	255	263	281	282	282	282	282
53 Nusa Tenggara Timur	66	68	69	69	69	69	69
54 Timor Timur	18	18	21	21	21	21	21
Bali, NT & Timtim	504	511	525	517	508	499	490
61 Kalimantan Barat	189	190	192	193	193	193	193
62 Kalimantan Tengah	104	104	105	105	105	105	105
63 Kalimantan Selatan	316	323	339	339	339	339	339
64 Kalimantan Timur	43	43	43	43	43	43	43
Kalimantan	652	661	679	679	679	679	679
71 Sulawesi Utara	78	80	82	82	82	82	82
72 Sulawesi Tengah	115	118	135	143	143	143	143
73 Sulawesi Selatan	750	754	760	753	740	722	701
74 Sulawesi Tenggara	44	45	47	47	47	47	47
Sulawesi	987	998	1,023	1,025	1,012	994	973
81 Maluku	3	3	5	5	5	5	5
82 Irian Jaya	6	7	9	9	9	9	9
Maluku & Irian Jaya	9	10	13	13	13	13	13
Indonesia	9,306	9,363	9,578	9,516	9,272	8,996	8,700

Source: JICA-FIDP team estimate.

Table 7.7 Projected Yield of Lowland Paddy by Province by Eco-type (1/2)

	Unit: ton/ha												
	1990	1991	1992	1993	1994	1995	1996	1997	1998	2003	2008	2013	2018
Acch													
Irrigated	4.40	4.48	4.56	4.64	4.72	4.80	4.88	4.96	5.04	5.38	5.68	5.92	6.12
Rainfed	3.20	3.24	3.28	3.32	3.36	3.40	3.44	3.48	3.52	3.72	3.92	4.06	4.16
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Sumatera Utara													
Irrigated	4.40	4.48	4.56	4.64	4.72	4.80	4.88	4.96	5.04	5.38	5.68	5.92	6.12
Rainfed	3.20	3.24	3.28	3.32	3.36	3.40	3.44	3.48	3.52	3.72	3.92	4.06	4.16
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Sumatera Barat													
Irrigated	5.00	5.06	5.12	5.18	5.24	5.30	5.36	5.42	5.48	5.72	5.92	6.12	6.32
Rainfed	4.00	4.04	4.08	4.12	4.16	4.20	4.24	4.28	4.32	4.52	4.66	4.76	4.86
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Riau													
Irrigated	4.40	4.48	4.56	4.64	4.72	4.80	4.88	4.96	5.04	5.38	5.68	5.92	6.12
Rainfed	3.20	3.24	3.28	3.32	3.36	3.40	3.44	3.48	3.52	3.72	3.92	4.06	4.16
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Jambi													
Irrigated	4.40	4.48	4.56	4.64	4.72	4.80	4.88	4.96	5.04	5.38	5.68	5.92	6.12
Rainfed	3.20	3.24	3.28	3.32	3.36	3.40	3.44	3.48	3.52	3.72	3.92	4.06	4.16
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Sumatera Selatan													
Irrigated	4.40	4.48	4.56	4.64	4.72	4.80	4.88	4.96	5.04	5.38	5.68	5.92	6.12
Rainfed	3.20	3.24	3.28	3.32	3.36	3.40	3.44	3.48	3.52	3.72	3.92	4.06	4.16
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Bengkul													
Irrigated	4.40	4.48	4.56	4.64	4.72	4.80	4.88	4.96	5.04	5.38	5.68	5.92	6.12
Rainfed	3.20	3.24	3.28	3.32	3.36	3.40	3.44	3.48	3.52	3.72	3.92	4.06	4.16
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Lampung													
Irrigated	4.40	4.48	4.56	4.64	4.72	4.80	4.88	4.96	5.04	5.38	5.68	5.92	6.12
Rainfed	3.20	3.24	3.28	3.32	3.36	3.40	3.44	3.48	3.52	3.72	3.92	4.06	4.16
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
DKI Jakarta													
Irrigated	5.40	5.46	5.52	5.58	5.64	5.70	5.76	5.82	5.88	-	-	-	-
Rainfed	4.60	4.64	4.68	4.72	4.76	4.80	4.84	4.88	4.92	-	-	-	-
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	-	-	-	-
Jawa Barat													
Irrigated	5.40	5.46	5.52	5.58	5.64	5.70	5.76	5.82	5.88	6.12	6.32	6.46	6.50
Rainfed	4.60	4.64	4.68	4.72	4.76	4.80	4.84	4.88	4.92	5.06	5.22	5.36	5.46
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Jawa Tengah													
Irrigated	5.40	5.46	5.52	5.58	5.64	5.70	5.76	5.82	5.88	6.12	6.32	6.46	6.50
Rainfed	4.60	4.64	4.68	4.72	4.76	4.80	4.84	4.88	4.92	5.06	5.22	5.36	5.46
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Yogyakarta													
Irrigated	5.40	5.46	5.52	5.58	5.64	5.70	5.76	5.82	5.88	6.12	6.32	6.46	6.50
Rainfed	4.60	4.64	4.68	4.72	4.76	4.80	4.84	4.88	4.92	5.06	5.22	5.36	5.46
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Jawa Timur													
Irrigated	5.40	5.46	5.52	5.58	5.64	5.70	5.76	5.82	5.88	6.12	6.32	6.46	6.50
Rainfed	4.60	4.64	4.68	4.72	4.76	4.80	4.84	4.88	4.92	5.06	5.22	5.36	5.46
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Bali													
Irrigated	5.40	5.46	5.52	5.58	5.64	5.70	5.76	5.82	5.88	6.12	6.32	6.46	6.50
Rainfed	4.60	4.64	4.68	4.72	4.76	4.80	4.84	4.88	4.92	5.06	5.22	5.36	5.46
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00

Table 7.7 Projected Yield of Lowland Paddy by Province by Eco-type (2/2)

	Unit: ton/ha												
	1990	1991	1992	1993	1994	1995	1996	1997	1998	2003	2008	2013	2018
Nusa Tenggara Barat													
Irrigated	4.80	4.84	4.88	4.92	4.96	5.00	5.04	5.08	5.12	5.32	5.52	5.72	5.92
Rainfed	3.30	3.34	3.38	3.42	3.46	3.50	3.54	3.58	3.62	3.82	4.02	4.22	4.42
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Nusa Tenggara Timur													
Irrigated	3.30	3.36	3.42	3.48	3.54	3.60	3.66	3.72	3.78	4.08	4.38	4.68	4.98
Rainfed	2.80	2.82	2.84	2.86	2.88	2.90	2.92	2.94	2.96	3.06	3.22	3.36	3.46
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Timor Timur													
Irrigated	2.80	2.84	2.88	2.92	2.96	3.00	3.04	3.08	3.12	3.44	3.84	4.24	4.64
Rainfed	2.40	2.42	2.44	2.46	2.48	2.50	2.52	2.54	2.56	2.66	2.82	3.02	3.22
Other paddy field	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.30	2.30	2.40	2.40
Kalimantan Barat													
Irrigated	2.80	2.84	2.88	2.92	2.96	3.00	3.06	3.12	3.18	3.48	3.78	4.08	4.38
Rainfed	2.70	2.72	2.74	2.76	2.78	2.80	2.82	2.84	2.86	2.96	3.12	3.26	3.42
Other paddy field	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.60	2.60	2.70	2.70
Kalimantan Tengah													
Irrigated	2.30	2.34	2.38	2.42	2.46	2.50	2.54	2.58	2.62	2.82	3.08	3.38	3.68
Rainfed	2.10	2.12	2.14	2.16	2.18	2.20	2.22	2.24	2.26	2.42	2.62	2.82	3.02
Other paddy field	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	2.00	2.00
Kalimantan Selatan													
Irrigated	3.00	3.04	3.08	3.12	3.16	3.20	3.26	3.32	3.38	3.68	4.04	4.38	4.68
Rainfed	2.80	2.82	2.84	2.86	2.88	2.90	2.92	2.94	2.96	3.06	3.22	3.36	3.46
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Kalimantan Timur													
Irrigated	2.80	2.84	2.88	2.92	2.96	3.00	3.06	3.12	3.18	3.48	3.78	4.08	4.38
Rainfed	2.70	2.72	2.74	2.76	2.78	2.80	2.82	2.84	2.86	2.96	3.12	3.26	3.42
Other paddy field	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.60	2.60	2.70	2.70
Sulawesi Utara													
Irrigated	4.50	4.58	4.66	4.74	4.82	4.90	4.98	5.06	5.14	5.54	5.88	6.12	6.32
Rainfed	3.50	3.54	3.58	3.62	3.66	3.70	3.72	3.74	3.76	3.92	4.12	4.32	4.46
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Sulawesi Tengah													
Irrigated	3.40	3.50	3.60	3.70	3.80	3.90	4.00	4.10	4.20	4.64	5.04	5.38	5.68
Rainfed	2.80	2.84	2.88	2.92	2.96	3.00	3.12	4.20	4.68	3.92	3.52	3.72	3.92
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Sulawesi Selatan													
Irrigated	4.50	4.58	4.66	4.74	4.82	4.90	4.98	5.06	5.14	5.54	5.88	6.12	6.32
Rainfed	3.50	3.54	3.58	3.62	3.66	3.70	3.72	3.74	3.76	3.92	4.12	4.32	4.46
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Sulawesi Tenggara													
Irrigated	3.40	3.50	3.60	3.70	3.80	3.90	4.00	4.10	4.20	4.64	5.04	5.38	5.68
Rainfed	2.80	2.84	2.88	2.92	2.96	3.00	3.12	4.20	4.68	3.92	3.52	3.72	3.92
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Maluku													
Irrigated	2.80	2.84	2.88	2.92	2.96	3.00	3.06	3.12	3.18	3.48	3.78	4.08	4.38
Rainfed	2.80	2.82	2.84	2.86	2.88	2.90	2.92	2.94	2.96	3.06	3.22	3.36	3.46
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00
Irian Jaya													
Irrigated	2.80	2.84	2.88	2.92	2.96	3.00	3.06	3.12	3.18	3.48	3.78	4.08	4.38
Rainfed	2.80	2.82	2.84	2.86	2.88	2.90	2.92	2.94	2.96	3.06	3.22	3.36	3.46
Other paddy field	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.90	2.90	3.00	3.00

Source: JICA-FIDP Team estimation.

Table 7.8 Estimated Production of Lowland Paddy by Province up to 2018

Unit: 1,000 ton

	1990	1993	1998	2003	2008	2013	2018
11 D.I.Aceh	1,132	1,212	1,390	1,498	1,581	1,645	1,697
12 Sumatera Utara	2,454	2,614	2,936	3,087	3,202	3,252	3,254
13 Sumatera Barat	1,653	1,741	1,992	2,102	2,175	2,245	2,316
14 Riau	345	361	391	416	436	452	464
15 Jambi	488	502	529	559	578	600	613
16 Sumatera Selatan	1,183	1,225	1,297	1,365	1,410	1,464	1,492
17 Bengkulu	274	293	322	344	362	377	389
18 Lampung	1,109	1,191	1,346	1,376	1,380	1,349	1,292
Sumatera	8,636	9,138	10,203	10,747	11,123	11,385	11,517
31 D.K.I.Jakarta	43	33	26	0	0	0	0
32 Jawa Barat	9,970	10,168	10,308	10,196	9,980	9,569	8,949
33 Jawa Tengah	7,736	8,255	9,398	10,082	10,190	10,178	9,999
34 D.I.Yogyakarta	524	554	577	586	578	547	495
35 Jawa Timur	7,898	8,120	8,774	9,133	8,999	8,756	8,368
Jawa	26,171	27,130	29,085	29,996	29,747	29,051	27,812
51 Bali	894	902	907	889	861	822	768
52 Nusa Tenggara Barat	1,163	1,249	1,397	1,459	1,515	1,571	1,628
53 Nusa Tenggara Timur	210	226	251	269	288	307	325
54 Timor Timur	42	44	53	58	61	66	70
Bali, NT & Timtim	2,310	2,421	2,608	2,674	2,726	2,766	2,791
61 Kalimantan Barat	509	525	558	591	625	661	695
62 Kalimantan Tengah	218	226	239	255	273	295	315
63 Kalimantan Selatan	892	929	1,013	1,064	1,109	1,167	1,202
64 Kalimantan Timur	115	119	124	130	137	144	151
Kalimantan	1,734	1,798	1,933	2,040	2,144	2,267	2,362
71 Sulawesi Utara	341	369	412	443	469	489	505
72 Sulawesi Tengah	386	434	566	663	720	768	811
73 Sulawesi Selatan	3,134	3,314	3,598	3,826	3,985	4,054	4,063
74 Sulawesi Tenggara	147	164	198	214	230	245	259
Sulawesi	4,008	4,281	4,774	5,146	5,403	5,556	5,637
81 Maluku	8	9	14	15	17	18	19
82 Irian Jaya	16	20	27	30	32	35	37
Maluku & Irian Jaya	25	29	41	45	49	52	56
Indonesia	42,884	44,797	48,644	50,648	51,192	51,077	50,174

Source: JICA-FIDP team estimate.

Table 7.9 Estimated Production of Lowland Paddy by Province up to 2018
Alternative Case (1) Low Land Conversion Scenario

	Unit: 1,000 ton						
	1990	1993	1998	2003	2008	2013	2018
11 D.I.Aceh	1,132	1,212	1,390	1,498	1,581	1,645	1,697
12 Sumatera Utara	2,454	2,614	2,939	3,095	3,216	3,274	3,287
13 Sumatera Barat	1,653	1,741	1,992	2,102	2,175	2,245	2,316
14 Riau	345	361	391	416	436	452	464
15 Jambi	488	502	529	559	578	600	613
16 Sumatera Selatan	1,183	1,225	1,297	1,365	1,410	1,464	1,492
17 Bengkulu	274	293	322	344	362	377	389
18 Lampung	1,109	1,194	1,353	1,389	1,401	1,381	1,335
Sumatera	8,636	9,141	10,214	10,769	11,158	11,439	11,592
31 D.K.I.Jakarta	43	34	29	0	0	0	0
32 Jawa Barat	9,970	10,194	10,384	10,327	10,169	9,827	9,278
33 Jawa Tengah	7,736	8,264	9,427	10,132	10,265	10,279	10,126
34 D.I.Yogyakarta	524	555	580	590	584	557	511
35 Jawa Timur	7,898	8,140	8,833	9,235	9,147	8,953	8,611
Jawa	26,171	27,188	29,252	30,283	30,165	29,615	28,526
51 Bali	894	905	915	903	881	849	801
52 Nusa Tenggara Barat	1,163	1,249	1,397	1,459	1,515	1,571	1,628
53 Nusa Tenggara Timur	210	226	251	269	288	307	325
54 Timor Timur	42	44	53	58	61	66	70
Bali, NT & Timtim	2,310	2,424	2,617	2,689	2,746	2,793	2,824
61 Kalimantan Barat	509	525	558	591	625	661	695
62 Kalimantan Tengah	218	226	239	255	273	295	315
63 Kalimantan Selatan	892	929	1,013	1,064	1,109	1,167	1,202
64 Kalimantan Timur	115	119	124	130	137	144	151
Kalimantan	1,734	1,798	1,933	2,040	2,144	2,267	2,362
71 Sulawesi Utara	341	369	412	443	469	489	505
72 Sulawesi Tengah	386	434	566	663	720	768	811
73 Sulawesi Selatan	3,134	3,316	3,602	3,837	4,002	4,082	4,104
74 Sulawesi Tenggara	147	164	198	214	230	245	259
Sulawesi	4,008	4,282	4,778	5,156	5,421	5,584	5,678
81 Maluku	8	9	14	15	17	18	19
82 Irian Jaya	16	20	27	30	32	35	37
Maluku & Irian Jaya	25	29	41	45	49	52	56
Indonesia	42,884	44,862	48,835	50,982	51,683	51,750	51,038

Source: JICA-FIDP team estimate.

Table 7.10 Estimated Production of Lowland Paddy by Province up to 2018
Alternative Case (2) Higher Yield Scenario

	Unit: 1,000 ton						
	1990	1993	1998	2003	2008	2013	2018
11 D.I.Aceh	1,132	1,207	1,376	1,494	1,602	1,712	1,825
12 Sumatera Utara	2,454	2,601	2,905	3,078	3,246	3,391	3,512
13 Sumatera Barat	1,653	1,741	1,995	2,138	2,260	2,387	2,523
14 Riau	345	360	389	416	440	465	489
15 Jambi	488	501	525	558	583	615	641
16 Sumatera Selatan	1,183	1,221	1,289	1,363	1,421	1,501	1,563
17 Bengkulu	274	291	318	342	368	396	425
18 Lampung	1,109	1,185	1,330	1,371	1,401	1,414	1,410
Sumatera	8,636	9,106	10,126	10,760	11,321	11,881	12,386
31 D.K.I.Jakarta	43	33	26	0	0	0	0
32 Jawa Barat	9,970	10,136	10,261	10,241	10,190	10,014	9,735
33 Jawa Tengah	7,736	8,230	9,357	10,125	10,400	10,643	10,866
34 D.I.Yogyakarta	524	552	575	588	592	576	544
35 Jawa Timur	7,898	8,095	8,734	9,173	9,189	9,167	9,112
Jawa	26,171	27,046	28,954	30,126	30,371	30,399	30,257
51 Bali	894	899	902	893	881	865	845
52 Nusa Tenggara Barat	1,163	1,258	1,427	1,512	1,597	1,686	1,778
53 Nusa Tenggara Timur	210	226	253	275	299	324	352
54 Timor Timur	42	44	55	60	64	69	74
Bali, NT & Timtim	2,310	2,428	2,637	2,740	2,840	2,945	3,049
61 Kalimantan Barat	509	528	564	599	637	680	724
62 Kalimantan Tengah	218	227	242	263	283	308	331
63 Kalimantan Selatan	892	932	1,023	1,078	1,127	1,191	1,241
64 Kalimantan Timur	115	119	125	131	139	147	155
Kalimantan	1,734	1,806	1,953	2,070	2,186	2,325	2,450
71 Sulawesi Utara	341	367	409	440	475	512	552
72 Sulawesi Tengah	386	426	546	645	718	799	891
73 Sulawesi Selatan	3,134	3,299	3,576	3,810	4,022	4,215	4,381
74 Sulawesi Tenggara	147	161	192	209	229	254	283
Sulawesi	4,008	4,252	4,723	5,104	5,444	5,781	6,106
81 Maluku	8	10	15	16	17	19	20
82 Irian Jaya	16	20	28	31	34	37	41
Maluku & Irian Jaya	25	29	42	47	51	56	61
Indonesia	42,884	44,667	48,435	50,847	52,213	53,386	54,310

Source: JICA-FIDP team estimate.

Table 7.11 Estimated Production of Lowland Paddy by Province up to 2018
Alternative Case (3) Low Cropping Intensity Scenario

	Unit: 1,000 ton						
	1990	1993	1998	2003	2008	2013	2018
11 D.I.Aceh	1,132	1,212	1,390	1,498	1,581	1,645	1,697
12 Sumatera Utara	2,454	2,614	2,936	3,087	3,202	3,252	3,254
13 Sumatera Barat	1,653	1,724	1,941	2,016	2,053	2,073	2,114
14 Riau	345	361	391	416	436	452	464
15 Jambi	488	502	529	559	578	600	613
16 Sumatera Selatan	1,183	1,225	1,297	1,365	1,410	1,464	1,492
17 Bengkulu	274	293	322	344	362	377	389
18 Lampung	1,109	1,191	1,346	1,376	1,380	1,349	1,292
Sumatera	8,636	9,121	10,152	10,661	11,001	11,213	11,316
31 D.K.I.Jakarta	43	33	26	0	0	0	0
32 Jawa Barat	9,970	10,067	10,053	9,743	9,390	8,865	8,163
33 Jawa Tengah	7,736	8,174	9,161	9,670	9,618	9,451	9,132
34 D.I.Yogyakarta	524	548	561	559	542	503	447
35 Jawa Timur	7,898	8,020	8,551	8,725	8,483	8,088	7,625
Jawa	26,171	26,841	28,352	28,696	28,032	26,906	25,367
51 Bali	894	892	882	845	804	754	692
52 Nusa Tenggara Barat	1,163	1,249	1,397	1,459	1,515	1,571	1,628
53 Nusa Tenggara Timur	210	226	251	269	288	307	325
54 Timor Timur	42	44	53	58	61	66	70
Bali, NT & Timtim	2,310	2,411	2,583	2,630	2,668	2,698	2,714
61 Kalimantan Barat	509	525	558	591	625	661	695
62 Kalimantan Tengah	218	226	239	255	273	295	315
63 Kalimantan Selatan	892	929	1,013	1,064	1,109	1,167	1,202
64 Kalimantan Timur	115	119	124	130	137	144	151
Kalimantan	1,734	1,798	1,933	2,040	2,144	2,267	2,362
71 Sulawesi Utara	341	369	412	443	469	489	505
72 Sulawesi Tengah	386	434	566	663	720	768	811
73 Sulawesi Selatan	3,134	3,283	3,511	3,676	3,789	3,795	3,744
74 Sulawesi Tenggara	147	164	198	214	230	245	259
Sulawesi	4,008	4,250	4,687	4,996	5,207	5,297	5,318
81 Maluku	8	9	14	15	17	18	19
82 Irian Jaya	16	20	27	30	32	35	37
Maluku & Irian Jaya	25	29	41	45	49	52	56
Indonesia	42,884	44,450	47,749	49,069	49,101	48,434	47,132

Source: JICA-FIDP team estimate.

Table 7.12 Estimated Production of Lowland Paddy by Province up to 2018
Alternative Case (4) Low Land Conversion and Higher Yield Scenario

	Unit: 1,000 ton						
	1990	1993	1998	2003	2008	2013	2018
11 D.I.Aceh	1,132	1,207	1,376	1,494	1,602	1,712	1,825
12 Sumatera Utara	2,454	2,601	2,908	3,086	3,260	3,414	3,547
13 Sumatera Barat	1,653	1,741	1,995	2,138	2,260	2,387	2,523
14 Riau	345	360	389	416	440	465	489
15 Jambi	488	501	525	558	583	615	641
16 Sumatera Selatan	1,183	1,221	1,289	1,363	1,421	1,501	1,563
17 Bengkulu	274	291	318	342	368	396	425
18 Lampung	1,109	1,187	1,337	1,385	1,423	1,447	1,455
Sumatera	8,636	9,109	10,137	10,782	11,357	11,937	12,467
31 D.K.I.Jakarta	43	34	29	0	0	0	0
32 Jawa Barat	9,970	10,162	10,337	10,372	10,384	10,285	10,095
33 Jawa Tengah	7,736	8,240	9,386	10,175	10,476	10,748	11,004
34 D.I.Yogyakarta	524	553	577	592	597	586	561
35 Jawa Timur	7,898	8,115	8,792	9,275	9,341	9,373	9,378
Jawa	26,171	27,103	29,120	30,415	30,798	30,991	31,037
51 Bali	894	902	911	908	902	893	881
52 Nusa Tenggara Barat	1,163	1,258	1,427	1,512	1,597	1,686	1,778
53 Nusa Tenggara Timur	210	226	253	275	299	324	352
54 Timor Timur	42	44	55	60	64	69	74
Bali, NT & Timtim	2,310	2,431	2,646	2,755	2,861	2,973	3,085
61 Kalimantan Barat	509	528	564	599	637	680	724
62 Kalimantan Tengah	218	227	242	263	283	308	331
63 Kalimantan Selatan	892	932	1,023	1,078	1,127	1,191	1,241
64 Kalimantan Timur	115	119	125	131	139	147	155
Kalimantan	1,734	1,806	1,953	2,070	2,186	2,325	2,450
71 Sulawesi Utara	341	367	409	440	475	512	552
72 Sulawesi Tengah	386	426	546	645	718	799	891
73 Sulawesi Selatan	3,134	3,300	3,581	3,820	4,040	4,245	4,425
74 Sulawesi Tenggara	147	161	192	209	229	254	283
Sulawesi	4,008	4,254	4,728	5,114	5,462	5,810	6,151
81 Maluku	8	10	15	16	17	19	20
82 Irian Jaya	16	20	28	31	34	37	41
Maluku & Irian Jaya	25	29	42	47	51	56	61
Indonesia	42,884	44,732	48,626	51,182	52,714	54,092	55,251

Source: JICA-FIDP team estimate.

Table 7.13 Trend Growth Projection of Upland Paddy Production

	Unit: 1,000 ton						
	1990	1993	1998	2003	2008	2013	2018
11 D.I.Aceh	16	16	15	15	15	15	15
12 Sumatera Utara	161	158	155	153	151	150	148
13 Sumatera Barat	30	33	38	43	46	50	53
14 Riau	87	91	97	101	105	108	111
15 Jambi	69	80	97	112	126	139	151
16 Sumatera Selatan	185	189	194	198	201	203	206
17 Bengkulu	38	39	39	39	40	40	40
18 Lampung	247	256	267	277	285	291	297
Sumatera	833	862	903	938	969	997	1,022
31 D.K.I.Jakarta	-	-	-	-	-	-	-
32 Jawa Barat	370	404	452	492	527	558	587
33 Jawa Tengah	159	175	197	216	232	247	260
34 D.I.Yogyakarta	98	105	114	121	128	133	138
35 Jawa Timur	233	254	283	308	330	350	367
Jawa	861	938	1,046	1,137	1,217	1,288	1,352
51 Bali	4	4	4	3	3	3	3
52 Nusa Tenggara Barat	29	29	29	30	30	30	30
53 Nusa Tenggara Timur	101	103	105	107	108	109	110
54 Timor Timur	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Bali, NT & Timtim	134	136	138	140	141	142	143
61 Kalimantan Barat	179	184	191	196	201	205	208
62 Kalimantan Tengah	76	79	83	86	89	91	93
63 Kalimantan Selatan	60	63	66	69	71	73	74
64 Kalimantan Timur	98	104	114	122	128	134	139
Kalimantan	413	431	454	473	489	503	516
71 Sulawesi Utara	22	22	22	22	23	23	23
72 Sulawesi Tengah	29	26	24	22	21	19	19
73 Sulawesi Selatan	31	30	28	28	27	26	26
74 Sulawesi Tenggara	27	26	25	24	24	23	23
Sulawesi	108	104	99	96	94	92	90
81 Maluku	9	8	7	6	6	5	5
82 Irian Jaya	3	3	3	4	4	5	5
Maluku & Irian Jaya	11	11	10	10	10	10	10
Indonesia	2,360	2,481	2,651	2,794	2,919	3,031	3,134

Remarks: - : no production; n.a. : data not available.

Source: JICA-FIDP team estimates

Table 7.14 Estimated Production of Paddy by Province up to 2018
Total of Lowland Paddy and Upland Paddy

Unit: 1,000 ton

	1990	1993	1998	2003	2008	2013	2018
11 D.I.Aceh	1,148	1,228	1,406	1,514	1,596	1,660	1,711
12 Sumatera Utara	2,615	2,772	3,091	3,240	3,353	3,402	3,403
13 Sumatera Barat	1,683	1,774	2,030	2,145	2,221	2,295	2,369
14 Riau	432	452	488	518	541	561	576
15 Jambi	557	583	626	671	704	739	764
16 Sumatera Selatan	1,367	1,413	1,491	1,563	1,610	1,667	1,697
17 Bengkulu	312	331	361	383	402	417	430
18 Lampung	1,356	1,447	1,613	1,652	1,664	1,640	1,590
Sumatera	9,469	10,000	11,106	11,685	12,092	12,382	12,539
31 D.K.I.Jakarta	43	33	26	0	0	0	0
32 Jawa Barat	10,340	10,572	10,760	10,688	10,506	10,127	9,536
33 Jawa Tengah	7,896	8,430	9,595	10,297	10,422	10,425	10,259
34 D.I.Yogyakarta	622	659	691	707	706	680	634
35 Jawa Timur	8,131	8,374	9,058	9,441	9,329	9,106	8,736
Jawa	27,032	28,068	30,130	31,133	30,964	30,338	29,164
51 Bali	898	906	911	892	864	825	771
52 Nusa Tenggara Barat	1,192	1,278	1,426	1,488	1,545	1,601	1,658
53 Nusa Tenggara Timur	312	329	356	376	396	416	435
54 Timor Timur	42	44	53	58	61	66	70
Bali, NT & Timtim	2,444	2,557	2,746	2,814	2,866	2,908	2,934
61 Kalimantan Barat	688	709	749	787	826	866	903
62 Kalimantan Tengah	294	305	322	342	362	387	408
63 Kalimantan Selatan	952	992	1,079	1,132	1,180	1,240	1,276
64 Kalimantan Timur	213	223	238	252	265	278	290
Kalimantan	2,147	2,229	2,387	2,513	2,633	2,770	2,878
71 Sulawesi Utara	363	391	434	465	492	512	528
72 Sulawesi Tengah	415	460	590	685	740	787	829
73 Sulawesi Selatan	3,165	3,344	3,626	3,854	4,012	4,080	4,088
74 Sulawesi Tenggara	174	190	223	238	253	268	281
Sulawesi	4,116	4,384	4,873	5,242	5,497	5,647	5,727
81 Maluku	17	17	21	22	22	23	24
82 Irian Jaya	19	23	31	34	37	40	42
Maluku & Irian Jaya	36	40	52	55	59	62	66
Indonesia	45,243	47,278	51,294	53,442	54,111	54,109	53,308

Source: JICA-FIDP team estimate

PART III

***FORMULATION OF IRRIGATION
DEVELOPMENT PROGRAM***

Chapter 8

PART III. FORMULATION OF IRRIGATION DEVELOPMENT PROGRAM

8. IRRIGATION DEVELOPMENT OBJECTIVES AND STRATEGIES

As mentioned in Chapter 2, the Government issued the Outline of the National Policies (GBHN, Garis-garis Besar Haluan Negara) which directs the future development for 25 years in March 1993. The GBHN stresses as a objective of development to enhance the living standard of all the citizens to build a strong foundation for the next development stage, to decrease economical dependency on foreign countries and to achieve self-sufficiency of fundamental needs of life. To achieve the objective, economical development and the enhancement of education standards are sought as strategies.

The role of irrigation as a supportive of agricultural sector is expected to contribute to self-sufficiency of staple food crops and to increase farm income, which are the objectives of agriculture development, through expansion of agricultural land and the increase in the productivity of crops. Irrigation development objectives and strategies are described below in line with national and agricultural development policies.

8.1 Irrigation Development Objectives

(1) Expected future roles of irrigation

The role of irrigation on crop production as a supportive of agriculture sector, is not only to contribute to increased crop production but also to assure stable production through timely supply of water.

The creation of water-assured environment related to stable production should be emphasized as one of the fundamental roles of irrigation, which is a key for farmers to make decision to increase farm input including fertilizer. Without irrigation development efforts, agricultural productivity would have not been increased. In this senesce, efficient and/or reliable water distribution will be the next subject to be considered. While the existing physical structure should be maintained, water management should also be paid attention to increase water use efficiency.

As accomplished in the first long term development stage (PJPT I, 1969 - 1993), irrigation development is expected to play a range of important roles in future development of Indonesia on production increase as well as on stable production.

First in the economic aspect, irrigation development is expected to increase farm income by increasing yield and production, which will give economic impact through creation of work opportunity, activating marketing sector, etc. It is also expected to be a driving force of development in regions where economic development has not been active. Thus, irrigation development is expected to contribute much to poverty alleviation program which is one of the main objectives in Repelita VI as well as PJPT II.

In social terms, assurance of stable crop production as a result of stable water supply create more steady environment of ordinary life, which will lead people to other sectors' activity. Division of work can be enhanced after foods, basic needs, are secured, for which irrigation plays a fundamental role.

(2) Irrigation Development Objectives

Broadly in line with the development goals presented above, and reflecting the expected roles of irrigation, the following three objectives have been set for the long-term development of irrigation sub-sector.

Objective (a): To expand irrigation area to increase crop production, especially paddy, through surface water/groundwater development so as to meet the increasing demand for food as well as to contribute to further development in economically depressed areas.

Although agricultural measures and rehabilitation/special maintenance of existing irrigation systems are expected to increase paddy production significantly, still expansion of irrigation area is a must to meet the increasing demand for rice mainly as a result of population increase. This will include new irrigation development and extension of existing irrigation system.

Irrigation area expansion implies the creation of stable crop production environment, not only for paddy but also for diversified crops as well, which will contribute to increase and stabilize farmers' income. Stabilization of crop production will contribute not only to farmers but also to international rice market.

In economically depressed area like eastern region, agricultural activities will be the driving force to expand economic activities. Irrigation development, particularly, is expected to create new employment opportunity for marketing as well as farming practice itself, given the sufficient rainfall/irrigation water is assured.

Objective (b): To upgrade/rehabilitate existing irrigation network to increase or not to reduce their productivity

Existing irrigation area have been selected generally when land of those areas had been found to be highly productive. Such areas should be maintained as prime agricultural land. However, improper and/or insufficient maintenance of existing irrigation and drainage facilities will result in reduction of productivity and net irrigated area, which lead to the necessity of major rehabilitation in earlier time after construction. Upgrade of such facilities sometimes will be necessary to maximize and/or improve water use efficiency. Those efforts will also contribute to increase or maintain farmers' income as well as increase overall water use efficiency of the river basin.

Existing paddy field in swamp area is of very low productivity reflecting low yield and low cropping intensity. These paddy areas tend to be utilized for subsistence of local people, who live in general below poverty line. Rehabilitation and/or upgrading of existing facilities in swamp area is expected to contribute to the poverty alleviation, one of the important national policy, by increasing production which will result in income increase and enhance the living standard.

Objective (c): To improve water management system involving beneficiary farmers

Excessive consumption of water resulting from improper use of water leads to water crisis. Water demand in several river basins in Indonesia, especially in many river basins in Jawa, has already reached to around the maximum supply capacity due mainly to sharp increase of DMI water demand. The competition of water use has been occurred. Since the government put priority on DMI water use, water for agricultural use may be restricted in water-critical basins in the near future. Efficient use of water, therefore, is required to make water value increase to maximum extent. Although domestic and industrial water use should be of paid attention, enhancing irrigation water use efficiency is not the exception in this regards. Farmers' involvement is a must to do so.

8.2 Basic Irrigation Development Strategies

8.2.1 Alternatives for Irrigation Development Strategy

Two distinct alternatives are conceived, each emphasizing either one of these development directions.

(1) Rehabilitation oriented development strategy

This strategy will propose the more economically efficient development. This includes upgrading, extension and improvement works as well as rehabilitation works. Under this strategy land and water use efficiency of existing irrigation networks will be maximized.

Rehabilitation works are expected to increase production with lower cost relative to new irrigation development. With the introduction of high management system, more intensive farming will be pursued. Farmers' involvement in water management will more be promoted under this strategy.

(2) New construction oriented development

Another distinct strategy may be to expand irrigation area in new areas. Selection of new irrigation area will depend primarily on the availability of land and water resources to agriculture and human resources.

This strategy includes conversion of rainfed-paddy field into irrigated-paddy field as well as clearance of forests and other non-paddy field into irrigated paddy field. Also new swamp development and groundwater development are categorized into this.

Under this strategy more dispersed paddy field area will be formed. Impact on production increase is generally large. Farmers' income will increase with use of high input and improved farming practice.

(3) Implication of alternatives

The rehabilitation oriented development strategy and new irrigation development oriented strategy are not mutually exclusive. They have different implications for the relative emphasis to be placed on each of the three irrigation development objectives discussed above.

Rehabilitation oriented development strategy is expected to contribute to maintain or recover the potential productivity of existing irrigated land. Through upgrading and/or repair works income of existing beneficiary farmers will be maintained or even increased with the introduction of more intensive farming based on higher water use efficiency. It will be more effective to the area where water supply capacity has already been in critical condition.

Since these works need lower costs and shorter time to realize the same benefit relative to new development, quick yield is expected. Also since rehabilitation works are for existing networks, large increase of the number of beneficiaries will not be expected, and impact on social aspects will be smaller than new irrigation development.

New irrigation development, on the other hand, can be formulated anywhere in principle, as far as land and water is available. This type of development is expected to increase production drastically, increase the number of beneficiaries, create new employment opportunities, all of which will be conducive to economic development. The realization of projects normally take longer period from planning to construct facilities. The effect of development, therefore, will appear rather later stage, especially when development is done on newly cleared land, and they need extension of farming technology to beneficiaries.

Groundwater development, however, will be the exception among new irrigation development. Although planning should be made carefully, especially hydro-geologic survey, relatively quick yield is expected after identification of projects.

8.2.2 Basic Elements of Development Strategy

(1) Paddy demand - supply balance and irrigation development potential

Referring to Chapter 4 and Chapter 7, paddy demand and supply balance in each region in 2018 without new irrigation development condition, is estimated as below:

Estimated Supply and Balance of Paddy in 2018 by Region
under without New Irrigation Development Condition

Unit: 1,000 ha

Region	1990			2018		
	Demand	Supply	Balance	Demand	Supply	Balance
Sumatera	10,585	9,414	-1,171	17,397	12,539	-4,858
Jawa	25,814	27,177	1,363	34,054	29,164	-4,890
Bali & Nusa Tenggara	2,611	2,360	-251	3,651	2,934	-717
Kalimantan	2,506	2,163	-343	4,690	2,857	-1,883
Sulawesi	3,444	4,028	584	5,304	5,727	423
Maluku & Irian Jaya*	556	36	-520	1,136	69	-1,067
Indonesia	45,516	45,179	-337	66,232	53,289	-12,943

Remarks: Some deficit in 1990 was compensated by supplying national stock through BULOG.
Source: JICA-FIDP team estimate.

The demand of paddy is anticipated to increase much in Jawa and Sumatera, and the incremental amount of paddy demand from 1990 to 2018 will be 21 million tons. Under without new irrigation development condition, the amount of increased paddy production during the same period is estimated at only 8 million tons. As a result, Indonesia may be back again into paddy deficit country in the near future, as already mentioned in Chapter 7. It is noteworthy that Jawa, where is main paddy supply base at present, will likely to be a paddy deficit area in near future.

Irrigation development potential determined by land and water potential by region is summarized below.

Irrigation Development Potential by Region

Unit: 1,000 ha

Region	1990	2020
Sumatera	4,009	3,972
Jawa	83	62
Bali & NT	98	90
Kalimantan	3,693	3,693
Sulawesi	535	524
Maluku & IJ	2,524	2,524
Indonesia	10,944	10,865

Source: JICA-FIDP team estimate. For details see Table 9.1

Irrigation potential is high in Sumatera, Kalimantan and Maluku and Irian Jaya. While Sumatera, where the demand of paddy is expected to increase much in future, still has high irrigation development potential, Jawa where paddy demand will also increase, has little possibility for further irrigation development.

New paddy production base, therefore, will have to be established in outer Jawa, in light with the high possibility of future deficit of paddy in Jawa. Referring to the irrigation development potential determined by land and water potential, Sumatera, Kalimantan and Irian Jaya will be able to be paddy production centre in Indonesia.

(2) Marketing of paddy among provinces

Table 8.1 shows the flow of rice marketing by sea cargo inside Indonesia in recent three years. Table 8.2 also shows the estimated demand and supply balance of rice based on the SUSENAS 1990, Food Balance Sheet 1990 and Paddy Production data 1990, CBS. Although rice flow does not express inland transportation, dynamics of rice flow among islands can largely be

grasped. At present, there are only two islands exporting paddy to other islands; Jawa and Sulawesi as shown below:

Loading and Unloading of Rice at Ports in Indonesia (1988-1990 average)

Region	Loading	Unloading	Balance
<i>Sumatera</i>	54,871	617,247	-562,376
Jawa	905,719	119,882	785,837
<i>Bali, NT & Timtim</i>	65,901	116,739	-50,838
<i>Kalimantan</i>	5,415	460,664	-455,249
Sulawesi	368,113	95,413	272,200
<i>Maluku & IJ</i>	10,902	93,229	-82,327
Indonesia	1,410,920	1,503,173	-92,253

Source: Consultants calculation based on *Cargo Loading and Unloading at Ports in Indonesia, 1988, 1989, 1990*, CBS. For details refer to Table 8.1

Sumatera and Kalimantan import big amount of paddy every year. Eastern region also imports paddy with less amount. Flow of products among islands are assumed from the statistical data of DOLOG. As seen in Figure 8.1, five provinces of Jawa Barat, Jawa Tengah, Jawa Timur, Nusa Tenggara Barat and Sulawesi Selatan are the exporters of rice to other islands. Especially Jawa Timur and Sulawesi Selatan are the dominant exporters, marketing rice to all over the Indonesia.

8.3 Irrigation Development Strategy

8.3.1 Type of Development

The following three types of development strategy will be applied for future planning to the irrigation sector, considering the characteristics of each region in terms of economy, resources, rice supply and demand balance, etc.

- (1) Large scale irrigation development to contribute to the sustenance of self-sufficiency
- (2) Small and middle scale irrigation development to contribute to the economic development
- (3) Rehabilitation/upgrade of existing irrigation network to contribute to the assurance of high water use efficiency as well as maintenance of crop productivity

(1) Large scale irrigation development to contribute to the sustenance of self-sufficiency

Large deficit of paddy is anticipated in the future including Jawa, currently major surplus region, which suggests the necessity of food supply to this region besides currently deficit regions such as Sumatera and Kalimantan. Taking the anticipated deficit regions into consideration besides land and water potential and human resources, Sumatera region may be put priority. On-going Upper Komering project in Sumatera Selatan and other projects in Lampung (Way Rarem, Way Jebara and Way Sekampong projects) is expected to play a leading role in this regards. Identification studies including feasibility studies should be started as soon as possible since it usually takes more than 10 years to realize ideas into implementation. This type of development, however, needs careful study including environmental impact assessment (AMDAL) prior to implementation as it is likely to bring about drastic change in land use (e.g. clearance of forests) and relocation of local people, which causes adverse effect on environment as well as social life of local people.

Kalimantan Selatan province may have big potential for further rice production increase, which suggests that the province may be able to become an steady rice supply base to eastern region as well as other provinces in Kalimantan island. Riam Kanan project which has recently been partly completed, is expected to be a driving force to jump up the productivity in this region.

(2) Small to medium scale irrigation development to contribute to the economic development

Small to medium scale irrigation development is expected to contribute to more equitable development. Groundwater development will be included in this category. For their scale, it usually takes shorter time to implement, for which quick yield can be expected. Moreover, dispersed development can be expected.

This type of development may be preferable to areas where economic activity is limited and where resources for development is not abundant. The first USAID and OECF co-financed project, Small Scale Irrigation Management Project (SSIMP), being implemented in the eastern islands is expected to contribute much to the economic development of rural areas in the region through groundwater development as well as construction of middle scale irrigation development with dam and reservoir.

Groundwater development in Jawa will also contribute to increase of farmers' income through supplement irrigation water to rainfed field, as farmers in Jawa averagely have only tiny farm in size. World Bank has been assisting such development.