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REPUBLIC OF INDONESIA
MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE

FEASIBILITY STUDY
FOR
LAND DEVELOPMENT PROJECT
IMPROVEMENT OF LAND AND IRRIGATION
SYSTEMS AT FARM LEVEL

VOLUME I
MAIN REPORT

OCTOBER, 1992

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO, JAPAN

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国際協力事業団

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PREFACE

In response to a request from the Government of Indonesia, the Government of Japan decided to conduct the Feasibility Study for Land Development Project -Improvement of Land and Irrigation Systems at Farm Level- and entrusted the study to the Japan International Cooperation Agency (JICA).

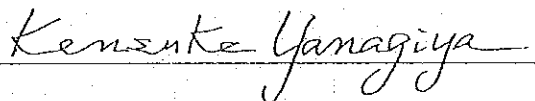
JICA sent to Indonesia a study team headed by Mr. Takeshi NOMOTO, Japan Irrigation and Reclamation Consultants Co., Ltd., five (5) times between March 1991 and August 1992.

The team held discussion with the officials concerned of the Government of Indonesia, and conducted field survey at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relation between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Indonesia for their close cooperation extended to the team.

Tokyo, October 1992

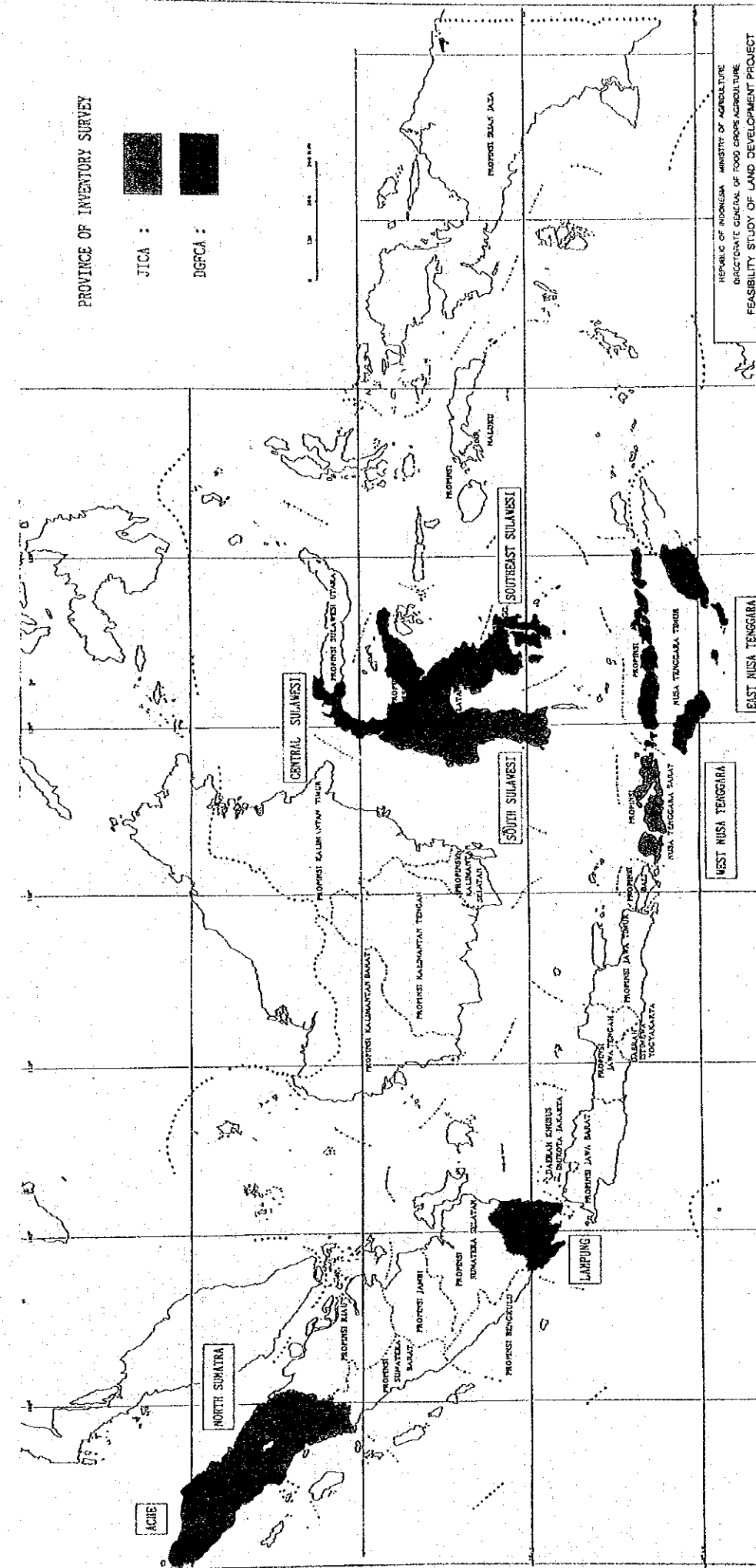


Kensuke Yanagiya

President

Japan International Cooperation Agency

LOCATION OF
THE FEASIBILITY STUDY ON THE LAND DEVELOPMENT
-IMPROVEMENT OF LAND AND IRRIGATION SYSTEM AT FARM LEVEL-



REPUBLIC OF INDONESIA - MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE
FEASIBILITY STUDY OF LAND DEVELOPMENT PROJECT
IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS
AT FARM LEVEL

LOCATION: MAP

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO (JICA)

DWG. NO. 1

GLOSSARY OF TERMS, ABBREVIATION AND SYMBOLS

1. Length

mm : millimeter
 cm : centimeter
 m : meter
 km : kilometer

2. Area

cm² : square centimeter
 m² : square meter
 ha : hectare
 km² : square kilometer

3. Volume

lit. : liter (=1,000 cm³)
 m³ : cubic meter
 m³/sec : cubic meter per second
 MCM : Million cubic meter

4. Weight

mg : milligram
 g : gram
 kg : kilogram
 t : ton (=1,000kg)
 t/ha : ton per hectare

5. Time

s (sec.) : second
 min. : minute
 hr : hour

6. Currency

US\$: US dollar
 Rp : Indonesian Rupiah
 US\$1.00=Rp.2,000
 ¥ : Japanese Yen

7. Other Measures

% : percent
 PS : French horse power
 pH : scale for acidity
 °C : centigrade
 ppm : part per million
 EC : electric conductivity
 CEC : cation exchange capacity

8. Technical Terms

EL : elevation
 M/D : man-day
 M/M : man-months

ADB	Asian Development Bank
AGRARIA	Directorate General of Agrarian Affairs, MHA
APBD	Provincial Government Budget
APBN	Central Government Budget
BAPPEDA	Provincial Development Planning Agency /Badang Perencanaan Pembangunan Daerah
BAPPENAS	National Development Planning Agency
B/C	Benefit Cost Ratio
B-C	Benefit minus Cost
BI	Bank Indonesia
BIMAS	Mass guidance for self sufficiency in food
stuffs/	
BPH	Bimbingan Massal Swa Sembada Bahan Makanan
BPH	Brown Plant Hopper
BPN	National Land Board/ Badang Pertanahan Nasional
BPP	Rural Agricultural Extension Center/ Balai Penyuluh Pertanian
BRI	Indonesian People's Bank/ Bank Rakyat Indonesia
BULOG	National Food Logistics Agency/

GLOSSARY OF TERMS, ABBREVIATION AND SYMBOLS

<p>1. <u>Length</u></p> <p>mm : millimeter cm : centimeter m : meter km : kilometer</p> <p>2. <u>Area</u></p> <p>cm² : square centimeter m² : square meter ha : hectare km² : square kilometer</p> <p>3. <u>Volume</u></p> <p>lit. : liter (=1,000 cm³)</p> <p>m³ : cubic meter m³/sec : cubic meter per second MCM : Million cubic meter</p> <p>4. <u>Weight</u></p> <p>mg : milligram g : gram kg : kilogram t : ton (=1,000kg) t/ha : ton per hectare</p>	<p>5. <u>Time</u></p> <p>s (sec.) : second min. : minute hr : hour</p> <p>6. <u>Currency</u></p> <p>US\$: US dollar Rp : Indonesian Rupiah US\$1.00=Rp.2,000 ¥ : Japanese Yen</p> <p>7. <u>Other Measures</u></p> <p>% : percent PS : French horse power pH : scale for acidity °C : centigrade ppm : part per million EC : electric conduc- tivity CEC : caution exchange capacity</p> <p>8. <u>Technical Terms</u></p> <p>EL : elevation M/D : man-day M/M : man-months</p>
<p>ADB Asian Development Bank AGRARIA Directorate General of Agrarian Affairs, MHA APBD Provincial Government Budget APBN Central Government Budget BAPPEDA Provincial Development Planning Agency /Badang Perencanaan Pembangunan Daerah BAPPENAS National Development Planning Agency B/C Benefit Cost Ratio B-C Benefit minus Cost BI Bank Indonesia BIMAS Mass guidance for self sufficiency in food stuffs/ BPH Bimbingan Massal Swa Sembada Bahan Makanan BPH Brown Plant Hopper BPN National Land Board/ Badang Pertanahan Nasional BPP Rural Agricultural Extension Center/ Balai Penyuluh Pertanian BRI Indonesian People's Bank/ Bank Rakyat Indonesia BULOG National Food Logistics Agency/</p>	

BULOG	National Food Logistics Agency/ Badang Urusan Logistik
BUPATI	District Chief, Head of Kabupaten
BUUD Desa	Village Unit Executive Body/ Bidden Usaha Unit
CAMAT	Sub-district Chief, Head of Kecamatan
CIF	Cost, Insurance and Freight
CRIA	Central Research Institute of Agriculture
DK	Small Village/ Desa Kecil
DESA /KELURAHAN	Administrative Sub-division of a Kecamatan (Sub-district) administered by kepala desa (desa chief) representing Camat
DGFCA	Directorate General of Food Crops Agriculture, MOA
DGWRD	Directorate General of Water Resources Development, Ministry of Public Works
DINAS	Provincial Government Services Agencies
DIP	Project Implementation Budget/ Daftar Isian Proyek
DIPERTA	Provincial Agricultural Service
DLRD	Directorate of Rehabilitation & Land Development, DGFCFA
DOLOG	Branch of BULOG/ Depot Logistik-Food Procurement Agency
DOI-I&II	Directorate of Irrigation I and II, DGWRD
DPU	Ministry of Public Works/ Department Pekerjaan Umum
DPUP	Department Pekerjaan Umum Propinsi
DU	Central Village/ Desa Utama
E&P	Operation and maintenance
EIRR	Economic Internal Rate of Return
EOM	Efficient Operation and Maintenance
FAO	Food and Agriculture Organization of the United Nations
FY	Fiscal Year (April 1 to March 31)
GDP	Gross Domestic Product
GOI	Government of Indonesia
GRDP	Gross Regional Domestic Product
GOLONGAN	Division of an irrigation area in order to phase planting and reduce peak water demand
GOTONG ROYONG	Mutual assistance system
HYV	High Yielding Variety
IBRD	World Bank/ International Bank for Reconstruction & Development
ICB	International Competitive bidding
IFAD	International Fund for Agricultural Development
IGGI	Inter-Governmental Group on Indonesia
INMAS	Mass Intensification/ Intensifikasi Massak
INPRES	Revenue sharing grant programs from GOI to Provincial, district and village authorities
INSUS	Special Intensification/ Intensifikasi Khusus
IPEDA	Land Tax/ Iuran Pembangunan Daerah
ISF	Irrigation Service Fee
ISSP	Irrigation SUB Sector Project (Loan 2880-IND)

JANTOP-AD	Army Topographical Agency
JICA	Japan International Cooperation Agency
KAB./KABUPATEN	Administrative District (headed by Bupati)
KANWIL	Regional office of any Ministry
KEC./KECAMATAN	Sub-District
KELOMPOK	Farmers' group
KONTAK TANI	Key farmer or leading farmer
KIK	Small Investment Credit
KIOSK	Small shop
KK	Households
KMKP	Pre-financing Loan for Working Capital
KUD	Koperasi Unit Desa - Village Unit Co-operative
KUPEDES	General Credit for Rural Area
LAHAN USAHA I	
/LH-I	First Arable Farm Land
LAHAN USAHA II	
/LH-II	Second Arable Farm Land
LAKU	Training and Visit System/ System Kerja Latihan dan Kunjungan
LCB	Local Competitive Bidding
LD	Land Development
LKMD	Social Institution for village Development at village level/ Lembaga Ketahanan Masyarakat Desa
LS	Lump Sum
MHA	Ministry of Home Affairs
MOA	Ministry of Agriculture
NES	Nucleus Estates and Smallholder
O&M	Operation and Maintenance
OECF	Overseas Economic Cooperation Fund (Japan)
P3A	Water User's Association
P3SA	Water Resources Development Planning & Project Division/ Proyek Perencanaan Pengembangan Sumber-sumber Air
PALAWIJA	Secondary food crops planted after harvest of wet season paddy
PEMDA	Local Government
PIADP	Provincial Irrigated Agriculture Development Project
PPL	Agricultural Field Extension Worker/ Penyuluh Pertanian Lapangan
PENGAIRAN	Water resources
PUSDATA	Center for Data processing and Mapping, Ministry of Public Works
PPM	Agricultural Extension Officer/ Penyuluh Pertanian Madya
PPS	Agricultural Extension Specialist/ Penyuluh Pertanian Specialis
PRIS	Provincial Irrigation Service
PUAD	Directorate General of Public Administration and Regional Autonomy, MHA
REPELITA/ PERITA	National Five-Year Development Plan/ Rencana Pembangunan Lima Tahun

	(Repelita V, 1989-94)
R&U	Rehabilitation and Upgrading
SAWAH	Paddy field
SID	Survey, Investigation and Design
SM	Special Maintenance
SPIDP	Second Provincial Irrigation Development Project (Loan 2375-IND)
SRDP	Small Holder Rubber Development Project
SSDP	Second stage Development Program
SUPRA INSUS	Super Intensifikasi Khusus
S/W	Scope of Work
TA	Technical Assistance
TOR	Terms of Reference
TDU	Tertiary Demonstration Unit
TISP	Third Irrigation Sector Project
T.S.P.	Triple Superphosphate
ULU-ULU/	
ULU2	Water distribution master of P3A or Village
UPP	Land Development Field Units/ Unit Pelaksanaan Proyek
VI	Village Irrigation
WFP	World Food Program
WUA	Water User's Association (P3A)

**FEASIBILITY STUDY
FOR
LAND DEVELOPMENT PROJECT
*IMPROVEMENT OF LAND & IRRIGATION SYSTEM AT FARM LEVEL***

VOLUME I MAIN REPORT

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CONCLUSION AND RECOMMENDATION

A. SUMMARY OF CONCLUSION

INTRODUCTION

1. The feasibility study for the Land Development Project-Improvement of Land and Irrigation System at Farm Level has been carried out since March 1991 in accordance with the Scope of Work and the Minutes of Understandings agreed upon in November 1990 between the Government of Indonesia and the Government of Japan. This report presents the development plan formulated on the basis of the field survey and the analysis in Japan for the feasibility study for the Project.
2. The Republic of Indonesia has peculiar circumstances such as centralization of population on Java Island and high population growth ratio reached to about 2.2% as of 1990. To overwhelm these matters, the Government of Indonesia strongly implemented the transmigration projects to the outer islands, and the irrigation and agricultural development projects for large rural population who were mostly engaged and kept their livelihood in agriculture during Repelita I to IV since 1969.
3. Actually, however, the investment for the operation and maintenance of the irrigation systems was comparatively small during the above period. Consequently, many systems are in poor physical conditions. For this, the Government of Indonesia recognizes the importance of O&M to maintain the self-sufficiency of rice and gives priority to the upgrading and rehabilitation, and O&M of existing small and medium-scale irrigation schemes, and further carries on the introduction of irrigation service fee for the cost recovery of O&M costs and the handing-over of the small scale schemes of which each area is less than 150 ha to the farmers' organization after improving the technical level of the scheme by the projects for upgrading and rehabilitation, efficient O&M, special maintenance, etc.
4. About 860,000 ha in the existing irrigation schemes mainly handled by the Directorates except the Directorate of Swamp of DGWRD are estimated as potential areas to be still developed. Out of 860,000, it is said that the farm land of about 300,000 ha remains undeveloped notwithstanding that the main systems for irrigation have been completed. For this, the Directorate of Land Rehabilitation and Development (DLRD), DGFCFA has implemented the land development of 375,000 ha, a target for Repelita V

including the development in swamps and village irrigation schemes. However, the above 300,000 ha includes the schemes which require the construction and/ or rehabilitation of tertiary canal, or the schemes for which the land development is difficult because of the shortage of water, or other various reasons. accordingly, it is necessary to do the detailed field survey on the schemes to check the actual conditions.

5. On the other hand, there are about one million ha of irrigation systems at farmers' level in the country which were constructed and have been maintained by farmers themselves to irrigate their lands. It is also recognized that these village irrigation systems play a significant role in meeting country's food requirements and in supporting lives of the rural population. However, many of such farmers' irrigation systems at farm level are damaged and not functioning well nor maintained well, and need frequent rehabilitation. There are the schemes that the following effects are expected by rehabilitation in such village irrigation schemes.

- 1) Stable paddy cultivation and decrease of damages
- 2) Increase of irrigated area in a scheme
- 3) Increase of irrigated area in dry season
- 4) Early occurrence of benefit
- 5) Cheeper construction cost due to the participation of farmers

Simple irrigation schemes are inferred to have larger effects than technical irrigation schemes due to 1), 2) and 3) in the above.

6. To improve the small scale existing irrigation systems consisting of the schemes with necessity of land development and village irrigation schemes at farm level for which the investment have been smaller up to present are considered to contribute not only to the self-sufficiency of rice, but also to the raise of income and stable livelihood of the farmers and the alleviation of poverty.

CONTENTS AND RESULTS OF THE STUDY

7. The objective of the Study is to formulate the land development project -improvement of land and irrigation systems at farm level- for existing on-farm irrigation areas in three (3) provinces (North Sumatra, South Sulawesi and West Tenggara). In

addition, the technical cooperation about the methodology and the sample check is to be provided on the inventory survey conducted by the Government of Indonesia in five (5) provinces (Ache, Lampung, Central Sulawesi, South East Sulawesi, and East Nusa Tenggara).

8. The Study is largely divided into the Phase I Study during the period from March to December 1991 and the Phase II Study from January to August 1992. The collection of information, inventory survey, selection of representative schemes for the feasibility study, decision on the development basic concepts for the Project, etc. were carried out in the Phase I Study. In the Phase II Study, the feasibility study on the representative schemes, selection of the schemes for the Project, the study on the draft implementation program of the Project and other works were rendered.

9. The Study area consists of the schemes with necessity of land development (LD schemes) in the existing irrigation schemes and the village irrigation schemes (VI schemes) as described in the above. The following tables show the numbers and acreage of the schemes selected in each step for the Study dividing into the initial data collection, inventory survey, feasibility study and selection of the Project schemes.

NUMBERS OF OBJECTIVE SCHEMES

Unit : Number of Scheme

Division	North Sumatra		South Sulawesi		West Nusa Tenggara		Total		
	LD	VI	LD	VI	LD	VI	LD	VI	Total
	Initial List	208	845	40	962	88	328	336	1,835
Inventory Survey	50	308	19	374	45	189	114	871	985
Feasibility Study	32	247	10	349	20	137	62	733	795
Formulation for Project	23	90	5	160	2	60	30	310	340

ACREAGE OF OBJECTIVE SCHEMES

Unit : ha

Division	North Sumatra		South Sulawesi		West Nusa Tenggara		Total		
	LD	VI	LD	VI	LD	VI	LD	VI	Total
Initial List	17,535	121,775	6,484	149,260	16,930	35,499	40,948	306,534	347,482
Inventory Survey	11,438	46,157	4,886	44,079	25,073	19,984	41,397	110,220	151,617
Feasibility Study	6,916	30,500	3,046	41,479	10,568	15,750	20,530	87,729	108,259
Formulation for Project	1,928	7,785	261	14,263	145	6,011	2,334	28,059	30,393

The guidelines for screening and selection of the schemes and the criteria for ranking to decide the priority schemes are studied and applied at each step of the Study. Especially, the detailed study on the representative schemes of 30 places in total, 10 places in average for three provinces was carried out in order to increase the accuracies for the estimation of construction cost and benefits.

As a result of the feasibility study on the objective schemes, the point of each scheme is estimated as follows ;

DISTRIBUTION OF EVALUATION RESULT OF FEASIBILITY STUDY

Unit : Number of Scheme

Division (Point)	North Sumatra		South Sulawesi		West Nusa Tenggara		Total		
	LD	VI	LD	VI	LD	VI	LD	VI	Total
0-30	9	0	5	0	18	0	32	0	32
31-40	0	1	0	4	0	0	0	5	5
41-50	0	3	0	52	0	3	0	58	58
51-60	0	21	1	91	0	29	1	141	142
61-70	1	58	0	69	1	25	2	152	154
71-80	4	93	2	88	0	66	6	247	253
81-90	16	68	2	41	1	14	19	123	142
91-100	2	3	0	4	0	0	2	7	9
Total	32	247	10	349	20	137	62	733	795

The ranking of the schemes of the feasibility study by province is decided as follows and the schemes classified as rank A are proposed for the Project.

RESULT OF RANKING

Unit : Number of Scheme

Division (Point)	North Sumatra		South Sulawesi		West Nusa Tenggara		Total		
	LD	VI	LD	VI	LD	VI	LD	VI	Total
A	23	90	5	160	2	60	30	310	340
B	0	118	0	151	0	44	0	313	313
C	9	39	5	38	18	33	32	110	142
Total	32	247	10	349	20	137	62	733	795

THE PROJECT

10. The objective schemes, 340 schemes of 30,400 ha in total for the Project consists of 30 schemes of 2,300 ha from the schemes with necessity of land development (LD schemes) in the existing irrigation schemes and 310 schemes of 28,100 ha from the village irrigation schemes (VI schemes).

11. It is recommendable to formulate the Project as a integrated land development project including land development schemes and village irrigation schemes. The project aims at accelerating land development at farm level in Indonesia. The project will precursoryly cover eight provinces grouped into two, namely, North Sumatra(Sumut), South Sulawesi(Sulsel) and West Nusa Tenggara(NTB) in the first and Ache, Lampung, Central Sulawesi, South East Sulawesi and East Nusa Tenggara in the second.

12. Main objectives of the Project are as follows ;

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

The Project attempts to support the Government's current development strategy in the agriculture sector that focuses on stabilizing self sufficiency in food crops, creating rural employment opportunities and promoting balanced regional development.

13. The scope of the Project will consist of the following items.

- 1) To fully develop the existing irrigation, drainage and other infrastructure facilities at farm level to complete the land development work in existing irrigation schemes.
- 2) To thoroughly develop potential irrigation areas by upgrading and expanding existing irrigation, drainage and other infrastructure facilities in village irrigation areas
- 3) To strengthen the institutional capabilities of relevant agencies for management and coordination of the development. The agencies include those at provincial, district and sub-district levels, Water Users' Associations(P3A) and Rural Extension Centers(BPP).

14. The Project consists of four major components, i.e., land development, village irrigation development, institutional strengthening and strengthening of coordination and monitoring. These components are explained in detail as follows. The former two are concerned with development of physical infrastructures while the latter two focus on the managerial aspect of the Project.

(1) Land Development

This component of the Project intends to expand farm land by completing the land development works, including replotting and farm road to support intensification program, left undone in existing irrigation schemes managed by DGWRD. Rehabilitation and improvement of existing facilities in tertiary systems related to these land development works are also included. Prior to the commencement of the Project works, surveys, mapping, planning and detailed designs should be carried out for a smooth implementation of land development and tertiary development works.

(2) Village Irrigation Development

This component intends to increase crop intensity with possible expansion of irrigated agricultural land. Existing facilities in the village irrigation schemes are to be rehabilitated and/or upgraded. The scope will include surveys, mapping, planning and detailed designs, if necessary, followed

by implementation of civil works for land development and facility rehabilitation/upgrading.

(3) Institutional Strengthening

The component for institutional strengthening will include:

- 1) To provide additional staff(s), when required, to BPP or other offices in the project schemes;
- 2) To train staffs of agricultural services at provincial, district and sub-district levels for the purpose of effective management of the Project;
- 3) To train provincial, district and rural extension staffs, as well as key farmers in the project schemes in water management and farm technologies for improved rice, secondary crops and/or tree crops.
- 4) To provide facilities and equipment for training, upon necessity.
- 5) To support establishment and/or strengthening of P3As and other farmer's groups for production in organizing arrangement and leveling up agricultural technique.
- 6) To train irrigators in the groups in O&M of tertiary and on-farm irrigation and drainage systems.

(4) Strengthening of Coordination and Monitoring

Coordination and monitoring of project implementation at the provincial and district levels, and at the Government and farm levels are planned to be made by BAPPEDA I(province) and BAPPEDA II(district). The Project will support these activities through arranging/offering office space, equipment and transportation facilities.

15. As a rule, the Ministry of Public Works (DPU) is responsible for the implementation of irrigation projects. However, the responsibility of DPU is generally limited up to the tertiary box equipped usually at the end of secondary canal. On-farm development within tertiary irrigation block such as construction of tertiary canal and its downstream canals, land clearing and leveling, construction of on-farm facilities, etc. are left to the farmers' hands. The rehabilitation of a small number of village irrigation schemes has been implemented by the Ministry of Agriculture, or the provincial Governments with the condition of the participation of farmers, but the implementation of the rehabilitation is apt to be delayed in its commencements because of the lack of fund and insufficient technique.

Consequently, it is desirable that the rehabilitation of canal systems at tertiary level in the land development schemes could be supported by DPU. On the other hand, the land clearing and leveling has been done by the budget of the Ministry of Agriculture.

As for the rehabilitation of village irrigation schemes, it is also recommendable that the works for the water source facilities and related structures are left to DPU and Provincial Irrigation Services (PRISs) and the works such as land clearing and leveling, and upgrading of on-farm facilities to the Ministry of Agriculture and Provincial Agricultural Services (PRASs), while the paddy field formation is to be done by farmers themselves.

16. The principal executing agency responsible for the Project implementation is the Directorate General of Food Crops Agriculture (DGFC) under the Ministry of Agriculture. Other executing agency is the Directorate General of Water Resources Development (DGWRD) under DPU, and it is recommendable that the coordination agency is BAPPENAS at national level. At provincial level, the executing agency consists of PRAS and PRIS and it is natural that the coordination agency is BAPPEDA.

17. The role of the central-level Government agencies will be mainly limited to planning, coordination and supervision of their respective components, technical guidance, selection and engagement of the consulting services in case with foreign consultants, and monitoring of loan disbursement, and liaison with a loan agency and other Government agencies at the national level.

Each project management unit at provincial level will serve as an operational unit for selection of subprojects, procurement of equipment and materials, loan disbursement, programming, managing, monitoring and coordinating of the various activities and for supervising the activities of the consultants.

It is necessary to coordinate the bidding works between the project management units in PRAS and PRIS because the survey and investigation, planning and design, and construction are desirable to be carried out by the same consultant or contractor for the same scheme.

18. The disbursement period of the loan for the Project is taken as seven (7) years after the end of 1994 taking into

considerations the periods for selection of consultants and preparation, the periods of about four(4) and half years for design and construction, and the periods for post evaluation and other works.

19. The Project cost for the first three provinces is estimated as follows ;

ESTIMATED PROJECT COST

Unit : Million Rp.

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

(Thousand US\$) 16,435 23,389 39,824
 Remarks ; 1 US\$ = Rp. 2,000 = YEN 129.0
 Price Index (Year 1992 = 100)

In the above, the cost covered by the participation of farmers is estimated at 14 % of the costs for civil works.

20. Evaluation of the entire project package is made dealing the 340 schemes recommended to be implemented as one project. The project is expected to generate economic internal rates of return (EIRRs) of 12.0%, 17.2% and 16.5% for the land development scheme, the village irrigation scheme and overall project, respectively. At a 10 percent opportunity cost of capital, the project yields net present values (NPVs) of Rp. 1.0 billion from the land development scheme and Rp. 23.6 billion from the village irrigation scheme. B/Cs at the same discount rate are estimated respectively at 1.16 and 1.62 and for overall project at 1.55. All the EIRRs pass the test of the 10 percent cost of capital figure that is commonly applied in evaluating projects. Sensitivity of project profitability is analyzed for the cases of cost increase and benefit decrease. 10 percent and 20 percent

changes are assumed and the EIRRs are calculated as follows:

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

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

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

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

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

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

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

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

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

B. RECOMMENDATION

1. The project aims at accelerating the development of paddy field and improving irrigation system at small scale existing irrigation schemes with smaller investment up to present consisting of the schemes with necessity of land development and village irrigation schemes. To rehabilitate and upgrade the existing simple systems and to accelerate the development of introduction paddy fields at small scale irrigation schemes bear earlier occurrence of benefit and cheaper construction cost due to the participation of farmers than at large scale irrigation schemes, and bring farmers stable paddy cultivation and decrease of damages. In addition, the Project will contribute not only to the self-sufficiency of rice, but also to the raise of income and stable livelihood of farmers and the alleviation of poverty. Thus, the early implementation of the Project have been expected.

2. It is expected that the Project is implemented in three provinces where the feasibility study has been carried out, namely, North Sumatra, South Sulawesi and West Nusa Tenggara in the first stage and in five provinces where the inventory survey was carried out by the Indonesian side, that is, Aceh, Lampung, Central Sulawesi, South East Sulawesi and East Nusa Tenggara in the second stage. Actually, however, it is desirable to do the additional inventory survey and the evaluation of the schemes already surveyed in the future in the later five provinces.

3. It is expected to examine the proper organization, recruiting of staff and budgetary arrangement for the preparation and implementation of the Project. Especially, it will be recommendable to establish a coordinating unit to play a role of a steering committee in the central Government because the cooperation between DGFCFA and DGWRD is indispensable.

4. It is a prerequisite for farmers to bear a part of construction cost for the Project because the Project mainly aims at the development of paddy fields at the tertiary blocks in the existing irrigation schemes and the rehabilitation of village irrigation schemes operated and maintained by farmers. Accordingly, it is recommendable to examine the scope, contents, etc. of farmers' participation and burden.

I. GENERAL

1.1 Background and Objective of the Study

This report is arranged for the results of the Feasibility Study for the Land Development Project - Improvement of Land Irrigation Systems at Farm Level - , which has been carried out since March 1991 in accordance with the Scope of Work and the Minutes of Understandings in November 1990 agreed between the Directorate General of Food Crops Agriculture (DGFA), the Government of the Republic of Indonesia and the Japan International Cooperation Agency (JICA) of the Government of Japan.

1.1.1 Background

Irrigation projects for paddy cultivation in Indonesia are largely divided into the followings.

- Projects under the Directorate of Irrigation, Directorate General of Water Resources Development (DGWRD), Ministry of Public Works
 - * Technical irrigation project
 - * Semi-Technical irrigation project
 - * Simple irrigation projects
- Projects under the Directorate of Swamp, DGWRD
 - * Tidal irrigation project
 - * Non-Tidal irrigation project
- Village irrigation projects operated and maintained by farmers
- Others

According to the data of the Directorate of Irrigation I, DGWRD, in April 1989, the land of about 300,000 ha out of the potential irrigation area of about 4,420,000 ha under the Directorate of Irrigation in the whole Indonesia has been left undeveloped as shown in the breakdown by province in Table 2-3-1. For this, the Government of Indonesia has aimed to develop the land of 375,000 ha in the Fifth Five Year Development Plan as shown in Table 2-3-3.

On the other hand, it is said that there are about one million ha of irrigation systems at farmers' level in the country ,which are constructed and maintained by farmers themselves to irrigate their lands. It is also recognized that these village

irrigation systems play a significant role in meeting country's food requirements and in supporting lives of the rural population.

However, many of such farmers' irrigation systems at farm level are damaged and not functioning well nor maintained well. It is pressing requirement to improve irrigation systems at farm level in order to increase agricultural production, expand employment opportunity, raise farmers' income, and improve welfare of the rural population.

The Government of Indonesia continues its efforts to further strengthen stable supply of staple foods for the fast-growing population, provide rural employment, achieve balanced regional development and thus bring country's dispersed and predominantly rural population into the mainstream of development.

In this context, there is increasing awareness that the most efficient approaches to increase food crops production, among others, are

- i) to fully utilize economic gains from already completed and operational irrigation systems and
- ii) to rehabilitate and construct damaged portions of the farmers' irrigation system at farm level.

1.1.2 Objective and Content of the Study

The objectives of the Study are as follows:

- To carry out an Inventory Survey for the analysis of actual situation and problems of on-farm irrigation areas consisting of those area left undeveloped in the existing irrigation schemes an existing village irrigation areas which are located in three provinces mentioned below, and then to make appropriate recommendation for the improvement and rehabilitation of these on-farm irrigation areas.
- To carry out a feasibility study on selected on-farm irrigation areas.
- To carry out the technical cooperation for advising/teaching the methodology of inventory survey at the seminars opened by the Government of Indonesia and to conduct a couple of sample check for the inventory survey done by the Government of Indonesia.
- To carry out technology transfer to the Indonesian counterpart personnel in the course of the Study.

The Study covers existing on-farm irrigation areas in three (3) provinces (North Sumatra, South Sulawesi and West Tenggara) among twenty-seven (27). In addition, the technical cooperation described in the above is provided on the inventory survey conducted by the Government of Indonesia in five (5) provinces (Ache, Lampung, Central Sulawesi, South East Sulawesi, and East Nusa Tenggara).

1.2 Activity of the Study Team

1.2.1 General

The Study was commenced in February 1991 dividing into Phase I Study and Phase II Study. The Phase I Study was carried out during the period from March 1, 1991 to December 30, 1991 dividing into the Field Work (I), (II) and (III) and Home Office Work.

The Phase I Study was carried out about the collection of information, field survey, control of entrusted works (inventory survey), estimation of potential development and evaluation of study area, and decision on the development basic concepts for the land development schemes and village irrigation schemes in three (3) provinces of North Sumatra, South Sulawesi and West Nusa Tenggara.

The Phase II Study was commenced in January 1992. The detailed work items are ; detailed field work of thirty (30) representative schemes, control of entrusted works (topo-survey, soil and land use survey), collection of supplemental data, and decision on the development plan in the Home Office.

The work schedule and the general work flow are shown in Fig. 1-2-1 and Fig.1-2-2 respectively.

Reports which have been submitted and date to be submitted to the Directorate General of Food Crops Agriculture (DGFA), the Government of the Republic of Indonesia are as follows:

Inception Report	:	March 4, 1991
Progress Report (I)	:	October 22, 1991
Interim Report	:	January 13, 1992
Progress Report (II)	:	March 23, 1992
Draft Final Report	:	August 4, 1992

WORK SCHEDULE

Fig. 1-2-1

WORK ITEM	1991												1992											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
(Overall schedule)																								
Phase I Field Work (I)																								
Phase I Field Work (II)																								
Phase I Field Work (III)																								
Phase I Home Office Work																								
Phase II Field Work																								
Phase II Home Office Work																								
Explanation Draft Final Report																								
Preparation of Final Report																								
(Reports)																								
Inception Report																								
Progress Report (I)																								
Interim Report																								
Progress Report (II)																								
Draft Final Report																								
Final Report																								

Remarks : Field Work Home Office Work Explanation of Report Other Works

Fig. 1. 2. 2

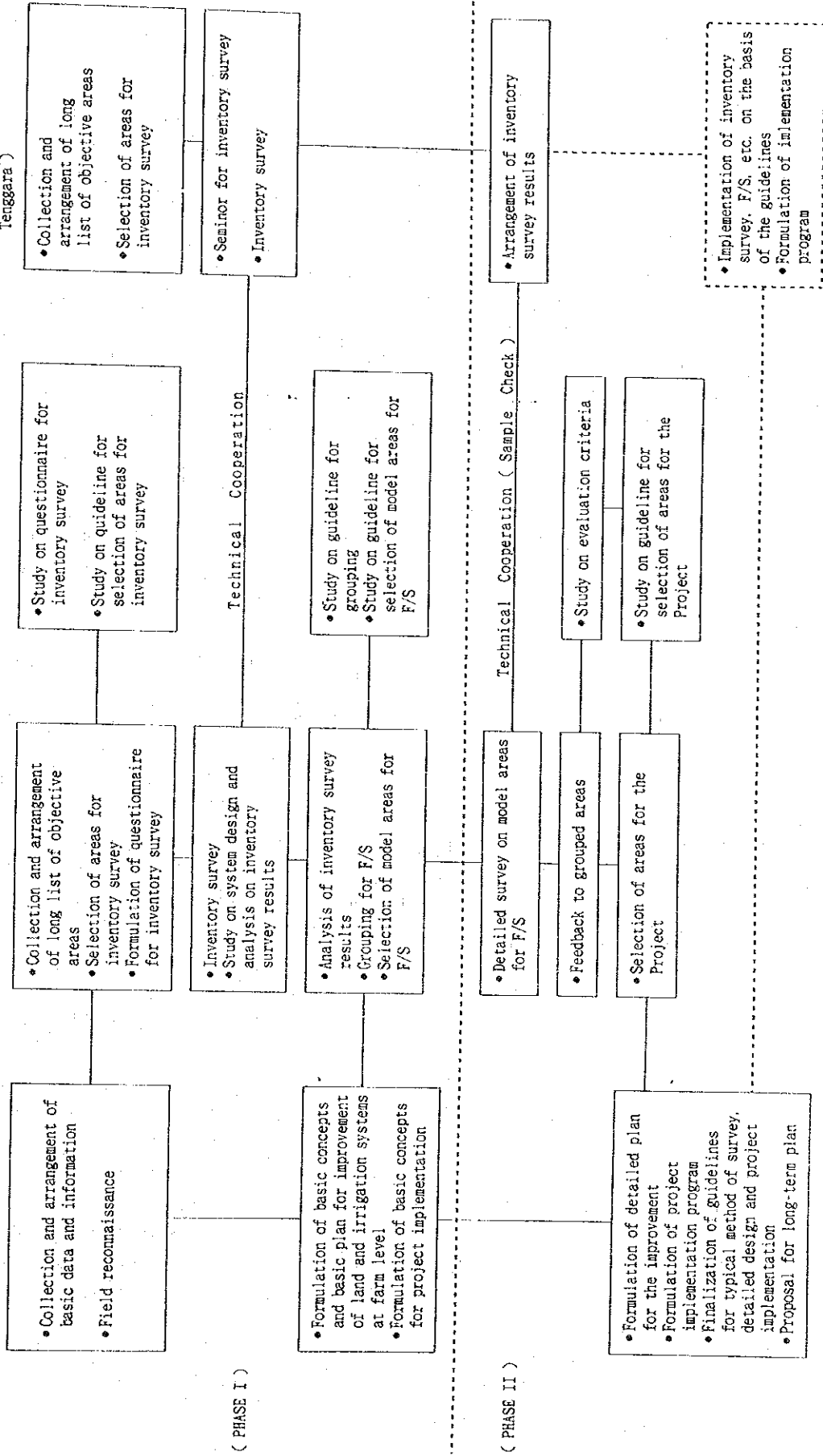
GENERAL WORK FLOW
IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS AT FARM LEVEL

FEASIBILITY STUDY
BY JICA

(North Sumatra,
South Sulawesi and
West Nusa Tenggara)

SURVEY BY INDONESIAN
SIDE

(Aceh, Lampung, Central
Sulawesi, South - East
Sulawesi, and East Nusa
Tenggara)



1.2.2 Phase I Field Work

(1) Field Work (I)

The Phase I Field Work (I) was carried out during the period from March 1 to March 26, 1991. The major work items are as follows:

- i) Explanation of and discussion on the Inception Report
- ii) Collection and arrangement of data and information
- iii) Field reconnaissance
- iv) Formulation of questionnaire for inventory survey
- v) Selection of areas for inventory survey
- vi) Preparation of field report I

(2) Field Work (II)

The Phase I Field Work (II) was conducted during the period from April 25 to August 7, 1991. The major work items are as follows:

- i) Contract and control of the inventory survey entrusted to Indonesian firms
- ii) Technical cooperation for the inventory survey by Indonesian side
- iii) Arrangement, system design and analysis of the data of the inventory survey
- iv) Preparation of field report II

(3) Field Work (III)

The Phase I Field Work (III) was carried out during the period from September 2 to October 30, 1991. The major work items are as follows:

- i) Collection of supplemental data
- ii) Field checking survey (checking of the inventory survey)
- iii) Study on the basic concepts for improvement of land and irrigation systems at farm level
- iv) Study on selection criteria of model areas for the feasibility study
- v) Preparation of the Progress Report (I)

1.2.3 Phase I Home Work

The Phase I Home Work was carried out during the period from November 1 to December 31, 1991. The major work items are as follows:

- (1) Arrangement and analysis of the results of the inventory survey
- (2) Selection and grouping of the objective areas for the feasibility study
- (3) Selection of the model area
- (4) Formulation of basic concepts for improvement of land and irrigation systems at farm level
- (5) Preparation of Interim Report

1.2.4 Phase II Field Work

The Phase II Field Work was carried out during period from January 12 to March 26, 1992. The major work items are as follows:

- (1) Topographical survey, soil test and contract and control of land use survey
- (2) Detailed survey of thirty (30) model areas
- (3) Field checking survey (checking of the inventory survey by Indonesian side)
- (4) Formulation of basic concepts for work plan
- (5) Formulation of guideline for priority
- (6) Preparation of Progress Report (II)

1.2.5 Phase II Home Work

The Phase II Home Work is carried out during the period from May 21 to October 30, 1992. The major work items are as follows:

- (1) Arrangement and analysis of the results of Field Work
- (2) Formulation of development plan on the improvement of land and irrigation systems for thirty (30) representative schemes
- (3) Formulation of project implementation
 - a. Selection of project schemes
 - b. Estimation of project cost and benefit
 - c. Project evaluation
 - d. Recommendation for the Project implementation
- (4) Preparation of Draft Final Report
- (5) Preparation of Final Report

II. BACKGROUND OF THE PROJECT

2.1 National Economy

The Republic of Indonesia has a total land area of about 1.92 million sq.km. The total population as of 1990 is about 179 million and population density is about 93 persons per sq.km. The annual population growth rate is 1.97 % on average during 1980 to 1990. Regionally, about 60 % of nation concentrates on Java island, which has an acreage of only 7 % of the national land. The total labor force as of 1989 is 73.9 million, and agriculture sector absorbed 41.1 million or 55.6 % of total labor force.

Gross Domestic Products (GDP) in Indonesia is about Rp. 166 trillion and GDP per capita is about Rp. 939,000 in 1989. Agriculture is most important sector, sharing about 23.5 % of GDP. Food crops sub-sector shares about 14.5 % of GDP or 62.0 % of agricultural sector. Agriculture has also become increasingly important in bolstering the development of other sectors of Indonesia's economy, particularly in providing raw materials to the country's rapidly expanding manufacturing sector.

As for foreign trade, Indonesia has been export surplus due to petroleum and gas production. The total amounts of export and import as of 1990 are estimated to be US\$ 25.8 billion and US\$ 20.1 billion, respectively. Agricultural sector accounted for about 30 % of all non-oil exports or 15 % of total exports.

The imbalance of income distribution is decreasing but still remains especially in urban area. Gini's coefficient for rural area as of 1987 is 0.26, on the other hand, Gini's coefficient for urban area is as high as 0.32. As for average per capita monthly expenditure, there is a large difference between Rp. 33,000 in urban area and Rp. 18,000 in rural area in 1987.

The Government of Indonesia has set Fifth Five-Year Development Plan (Repelita V) during 1989/90 to 1993/94. The Government plans economic growth rate of 5 % during the period. The growth target of manufacturing sector is the highest as 8.5 % per annum. For agricultural sector, growth rate in the Plan is set as 3.6 %, which is relatively low among the sectors. However, agricultural sector is still expected to be the largest sector having GDP share of 21.6 % in the last year of the on-going Plan.

Table 2-1-1 BASIC FIGURES FOR REPELITA V

(1) Population Projection	
-Increase rate	: 1.9% per annum on an average
-Population in 1993	: 192.9 million
-Increase of population	: 17.3 million in five (5) years
	: 3.5 million annually
-Work force	: 86.4 million
-Increase of work force	: 11.9 million in five (5) years
	: 2.4 million annually
(2) Target of Economic Growth Rate	
-Overall target	: 5 % on an annual average
-Sectoral target	
Agriculture	: 3.6%(including 3.2 % of rice production increase)
Industry	: 8.5%
Trade/transport	: 6 %
Construction	: 6 %
Communication	: 6.4%
Other Sectors	: 6.1%
(3) Share of Sectors in the national Production	
-Industrial Sector	: from 14.4 %(1988) to 16.1%(1993)
-Agricultural Sector	: from 23.2 %(1988) to 21.6%(1993)
-Oil/gas Sector	: from 19.6 %(1988) to 16.3%(1993)

2.2 Agricultural Sector

Agriculture has long served as the backbone of the Indonesian economy. Closely integrated with the wider objectives of national development, Indonesia's agricultural sector serves a strategic, multipurpose role as a provider of food and employment, a supplier of raw materials to other sectors of the economy, and as an important source of foreign trade.

As the main provider of food for the nation, Indonesia's agricultural sector has achieved significant growth in production to meet the growing domestic demand resulting from an expanding population and rising per capita consumption. Between 1968 and 1989, production of paddy increased by over 160 %, from about 17.2 million tons to some 44.7 million tons. Over the same period, production of corn increased by nearly 96 %, and soybean by over 200 %. Although the development of other sectors of the

economy has led to substantial new job opportunities in industry and commerce, agriculture is still the main provider of employment opportunity in Indonesia.

Owing to agriculture's pivotal role in the economy, the Government has placed high priority on the development of this sector in the series of Five Year Development Plans (Repelitas), launched in 1969. In the three Plans spanning the period from 1969/74 to 1979/84, agriculture received 21.7 %, 19.1 % and 17.1 %, respectively, of total Government development expenditures. The sector's share was 21.9 % in the period of the Fourth Five-Year Plan (1984/85 to 1988/89) and continues at a high level in the current Fifth Five-Year Plan from 1989/90 to 1993/94.

Agricultural activities accounts for a further 500 million ha, or 25 % of total land area. The arable land currently amounts to some 14 million ha, of which 8 million constitute wetland suitable for rice production. Of total arable land, 6 million ha are located on Java, the most fertile island.

While an equatorial location and tropical climate are common to the whole country, variations in soil type, fertility and rainfall have resulted in significant differences in agricultural production in the major farming areas. The fertile volcanic soils of the inner islands of Java and Bali have most naturally lent themselves to intensive cultivation, especially of rice and other food crops. In the outer islands, lesser soil fertility has led largely to extensive cultivation of perennial shrub and tree crop produced primarily for export.

For many years following national independence in 1945, rice production lagged considerably behind expanding domestic demand. In the 1970s and 1980s, Indonesia ranked among the world's largest purchasers of rice, with imports peaking at 2 million tons in 1980. Just 4 years later, in 1984, self-sufficiency in rice was attained with long term and great efforts for expansion of rice production. Continuous growth in rice production has enabled Indonesia to sustain self-sufficiency in subsequent years.

The basic strategy for reaching rice self-sufficiency concentrated on:

- Intensification - aimed at increasing rice yields through the introduction of advanced production technologies, including the application of new seed varieties,

fertilizers, pesticides and irrigation; and

- Extension - aimed at increasing the area of rice production and quantity of rice harvested through the use of rainfed fields and the conversion of swamps and flood land into fertile fields.

Within the strategic framework, Government policy for increasing rice production focused on four main areas:

- Research and development of modern technologies;
- Motivation, organization and training of farmers to participate in the program;
- Incentives to use farm inputs; and
- Establishment of a "floor" price for rice.

2.3 Irrigation Sub-Sector

As for the irrigation development in the agricultural sector, it is said that during Repelitas I and II, emphasis in the irrigation subsector was on the rehabilitation of old irrigation systems to achieve benefits quickly and at low cost, and during Repelita III, greater emphasis was placed on the development of new irrigation facilities and the construction of tertiary facilities for efficient on-farm management, and while maintaining its priority for irrigation, plans for Repelita IV included a shift in emphasis away from large-scale irrigation works to the development and rehabilitation of small and medium-scale projects.

The Government's massive investment in the rehabilitation and expansion of irrigation infrastructure over the last two decades has made a major contribution to bringing the country to the threshold of self-sufficiency in rice. However, this successful intervention was not accompanied by a countrywide effort to operate and efficiently maintain the irrigation systems. Consequently, many systems are in poor physical condition. Recognition of the importance of operation and maintenance (O&M), together with the achievement of near self-sufficiency in rice has led to a significant reorientation of the Government's priority away from construction of large-scale irrigation schemes and toward rehabilitating of existing irrigation schemes and constructing of small and medium-scale schemes, and involving farmers in the management and financing

of irrigation systems through O&M cost recovery, transfer of irrigation schemes, etc.

The Land Development Project to convert unirrigated land to irrigated paddy field which was initiated in 1997/80 under the Directorate of Land Rehabilitation and Development (DLRD), the Directorate General of Food Crops Agriculture (DGFA), Ministry of Agriculture was a support to farmers through the credit from the Bank Rakyat Indonesia. However, to the target of 700,000 ha for Repelitas III and IV, only about 350,000 ha consisting of 110,000 ha by the Prefinancing Credit and 240,000 ha by farmers themselves were completed. Based on the above experiences, a new policy to reach the Repelita V land development target, 375,000 ha was issued in August 1989. The new policy comprises "Assisted Self-help Development System" and "Private Credit Land Development System" In the assisted self-help development system, part of the land development is a contribution by the Government. It includes site selection (investigation), survey and design, farmers registration, land clearing, land levelling and supervision. The field dikes and field canals are constructed by the farmers themselves.

According to the data in April 1989 of the Directorate of Irrigation I, DGWRD, Ministry of Public Works, about 860,000 ha are estimated as potential areas to be still developed by irrigation out of about 4,820,000 ha of the designed irrigation area handled by the Directorates except the Directorate of Swamp of DGWRD, and out of the above 860,000 ha, it is said that the farm land of about 300,000 ha remains undeveloped notwithstanding that the main systems for irrigation have been completed. Tables 2-3-1 and 2-3-2 show the breakdown of designed areas of irrigation schemes under PU by province and the breakdown of undeveloped area classified technically in existing irrigation schemes under PU by province respectively. To solve this matter, the land development of 375,000 ha including the development in swamps and village irrigation schemes has been a target for Repelita V as shown in Table 2-3-3. The progress as of May 1992 is that the completed works through the budget from the central Government including the sector program loan from the OECF for land clearing and levelling are 218,175 ha and out of these, the completed works of paddy field formation consisting of the works for dikes, canals, roads, etc. in field to be principally constructed by farmers are 169,714 ha for which the budget from the Government has been used for 107,663 ha and the remaining, 62,051 ha has been constructed by farmers as shown in Tables 2-3-4 and 2-3-5.

One of the problems is that there are considerably large areas already converted to the land for cash crop cultivation, or difficult to be developed due to insufficient water, or other reasons in the area of about 300,000 ha that has not yet been converted to paddy land, but with the main and secondary irrigation canals already in place. In the provinces of West Nusa Tenggara and South Selawesi out of three provinces which have been surveyed by the JICA study in this time, at least 30 % of the area for the land development will be excluded from the project. It simply suggests that it is necessary to do detailed investigations even on the potential area of about 860,000 ha to be developed.

On the other hand, there are about one million ha of irrigation systems at farmers' level in the country as shown in Table 2-3-6 which are constructed and maintained by farmers themselves to irrigate their lands. It is also recognized that these village irrigation systems play a significant role in meeting country's food requirements and in supporting lives of the rural population (Refer to Table 2-3-7).

However, many of such farmers' irrigation systems at farm level are damaged and not functioning well nor maintained well. It is pressing requirement to improve irrigation systems at farm level in order to increase agricultural production, expand employment opportunity, raise farmers' income, and improve welfare of the rural population.

At present, the rehabilitation of existing village irrigation schemes has been mainly implemented through the budget of DGFCFA, Ministry of Agriculture (APBN) and the budget of the provincial Government (APBD). Tables 2-3-8 and 2-3-9 show the progress of the rehabilitation program of village irrigation schemes carried out by DGFCFA during two years from 1989/90 to 1990/91.

The Government of Indonesia continues its efforts to further strengthen stable supply of stable foods for the fast-growing population, provide rural employment, achieve balanced regional development and thus bring country's dispersed and predominantly rural population into the mainstream of development.

In this context, there is increasing awareness that the most efficient approaches to increase food crops production, among others, are

- (i) to fully utilize economic gains from already completed

and operational irrigation systems and
(ii) to rehabilitate and construct damaged portions of the farmers' irrigation systems at farm level.

In general, simple irrigation schemes are inferred to have larger effects than technical irrigation schemes due to 1), 2) and 3) below.

- 1) Stable paddy cultivation and decrease of damages
- 2) Increase of irrigated area in a scheme
- 3) Increase of irrigated area in dry season

The above matter may be driven by the following table.

IRRIGATION RATIO BY TECHNICAL LEVEL IN 1989

Technical Level	Designed Area (ha)	Irrigated Area (ha)	Ratio (%)
Technical	2,701,765	2,398,464	89
Semi-Technical	1,271,472	918,490	72
Simple	846,548	556,219	66
Total	4,819,785	3,873,173	80

Source : EXKAPITULASI DAERAH IRIGASI PU, APRIL 1989

In addition, the small irrigation schemes can bring farmers early occurrence of benefit, and its rehabilitation cost for civil works is generally cheaper and that for village irrigation schemes can expect farmers' burden. The cost of civil works for the Project is estimated at about 1,300,000 Rp/ha, while the average unit costs by project type are estimated as follows:

AVERAGE UNIT COST BY PROJECT FOR IRRIGATION PROJECT
(1989/90-1991/92)

Project Type	Total Cost Milli.Rp	Total Progress ha	Average Unit Cost Rp/ha
Efficient O&M	95,131	1,360,987	69,899
O&M	176,919	4,305,620	41,090
Improvement of Small Schemes	11,726	67,780	1,730,000
Rehabilitation	694,357	283,918	2,445,625
Special Maintenance	105,295	386,723	272,274
New Irrigation	1,229,274	264,533	4,646,958

Source: Mid Term review, BPP, Oct. 1991

Table 2-3-1 BREAKDOWN OF DESIGNED AREA OF IRRIGATION SCHEMES UNDER PU BY PROVINCE

Unit:ha

No.	Province	Designed Area	With Main Systems Already Constructed				With Main Systems under Construction or not yet constructed			
			Paddy Field		Upland Field		Total	Paddy Field	Upland or Others	
			Total	Irrigated	Not yet irrigated	Convertible to paddy field				Inconvertible to paddy field
1	D. I. Aceh	214,163	128,706	107,280	12,811	6,475	2,140	85,457	69,354	16,103
2	Sumatera Utara	259,059	198,456	158,232	19,116	17,535	3,573	60,603	16,051	44,552
3	Sumatera Barat	234,453	201,933	158,142	13,948	25,086	4,757	32,520	5,649	26,871
4	Riau	33,621	21,866	8,307	2,568	10,117	874	11,755	526	11,229
5	Jambi	26,498	26,190	14,288	3,233	8,038	631	308	30	278
6	Sumatera Selatan	87,418	65,699	48,467	4,516	12,451	265	21,719	335	21,384
7	Bengkulu	81,783	72,047	46,317	11,827	12,640	1,263	9,736	3,024	6,712
8	Lampung	172,249	169,002	86,253	2,480	66,223	14,046	3,247	-	3,247
	SUMATERA	1,109,244	883,899	627,286	70,499	158,565	27,549	225,345	94,969	130,376
9	D. K. I. Jakarta	20,528	15,053	8,945	2,032	1,324	2,752	5,475	2,379	3,096
10	Jawa Barat	915,584	892,168	830,055	24,325	12,781	25,007	23,416	15,184	8,232
11	Jawa Tengah	834,181	810,524	790,709	12,118	4,051	3,646	23,657	14,783	8,874
12	D. I. Yogyakarta	61,150	59,914	54,873	1,674	2,812	555	1,236	988	248
13	Jawa Timur	938,512	938,462	930,449	2,926	4,703	384	50	50	-
	JAWA & MADURA	2,769,955	2,716,121	2,615,031	43,075	25,671	32,344	53,834	33,384	20,450
14	Bali	89,123	89,123	82,612	-	6,511	-	-	-	-
15	Nusa Tenggara Barat	180,021	172,997	149,546	6,513	16,930	8	7,024	4,618	2,406
16	Nusa Tenggara Timur	43,462	40,077	22,456	4,899	11,071	1,651	3,385	1,562	1,823
	BALI & NUSA TENGGARA	312,606	302,197	254,614	11,412	34,512	1,659	10,409	6,180	4,229
17	Kalimantan Barat	21,931	12,512	9,038	1,529	1,632	313	9,419	4,880	4,539
18	Kalimantan Tengah	4,560	3,788	1,896	482	1,351	59	772	562	210
19	Kalimantan Selatan	33,294	21,926	11,214	4,024	5,209	1,479	11,368	3,775	7,593
20	Kalimantan Timur	32,315	19,590	5,619	6,352	5,749	1,870	12,725	4,469	8,256
	KALIMANTAN	92,100	57,816	27,767	12,387	13,941	3,721	34,284	13,686	20,598
21	Sulawesi Utara	66,923	66,025	48,984	3,374	13,010	657	898	56	842
22	Sulawesi Tengah	89,769	84,741	51,159	146	25,359	8,077	5,028	2,304	2,724
23	Sulawesi Selatan	291,214	238,977	210,641	16,009	6,483	5,844	52,237	35,744	16,493
24	Sulawesi Tenggara	54,138	45,541	19,679	-	22,629	3,233	8,597	1,574	7,023
	SULAWESI	502,044	435,284	330,463	19,529	67,481	17,811	66,760	39,678	27,082
25	Maluku	15,973	15,683	9,848	3,357	1,597	881	280	180	110
26	Irian Jaya	9,990	5,040	2,122	850	2,068	-	4,950	3,650	1,300
27	Timor Timur	7,873	7,313	6,042	1,271	-	-	560	560	-
	Sub-Total	33,836	28,036	18,012	5,478	3,665	881	5,800	4,390	1,410
	INDONESIA	4,819,785	4,423,353	3,873,173	162,380	303,835	83,965	396,432	192,287	204,145

Source : Rekapitulasi Daerah Irigasi PU, April 1989

Table 2-3-2 BREAKDOWN OF UNDEVELOPED AREA CLASSIFIED TECHNICALLY IN EXISTING IRRIGATION SCHEMES UNDER PU BY PROVINCE (ha)

No.	Province	Technical Irrigation	Semi-Tech. Irrigation	Simple Irrigation	Total
		ha	ha	ha	ha
1	Ache	-	1,895	4,580	6,475
2	North Sumatera	4,374	11,589	1,572	17,535
3	West Sumatera	9,549	7,188	8,349	25,086
4	Riau	346	9,771	-	10,117
5	Jambi	503	4,151	3,384	8,038
6	South Sumatera	-	12,141	310	12,451
7	Bengkulu	6,635	3,374	2,631	12,640
8	Lampung	59,164	2,695	4,364	66,223
	Sub-Total	80,571	52,804	25,190	158,565
9	Jakarta	-	1,254	70	1,324
10	West Java	5,227	4,525	3,029	12,781
11	Central Java	2,977	960	114	4,051
12	Yogyakarta	1,729	675	408	2,812
13	East Java	2,340	815	1,548	4,703
	Sub-Total	12,273	8,229	5,169	25,671
14	Bali	1,360	4,368	783	6,511
15	West Nusa Tenggara	2,475	13,524	931	16,930
16	East Nusa Tenggara	2,202	7,107	1,762	11,071
	Sub-Total	6,037	24,999	3,476	34,512
17	West Kalimantan	63	1,350	219	1,632
18	Central Kalimantan	-	394	957	1,351
19	South Kalimantan	1,527	1,560	2,122	5,209
20	East Kalimantan	-	1,783	3,966	5,749
	Sub-Total	1,590	5,087	7,264	13,941
21	North Sulawesi	6,964	5,119	927	13,010
22	Central Sulawesi	8,947	12,746	3,666	25,359
23	South Sulawesi	4,012	1,339	1,132	6,483
24	South-East Sulawesi	14,868	7,761	-	22,629
	Sub-Total	34,791	26,965	5,725	67,481
25	Maluk	-	-	1,597	1,597
26	Irian Jaya	-	1,259	809	2,068
27	East Timor	-	-	-	-
	Sub-Total	-	1,259	2,406	3,665
	Total	135,262	119,343	49,230	303,835

Source : REKAPITULASI DAERAH IRIGASI PU, April 1989

Table 2-3-3 LAND DEVELOPMENT PLAN BY PROVINCE FOR REPELITA V

Unit: ha

No.	Province	1989/90	1990/91	1991/92	1992/93	1993/94	Total
1	Ache	4,600	3,000	3,000	3,500	2,600	16,700
2	North Sumatera	4,400	4,300	4,500	4,000	2,700	19,900
3	West Sumatera	5000	3,500	3,500	4,000	3,000	19,000
4	Riau	3,800	3,000	3,200	3,000	2,000	15,000
5	Jambi	3,000	2,500	2,500	2,200	1,200	11,400
6	South Sumatera	3,600	3,800	3,500	3,000	2,000	15,900
7	Bengkuru	5,500	4,200	4,500	4,500	3,500	22,200
8	Lampung	10,500	8,000	7,500	7,000	5,500	38,500
Sub-Total		40,400	32,300	32,200	31,200	22,500	158,600
9	Jakarta						
10	West Java	13,900	3,700	4,000	4,000	3,000	28,600
11	Central Java	1,900	3,500	3,200	3,000	2,000	13,600
12	Yogyakarta	300	500	500	500	300	2,100
13	East Java	3,700	3,500	3,500	3,500	2,000	16,200
Sub-Total		19,800	11,200	11,200	11,000	7,300	60,500
14	Bali	200	500	500	500	200	1,900
15	West Nusa Tenggara	1,000	1,500	1,500	1,500	1,000	6,500
16	East Nusa Tenggara	2,000	2,500	2,500	2,500	1,500	11,000
Sub-Total		3,200	4,500	4,500	4,500	2,700	19,400
17	West Kalimantan	6,400	2,500	2,600	3,000	2,000	16,500
18	Central Kalimantan	2,700	1,500	1,500	1,500	1,000	8,200
19	South Kalimantan	4,000	3,500	4,000	4,500	3,000	19,000
20	East Kalimantan	2,000	1,500	1,300	1,400	500	6,700
Sub-Total		15,100	9,000	9,400	10,400	6,500	50,400
21	North Sulawesi	3,000	2,500	3,000	3,200	2,000	13,700
22	Central Sulawesi	5,000	7,000	6,000	6,000	4,000	28,000
23	South Sulawesi	6,000	3,000	3,000	3,000	1,500	16,500
24	South-East Sulawesi	4,500	3,000	3,200	3,200	2,000	15,900
Sub-Total		18,500	15,500	15,200	15,400	9,500	74,100
25	Maluk	1,500	1,000	1,000	1,000	500	5,000
26	Irian Jaya	1,000	1,000	1,000	1,000	500	4,500
27	East Timor	500	500	500	500	500	2,500
Sub-Total		3,000	2,500	2,500	2,500	1,500	12,000
Total		100,000	75,000	75,000	75,000	50,000	375,000

Source : General Guidelines of Land Development, DGFC, MOA, August 1989

Table 2-3-4 PROGRESS OF LAND DEVELOPMENT PROJECT FOR REPELITA V

Unit : ha

No.	Province	1989/90			1990/91			1991/92			Total			
		Target	Government Subsidy	Farmer' Work	Target	Govrn. Subsidy	Farmer' Work	Target	Govrn. Subsidy	Farmer' Work	Target	Govrn. Subsidy	Farmer' Work	Total
1	D. I. Aceh	4,166	3,574	0	8,270	552	0	3,524	1,118	0	15,960	5,244	0	5,244
2	Sumatera Utara	2,500	1,552	1,340	6,250	0	0	4,500	420	3,853	13,250	1,972	5,193	7,165
3	Sumatera Barat	4,157	2,784	670	7,494	1,734	0	2,323	268	0	13,974	4,786	670	5,456
4	Riau	2,083	408	15	2,950	339	0	5,274	3,798	0	10,307	4,545	15	4,560
5	Jambi	2,224	2,147	2,602	2,696	0	2,507	3,850	866	1,129	8,770	3,013	6,238	9,251
6	Sumatera Selatan	3,683	83	2,716	3,900	0	790	3,200	3,118	155	10,783	3,201	3,661	6,862
7	Bengkulu	3,179	2,307	196	7,334	2,167	46	3,903	521	306	14,416	4,995	548	5,543
8	Lampung	4,601	2,596	2,586	10,850	7,034	1,105	6,748	5,434	264	22,199	15,064	3,955	19,019
	SUMATERA	26,593	15,451	10,125	49,744	11,826	4,448	33,322	15,543	5,707	109,659	42,820	20,280	63,100
9	D. K. I. Jakarta	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Jawa Barat	10,512	10,389	0	7,750	0	0	3,490	0	0	21,752	10,389	0	10,389
11	Jawa Tengah	1,856	1,192	1,428	4,030	1,498	3,236	2,330	2,330	67	8,216	5,020	4,731	9,751
12	D. I. Yogyakarta	458	0	55	1,042	55	110	180	0	0	1,680	55	165	220
13	Jawa Timur	3,500	3,500	354	5,305	3,250	0	3,000	3,000	0	11,805	9,750	354	10,104
	JAWA & MADURA	16,326	15,081	1,837	18,127	4,803	3,346	9,000	5,330	67	43,453	25,214	5,250	30,464
14	Bali	150	102	160	300	300	79	150	102	0	600	504	239	743
15	Nusa Tenggara Barat	1,000	0	1,475	1,900	0	1,331	529	457	809	3,429	457	3,615	4,072
16	Nusa Tenggara Timur	1,000	735	0	5,845	0	0	1,510	1,510	0	8,355	2,245	0	2,245
	BALI & NUSA TENGGARA	2,150	837	1,635	8,045	300	1,410	2,189	2,069	809	12,384	3,206	3,854	7,060
17	Kalimantan Barat	6,483	575	645	2,936	0	717	2,550	0	375	11,969	575	1,737	2,312
18	Kalimantan Tengah	1,267	967	1,685	3,396	2,110	1,902	5,200	0	759	9,863	3,077	4,346	7,423
19	Kalimantan Selatan	3,350	2,512	300	5,857	1,406	2,261	2,997	2,997	1,071	12,204	6,915	3,632	10,547
20	Kalimantan Timur	901	697	767	1,800	733	129	1,100	243	0	3,801	1,673	896	2,569
	KALIMANTAN	12,001	4,751	3,397	13,989	4,249	5,009	11,847	3,240	2,205	37,837	12,240	10,611	22,851
21	Sulawesi Utara	2,662	0	1,114	5,632	0	16	4,250	2,647	137	12,544	2,647	1,267	3,914
22	Sulawesi Tengah	8,707	5,381	2,718	7,820	0	0	4,850	634	0	21,377	6,015	2,718	8,733
23	Sulawesi Selatan	6,000	3,884	1,637	3,329	0	3,574	1,900	952	7,483	11,229	4,836	12,694	17,530
24	Sulawesi Tenggara	4,297	4,131	1,475	5,555	772	3,161	5,250	4,261	0	15,102	9,164	4,636	13,800
	SULAEWSI	21,666	13,396	6,944	22,336	772	6,751	16,250	8,494	7,620	60,252	22,662	21,315	43,977
25	Maluku	1,000	0	0	1,316	770	0	742	0	0	3,058	770	0	770
26	Irian Jaya	550	308	541	1,000	0	0	518	218	200	2,068	526	741	1,267
27	Timor Timur	1,059	0	0	1,250	0	0	1,132	225	0	3,441	225	0	225
	Sub-Total	2,609	308	541	3,566	770	0	2,392	443	200	8,567	1,521	741	2,262
	INDONESIA	81,345	49,824	24,479	115,807	22,720	20,964	75,000	35,119	16,608	272,152	107,663	62,051	169,714

Source : Directorate of Land Rehabilitation and Development, June 1992

Table 2-3-5 (1) PROGRESS AND CONSUMED BUDGET FOR LAND CLEARING AND LEVELLING BY PROVINCE

Local Currency Budget									
No.	Province	Progress (ha)			Consumed Budget (Rp. million)				
		1989/90	1990/91	1991/92	Sub-Total	1989/90	1990/91	1991/92	Sub-Total
1	D. I. Aceh	0	6,018	3,524	9,542	0	2,585	2,733	5,318
2	Sumatera Utara	0	4,709	4,500	9,209	0	1,972	2,463	4,435
3	Sumatera Barat	0	5,403	2,323	7,726	0	1,978	2,010	3,988
4	Riau	0	1,270	5,274	6,544	0	587	3,011	3,598
5	Jambi	83	2,000	3,850	5,933	25	937	1,996	2,958
6	Sumatera Selatan	83	0	3,118	3,201	25	0	1,869	1,894
7	Bengkulu	0	5,000	3,903	8,903	0	2,297	2,650	4,947
8	Lampung	155	5,999	5,470	11,624	25	2,300	2,210	4,535
	SUMATERA	321	30,399	31,962	62,682	75	12,656	18,942	31,673
9	D. K. I. Jakarta	0	0	0	0	0	0	0	0
10	Jawa Barat	0	4,218	3,490	7,708	0	1,919	1,472	3,391
11	Jawa Tengah	0	0	2,330	2,330	0	0	762	762
12	D. I. Yogyakarta	0	0	180	180	0	0	66	66
13	Jawa Timur	0	3,250	3,000	6,250	0	1,268	1,272	2,540
	JAWA & MADURA	0	7,468	9,000	16,468	0	3,187	3,572	6,759
14	Bali	0	300	150	450	0	90	50	140
15	Nusa Tenggara Barat	0	0	529	529	0	0	302	302
16	Nusa Tenggara Timur	0	2,506	1,510	4,016	0	0	829	829
	BALI & NUSA TENGGARA	0	2,806	2,189	4,995	0	90	1,181	1,271
17	Kalimantan Barat	83	468	2,492	3,043	25	224	1,710	1,959
18	Kalimantan Tengah	167	1,518	5,200	6,885	48	1,136	3,112	4,296
19	Kalimantan Selatan	0	2,350	2,997	5,347	0	587	2,254	2,841
20	Kalimantan Timur	0	1,673	1,100	2,773	0	682	715	1,397
	KALIMANTAN	250	6,009	11,789	18,048	73	2,629	7,791	10,493
21	Sulawesi Utara	0	1,301	4,250	5,551	0	495	1,548	2,043
22	Sulawesi Tengah	0	5,288	4,380	9,668	0	2,458	2,827	5,285
23	Sulawesi Selatan	0	580	1,900	2,480	0	216	1,102	1,318
24	Sulawesi Tenggara	0	4,600	5,250	9,850	0	2,173	3,020	5,193
	SULAEWSI	0	11,769	15,780	27,549	0	5,342	8,497	13,839
25	Maluku	0	1,286	0	1,286	0	544	0	544
26	Irian Jaya	0	0	518	518	0	0	402	402
27	Timor Timur	0	0	1,132	1,132	0	0	598	598
	Sub-Total	0	1,286	1,650	2,936	0	544	1,000	1,544
	INDONESIA	571	59,737	72,370	132,678	148	24,448	40,983	65,579

Source : Direktorat Bina Rehabilitasi dan Pengembangan Lahan, Jun. 1992

Table 2-3-5 (2) PROGRESS AND CONSUMED BUDGET FOR LAND CLEARING AND LEVELLING BY PROVINCE

No.	Province	OECE Loan Budget						Total	
		Progress (ha)			Consumed Budget (Rp.milli.)			Progress (ha)	Consumed Budget (Rp.milli.)
		1989/90	1990/91	Sub-Total	1989/90	1990/91	Sub-Total		
1	D. I. Aceh	4,165	2,252	6,417	1,848	1,324	3,172	15,959	8,490
2	Sumatera Utara	2,500	0	2,500	1,017	0	1,017	11,709	5,452
3	Sumatera Barat	3,579	0	3,579	1,531	0	1,531	11,305	5,519
4	Riau	616	0	616	263	0	263	7,160	3,861
5	Jambi	2,141	696	2,837	825	377	1,202	8,770	4,160
6	Sumatera Selatan	1,866	0	1,866	663	0	663	5,067	2,557
7	Bengkulu	2,884	2,334	5,218	1,408	1,714	3,122	14,121	8,069
8	Lampung	2,440	2,100	4,540	884	1,355	2,239	16,164	6,774
	SUMATERA	20,191	7,382	27,573	8,439	4,770	13,209	90,255	44,882
9	D. K. I. Jakarta	0	0	0	0	0	0	0	0
10	Jawa Barat	10,512	0	10,512	3,820	0	3,820	18,220	7,211
11	Jawa Tengah	1,856	1,530	3,386	541	457	998	5,716	1,760
12	D. I. Yogyakarta	458	1,042	1,500	136	296	432	1,680	498
13	Jawa Timur	3,500	1,875	5,375	1,323	711	2,034	11,625	4,574
	JAWA & MADURA	16,326	4,447	20,773	5,820	1,464	7,284	37,241	14,043
14	Bali	150	0	150	45	0	45	600	185
15	Nusa Tenggara Barat	0	0	0	0	0	0	529	302
16	Nusa Tenggara Timur	973	2,029	3,002	313	996	1,309	7,018	2,138
	BALI & NUSA TENGGARA	1,123	2,029	3,152	358	996	1,354	8,147	2,625
17	Kalimantan Barat	2,991	536	3,527	1,396	312	1,708	6,570	3,667
18	Kalimantan Tengah	800	1,046	1,846	379	662	1,041	8,731	5,337
19	Kalimantan Selatan	3,069	1,257	4,326	1,126	831	1,957	9,673	4,798
20	Kalimantan Timur	897	0	897	334	0	334	3,670	1,731
	KALIMANTAN	7,757	2,839	10,596	3,235	1,805	5,040	28,644	15,533
21	Sulawesi Utara	317	0	317	136	0	136	5,868	2,179
22	Sulawesi Tengah	8,707	2,577	11,284	4,172	1,233	5,405	20,952	10,690
23	Sulawesi Selatan	6,000	0	6,000	1,943	0	1,943	8,480	3,261
24	Sulawesi Tenggara	4,297	955	5,252	1,725	460	2,185	15,102	7,378
	SULAEWSI	19,321	3,532	22,853	7,976	1,693	9,669	50,402	23,508
25	Maluku	0	0	0	0	0	0	1,286	544
26	Irian Jaya	550	0	550	200	0	200	1,068	602
27	Timor Timur	0	0	0	0	0	0	1,132	598
	Sub-Total	550	0	550	200	0	200	3,486	1,744
	INDONESIA	65,268	20,229	85,497	26,028	10,728	36,756	218,175	102,335

Source : Direktorat Bina Rehabilitasi dan Pengembangan Lahan, Jun. 1992

Table 2-3-6 BREAKDOWN OF VILLAGE IRRIGATION AREA BY PROVINCE

No.	Province	Data From DOI-I (Sep. 1982)			From Various Sources (1992)			Source
		Nos of Schemes	Potential Area (ha)	Irrigated Area (ha)	Nos of Schemes	Potential Area (ha)	Irrigated Area (ha)	
1	Ache	852	96,649	43,266	598	57,523	32,213	PRAS/JICA
2	North Sumatera	1,132	193,435	79,580	845	121,775	57,234	PRAS/JICA
3	West Sumatera	2,944	107,641	70,580				
4	Riau	99	25,813	2,491				
5	Jambi	333	66,719	18,957	398	47,924	28,754	PRIS
6	South Sumatera	1,379	110,278	62,959				
7	Bengkulu	121	28,130	16,189				
8	Lampung	964	63,542	31,542	130	25,815	14,066	PRAS/JICA
	Sub-Total	7,824	692,207	325,564	1,971	253,037	132,267	
9	Jakarta	29	4,868	1,607				
10	West Java	10,298	310,364	251,809	2,855	165,942	99,565	PRAS
11	Central Java	507	27,168	26,325				
12	Yogyakarta	0	0	0				
13	East Java	818	41,950	34,852				
	Sub-Total	11,652	384,350	314,593	2,855	165,942	99,565	
14	Bali	1,000	42,032	39,529	468	20,647	19,874	IISP-II (TA)
15	West Nusa Tenggara	773	66,439	48,864	328	35,499	29,800	PRAS/JICA
16	East Nusa Tenggara	1,126	109,859	42,624	305	47,231	28,302	PRAS/JICA
	Sub-Total	2,899	218,330	131,017	1,143	103,377	77,976	
17	West Kalimantan	319	63,921	33,569				
18	Central Kalimantan	19	6,329	986				
19	South Kalimantan	833	237,893	111,451				
20	East Kalimantan	124	31,593	11,601				
	Sub-Total	1,295	339,736	157,607				
21	North Sulawesi	483	26,138	12,252	240	19,086	11,500	IISP-II (TA)
22	Central Sulawesi	139	17,809	10,361	134	13,803	8,218	PRAS/JICA
23	South Sulawesi	842	182,380	75,084	962	149,260	67,265	PRAS/JICA
24	South-East Sulawesi	170	24,792	10,135	163	40,366	18,082	PRAS/JICA
	Sub-Total	1,634	251,119	107,832	1,499	222,515	105,065	
25	Maluk	0	0	0	NA	6,000	3,600	IISP-II (TA)
26	Irian Jaya	n.a.	n.a.	n.a.	16	9,014	349	IISP-II (TA)
27	East Timor	n.a.	n.a.	n.a.	NA	20,000	10,000	IISP-II (TA)
	Sub-Total	n.a.	n.a.	n.a.	16	35,014	13,949	
	Total	25,304	1,885,742	1,036,613	7,484	779,885	428,823	
	(12 Provinces in 1992)	18,112	1,200,158	664,003	7,468	744,871	414,874	
	Ratio : 1992/1982 (%)				41	62	62	

Table 2-3-7 BREAKDOWN OF PADDY FIELD BY PROVINCE

Unit:ha

No.	Province	Technical Irrigation Area	Semi-Tech. Irrigation area	Simple/Village Irrigation	Tidal Swamp Area	Non-Tidal Swamp Area	Rain-fed Area	Total
1	D. I. Aceh	3,000	30,116	112,291	1,350	37,428	138,945	323,130
2	Sumatera Utara	51,317	62,831	159,015	9,204	49,925	209,540	541,832
3	Sumatera Barat	10,057	53,952	92,134	350	1,871	64,204	222,568
4	Riau	0	1,765	21,316	44,429	103,801	40,662	211,973
5	Jambi	650	10,619	29,577	67,197	73,548	31,224	212,815
6	Sumatera Selatan	12,675	6,194	40,284	71,059	279,621	48,052	457,885
7	Bengkulu	7,527	13,015	23,758	522	13,359	13,308	71,489
8	Lampung	74,169	17,153	36,932	2,244	23,358	61,802	215,658
	SUMATERA	159,395	195,645	515,307	196,355	582,911	607,737	2,257,350
9	D. K. I. Jakarta	1,795	1,135	481	0	255	3,005	6,671
10	Jawa Barat	438,397	145,062	319,283	26	15,061	276,678	1,194,507
11	Jawa Tengah	330,181	133,623	213,534	28	3,763	329,377	1,010,506
12	D. I. Yogyakarta	0	41,205	11,171	0	0	10,176	62,552
13	Jawa Timur	612,554	140,011	146,072	492	3,011	269,176	1,171,316
	JAWA & MADURA	1,382,927	461,036	690,541	546	22,090	888,412	3,445,552
14	Bali	1,064	65,055	26,719	0	450	812	94,100
15	Nusa Tenggara Barat	37,727	76,292	38,469	5,242	185	39,334	197,249
16	Nusa Tenggara Timur	5,848	19,195	38,287	184	28,188	26,856	118,558
	BALI & NUSA TENGGARA	44,639	160,542	103,475	5,426	28,823	67,002	409,907
17	Kalimantan Barat	0	4,103	93,346	59,004	101,871	173,199	431,523
18	Kalimantan Tengah	1,882	18,100	26,713	60,494	73,462	41,575	222,226
19	Kalimantan Selatan	7,699	3,806	26,077	134,449	182,154	112,862	467,047
20	Kalimantan Timur	0	368	5,719	4,222	98,757	52,450	161,516
	KALIMANTAN	9,581	26,377	151,855	258,169	456,244	380,086	1,282,312
21	Sulawesi Utara	17,176	15,434	11,814	0	11,121	11,133	66,678
22	Sulawesi Tengah	21,110	29,156	45,572	830	12,046	9,649	118,363
23	Sulawesi Selatan	123,648	41,391	151,062	990	15,533	256,659	589,283
24	Sulawesi Tenggara	2,351	9,776	17,635	451	21,186	5,551	56,950
	SULAEWSI	164,285	95,757	226,083	2,271	59,886	282,992	831,274
25	Maluku	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0
26	Irian Jaya	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0
27	Timor Timur	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0
	MALUKU IRIAN JAYA	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0
	INDONESIA	1,760,827	939,357	1,687,261	462,767	1,149,954	2,226,229	8,226,395

Table 2-3-8 NUMBERS AND AREAS FOR REHABILITATION OF VILLAGE IRRIGATION

No.	Province	1989/90	1990/91	1991/92	1992/93	Total	1989/90	1990/91	1991/92	1992/93	Total
1	D. I. Aceh	1	5	3		9	90	325	180		595
2	Sumatera Utara			3	18	21			301	n.a.	n.a.
3	Sumatera Barat		1	2	6	9		70	150	n.a.	n.a.
4	Riau				6	6				n.a.	n.a.
5	Jambi				6	6				n.a.	n.a.
6	Sumatera Selatan		3	1	6	10		370	607	n.a.	n.a.
7	Bengkulu			3	12	15			155	n.a.	n.a.
8	Lampung	2	3	1	6	12	220	350	300	n.a.	n.a.
	SUMATERA	3	12	13	60	88	310	1,115	1,693	n.a.	n.a.
9	D. K. I. Jakarta										
10	Jawa Barat	3	5	1	8	17	255	370	150	542	1,317
11	Jawa Tengah	3	3	1	12	19	156	200	135	n.a.	n.a.
12	D. I. Yogyakarta	2	3	3		8	130	145	226		501
13	Jawa Timur	3	4	1	10	18	102	43	75	578	798
	JAWA & MADURA	11	15	6	30	62	643	758	586	n.a.	n.a.
14	Bali	2	3	4	6	15	80	119	126	326	651
15	Nusa Tenggara Barat	5	6	4	10	25	564	647	140	515	1,866
16	Nusa Tenggara Timur			3	12	15			2,010	n.a.	n.a.
	BALI & NUSA TENGGARA	7	9	11	28	55	644	766	2,276	n.a.	n.a.
17	Kalimantan Barat	2	5	6	10	23	140	227	461	804	1,632
18	Kalimantan Tengah				6	6				n.a.	n.a.
19	Kalimantan Selatan		3	1	8	12		190	100	615	905
20	Kalimantan Timur			3	8	11			182	n.a.	n.a.
	KALIMANTAN	2	8	10	32	52	140	417	743	n.a.	n.a.
21	Sulawesi Utara	2	2	4	20	28	210	130	167	1,093	1,600
22	Sulawesi Tengah			2	6	8			172	395	567
23	Sulawesi Selatan	3	4	1	4	12	229	245	50	710	1,234
24	Sulawesi Tenggara				10	10				n.a.	n.a.
	SULAEWSI	5	6	7	40	58	439	375	389	n.a.	n.a.
25	Maluku				6	6					
26	Irian Jaya					0					
27	Timor Timur					0					
	MALUKU IRIAN JAYA	0	0	0	6	6					
	INDONESIA	28	50	47	196	321	2,176	3,431	5,687	n.a.	n.a.

Source : Directorate of Land Rehabilitation and Development, DGFCA

Table 2-3-9 BUDGET USED FOR REHABILITATION OF VILLAGE IRRIGATION (APBN)

No.	Province	1989/90	1990/91	1991/92	Unit: Rpl.000	
					1992/93	Total
1	D. I. Aceh	3,100	18,875	14,100		36,075
2	Sumatera Utara			12,500	118,980	131,480
3	Sumatera Barat		3,775	9,400	42,400	55,575
4	Riau				42,525	42,525
5	Jambi				39,120	39,120
6	Sumatera Selatan		10,800	5,390	41,580	57,770
7	Bengkulu			12,860	61,680	74,540
8	Lampung	6,200	11,325	5,300	38,170	60,995
	SUMATERA	9,300	44,775	59,550	384,455	498,080
9	D. K. I. Jakarta					
10	Jawa Barat	9,300	7,770	4,120	53,040	74,230
11	Jawa Tengah	9,300	14,670	5,200	34,360	63,530
12	D. I. Yogyakarta	5,800	10,400	9,450		25,650
13	Jawa Timur	9,300	15,100	4,000	65,700	94,100
	JAWA & MADURA	33,700	47,940	22,770	153,100	257,510
14	Bali	620	5,100	12,450	39,420	57,590
15	Nusa Tenggara Barat	15,500	22,650	19,500	102,900	160,550
16	Nusa Tenggara Timur		7,550	14,100	81,960	103,610
	BALI & NUSA TENGGARA	16,120	35,300	46,050	224,280	321,750
17	Kalimantan Barat		22,650	26,730	65,700	115,080
18	Kalimantan Tengah				43,980	43,980
19	Kalimantan Selatan		21,150	5,400	52,560	79,110
20	Kalimantan Timur			14,100	60,680	74,780
	KALIMANTAN	0	43,800	46,230	222,920	312,950
21	Sulawesi Utara	9,300	7,550	18,800	131,400	167,050
22	Sulawesi Tengah			16,380	39,420	55,800
23	Sulawesi Selatan	9,300	15,100	5,950	22,680	53,030
24	Sulawesi Tenggara				66,700	66,700
	SULAWESI	18,600	22,650	41,130	260,200	342,580
25	Maluku				40,980	40,980
26	Irian Jaya					0
27	Timor Timur					0
	MALUKU IRIAN JAYA				40,980	40,980
	INDONESIA	77,720	194,465	215,730	1,285,935	1,773,850

Source : Directorate of Land Rehabilitation and Development, DGFCA

2.4 Regional Economy

2.4.1 North Sumatra Province

North Sumatra province is geographically located on 1^o to 4^o north latitude and 98^o to 100^o east longitude. The province has an acreage of about 70,787 sq. km or 3.7 % of the national land of Indonesia.

Administratively, North Sumatra province consists of eleven (11) Kabupatens and six (6) Kotamadyas, and the capital of the province is Medan. The numbers of Kecamatan and Kelurahan/Desa are 209 and 5,665, respectively.

The population in 1990 was 10.26 million or 5.7 % of the total population in Indonesia. Annual population growth rate was 2.06 % on average from 1980 to 1990. Population density per sq. km was 145 in 1990, and 15 % of the provincial population gravitated toward Medan. Regarding to labor force, agriculture sector absorbed 2.51 million people or 62.5 % of the total labor force of the province in 1989.

Gross Regional Domestic Products (GRDP) in the province was Rp. 7,592 billion in 1988 and its 36.6 % was derived from the agriculture sector. GRDP per capita was Rp. 759,000 in 1988 which was smaller than the national average of Rp. 804,000.

North Sumatra province is one of the export surplus provinces. Total amount of export was US\$ 1,721 million and that of import was US\$ 813 million in 1989. The major export commodities are rubber, aluminum, coconut and wood.

North Sumatra province officially sets the growth target of each economic sector on Five-Year Development Plans. In the Fifth Five-Year Plan, target of annual growth rate of the whole sectors is 5.4 %. The highest growth target is put on manufacturing industries at 10.4 %. Agriculture sector is expected to growth at the rate of 4.4 % annually, but have still highest weight of the provincial economy with about one third of the total DRGP in the last year of the Plan.

2.4.2 South Sulawesi Province

South Sulawesi province is geographically located on 0^o12' to 8^o south latitude and 116^o48' to 122^o east longitude. The province has an acreage of about 72,781 sq. km or 3.8 % of the

national land of Indonesia.

Administratively, South Sulawesi province consists of twenty one (21) Kabupatens and two (2) Kotamadyas, and the capital of the province is Ujung Pandang. The numbers of Kecamatan and Kelurahan/Desa are 177 and 1,375, respectively.

The population in 1990 was 6.98 million or 3.9 % of the total population in Indonesia. Annual population growth rate was 1.42 % on average from 1980 to 1990. Population density per sq. km was 108 in 1990, and 12 % of the provincial population gravitated toward Ujung Pandang. Regarding to labor force, agriculture sector absorbed 1.52 million people or 60.5 % of the total labor force of the province in 1989.

Gross Regional Domestic Products (GRDP) in the province was Rp. 3,320 billion in 1988 and its 44.1 % was derived from the agriculture sector. The food crop production shares 25.8 % out of the GRDP and 58.0 % out of the agriculture sector. GRDP per capita was Rp. 487,000 in 1988 which was smaller than the national average.

South Sulawesi province in one of the export surplus provinces. Total amount of export was US\$ 499 million and that of import was US\$ 153 million in 1988. The major export commodities are nickel, shrimp and plywood.

South Sulawesi province officially provides the growth target of each economic sector on Five-Year Development Plans. In the Fifth Five-Year Plan, target of annual growth rate of the whole sectors is 4.9 %. The highest growth target is put on manufacturing industries at 7.9 %. Agriculture sector is expected to growth at the rate of 4.1 % annually, but have still highest weight of the provincial economy with about one third of the total DRGP in the last year of the Plan.

2.4.3 West Nusa Tenggara Province

West Nusa Tenggara province is geographically located on 8_o5' to 9_o5' south latitude and 115_o5' to 119_o5' east longitude. The province has an acreage of about 20,177 sq. km or 1.1 % of the national land of Indonesia.

Administratively, North Sumatra province consists of six (6) Kabupatens, and the capital of the province is Mataram. The

numbers of Kecamatan and Kelurahan/Desa are 59 and 564, respectively.

The population in 1990 was 3.37 million or 1.9 % of the total population in Indonesia. Annual population growth rate was 2.15 % on average from 1980 to 1990. Population density per sq. km was 167 in 1989. Regarding to labor force, agriculture sector absorbed 1.00 million people or 70.0 % of the total labor force of the province in 1989.

Gross Regional Domestic Products (GRDP) in the province was Rp. 951 billion in 1988 and its 51.1 % was derived from the agriculture sector. The food crops production shares 33.9 % of GRDP and 66.3 % in the agriculture sector. GRDP per capita was Rp. 294,000 in 1988 which was much smaller than the national average.

Total amount of export of West Nusa Tenggara province was only US\$ 10 million. The major export commodities are pumice and cultured pearl, and the export by these two commodities reaches more than 70 % of the total export amount.

West Nusa Tenggara province officially sets the growth target of each economic sector on Five-Year Development Plans. In the Fifth Five-Year Plan, target of annual growth rate of the whole sectors is 4.8 %. The highest growth target is put on manufacturing sector at 9.0 %. Agriculture sector is expected to growth at the rate of 3.7 % annually, and have still high weight of the provincial economy with about 18 % of the total DRGP, which is third highest share next to public service sector and trade and hotels sector.

III. INVENTORY SURVEY

3.1 Objective of Inventory Survey

The object of inventory survey is to catch hold of present conditions and development potential for land development schemes including rehabilitation of village irrigation schemes, and also to apply the collected data as basic figure for the further study of Project formulation in three (3) Provinces of North Sumatra, South Sulawesi and Nusa Tenggara Barat.

3.2 Selection of Inventory Survey Schemes

(1) Long List of Land Development Schemes

In Indonesia the target area of land development of paddy field is scheduled to be about 375,000 ha consisting of about 340,000 ha of the potential area of existing PU irrigation projects, 20,000 ha of swamp development area and 15,000 ha from village irrigation area during the period of Pelita V (1989/90 - 1993/94).

In the whole provinces, the total achievement of land development area of paddy field has been already recorded about 218,000 ha since the beginning of Pelita V to February 1992 including development by farmers themselves, which is called as Swadaya Masyarakat.

As the said target area, new planning area of land development in all Indonesia are mainly selected from the existing PU projects area where have already major irrigation and drainage facilities, but where not yet developed by farmers for paddy field owing to the local site conditions. Those potential area of paddy field are corresponded to the area of Column No.13 in the projects registration book (Buku Pintar) for existing irrigation projects under controlling by the Ministry of Public Works. The present land use of such area consist of forest, bush, upland field, fish pond and swamp, etc. where can be converted to paddy field in future.

According to the record published by PU on April 1989, the total figure of the Column No.13 is summed up for the potential area of land development of paddy field in three (3) provinces of North Sumatra, South Sulawesi and Nusa Tenggara as bellow.

Potential Area of Land Development in DPU Projects

Province	Technical Irrigation	Semi Technical Irrigation	Simple Irrigation	Total Area	No. of Projects	Average Area
	ha	ha	ha	ha	nos	ha
North Sumatra	4,374	11,589	1,572	17,535	208	84
South Sulawesi	4,012	1,339	1,132	6,483	40	162
NIB	2,475	13,524	931	16,930	88	192
sub total	10,861	26,452	3,635	40,948	336	122
All Indonesia	135,262	119,343	49,230	303,835		

Note: Projects under construction are not included.
 Source: Buku Pintar 1989, DOI-I, DPU

From the above table, the total area of 40,948 ha and 336 schemes in three province are considered to major long list for land development schemes.

(2) Long List of Village Irrigation Schemes

Village irrigation project is defined to be irrigation areas where were constructed by farmers' group themselves, and the operation and maintenance of the projects are being carried out by farmer themselves. However the material costs for cement, reinforcement bar and/or steal material, etc. are provided using subsidy from Directorate General of Food Crops Agriculture, Ministry of Agriculture, or Directorate General of Rural Development, Ministry of Home Affairs, or local self-government of province or district and other special body.

The following shows the title of long list for village irrigation schemes that are grasped at present by each provincial agriculture service office. The form of these lists are not the same.

- North Sumatra : List of Rekapitulasi Konstruksi Pengairan Desa Propinsi Sumatera Utara, 1969/70 - 1990/91
- South Sulawesi : Data Inventarisasi Irigasi Pedesaan Prop. Dati I Sulawesi Selatan, 1991 March
- West Nusa Tenggara : List of Inventarisasi Pengairan Pedesaan Propinsi Nusa Tenggara Barat

According to the above lists, the number of village irrigation project is summed up as below;

Number and Total Area of Village Irrigation

Province	Total Number of Project	Total Area (Potential)	Average Area
	nos	ha	ha/scheme
North Sumatra	845	121,775	144
South Sulawesi	962	149,260	155
NTB	328	35,499	108
Total	2,135	306,534	144

(3) Selection of Inventory Survey Schemes

1) Selection of Land Development Schemes

From the above-mentioned long lists, object schemes for inventory survey are selected in accordance with the following selection guideline.

- a. Potential area for land development of paddy fields is more than 25 ha.
- b. The scheme is not under construction and/or there is no schedule as land development project.
- c. The scheme has no budgetary assistance by foreign aid such as IBRD, ADB and OECF.
- d. The area has no periodical transportation means, such as isolated island etc., should be excluded.

2) Selection of Village Irrigation Schemes

As well as the selection of land development schemes, object schemes for inventory survey are selected from the above-mentioned long lists in accordance with the following selection guideline.

- a. Potential area is larger than 25 ha and less than 500 ha.
- b. The scheme has necessity to rehabilitate or upgrade their present irrigation and drainage facilities.
- c. At present there is no schedule which has budgetary arrangement for rehabilitation and/or upgrading, construction works, or not under construction.

- d. Excluding the schemes completed recently and good condition.
- e. The schemes has no budgetary assistance by foreign aid program.
- f. Excluding the schemes located in the special projects.
- g. The area has no periodical transportation means, such as isolated island etc. should be excluded.

The above both selection guidelines and flow are shown in Fig.3.2.1.

3) Scheduled Schemes for Inventory Survey

After the check and examine about above each condition, number of the study for land development schemes is 114 schemes and that of village irrigation is 871 schemes.

Scheduled Schemes for Inventory Survey

Province	Land Development Scheme	Village Irrigation Scheme	Total
	nos	nos	nos
North Sumatra	50	308	358
South Sulawesi	19	374	393
NTB	45	189	234
Total	114	871	985

Note; The total potential area for paddy field is about 154,000 ha.

3.3 Implementation of Inventory Survey

3.3.1 Formulation of Questionnaire

Ministry of Agriculture has both inventory forms for land development project and village irrigation project and the inventory data is evaluated using their standard for the decision of project formulation and implementation.

- In case of land development project (Pencetakan Sawah) The inventory form were made on August 1989 by the Directorate of Rehabilitation and Land Development (DRLD), Directorate General of Food Crops Agriculture (DGFA), Ministry of Agriculture, and inventory survey is carried

out by Indonesian consultants.

Name of Questionnaire Form :

PETUNJUK PELAKSANAAN SURVEY (INVENTIGASI) LOKASI
PENCETAKAN SAWAH

- In case of village irrigation project (Irigasi Pedesaan) As well as the land development survey, questionnaire form of village irrigation which was prepared by DRLD are used in each province. The inventory survey is carried out by agricultural service in district level and village, after that, such inventory data is submitted to the provincial agricultural service (PRAS) in order to keep budget of subsidy from national or provincial level.

Name of Questionnaire Form :

DAFTAR PERTANYAN APPRAISAL CALON LOKASI PEMBANGUNAN
DAN PENGEMBANGAN PENGAIRAN PEDESAAN

Questionnaire form which is utilized for the Study, was arranged into one form using the above two questionnaires by the Study team at the beginning stage of Phase I Field Survey (II). (refer to Appendix)

The questionnaire form has been made in both English and Indonesian. The following table shows a flow chart of formulation of questionnaire for inventory survey.

3.3.2 Implementation of Inventory Survey

(1) Record of Procedure

Inventory survey itself were almost entrusted to know the present condition on land development project and village irrigation project by the Study team to the three (3) Indonesian consulting firms which have experience in the same field survey in Indonesia. The entrusted works between JICA Study team and each consultant firm entered into the contract on May 7, 1991 at DRLD Jakarta for the three provinces of North Sumatra, South Sulawesi and West Nusa Tenggara. The entrusted firms are as follows;

Entrusted Works-I, South Sulawesi	:PT.Indeco Duta Utama
Entrusted Works-II, NTB	:PT.Bimaseta Cipta Optimal
Entrusted Works-III, North Sumatra	:Pusat Pengembangan Agribisnis

Number of Inventory Survey

Province	LD project	VI Project	Total
	nos	nos	nos
North Sumatra	50	308	358
South Sulawesi	19	374	393
West Nusa Tenggara	45	189	234
Total	114	871	985

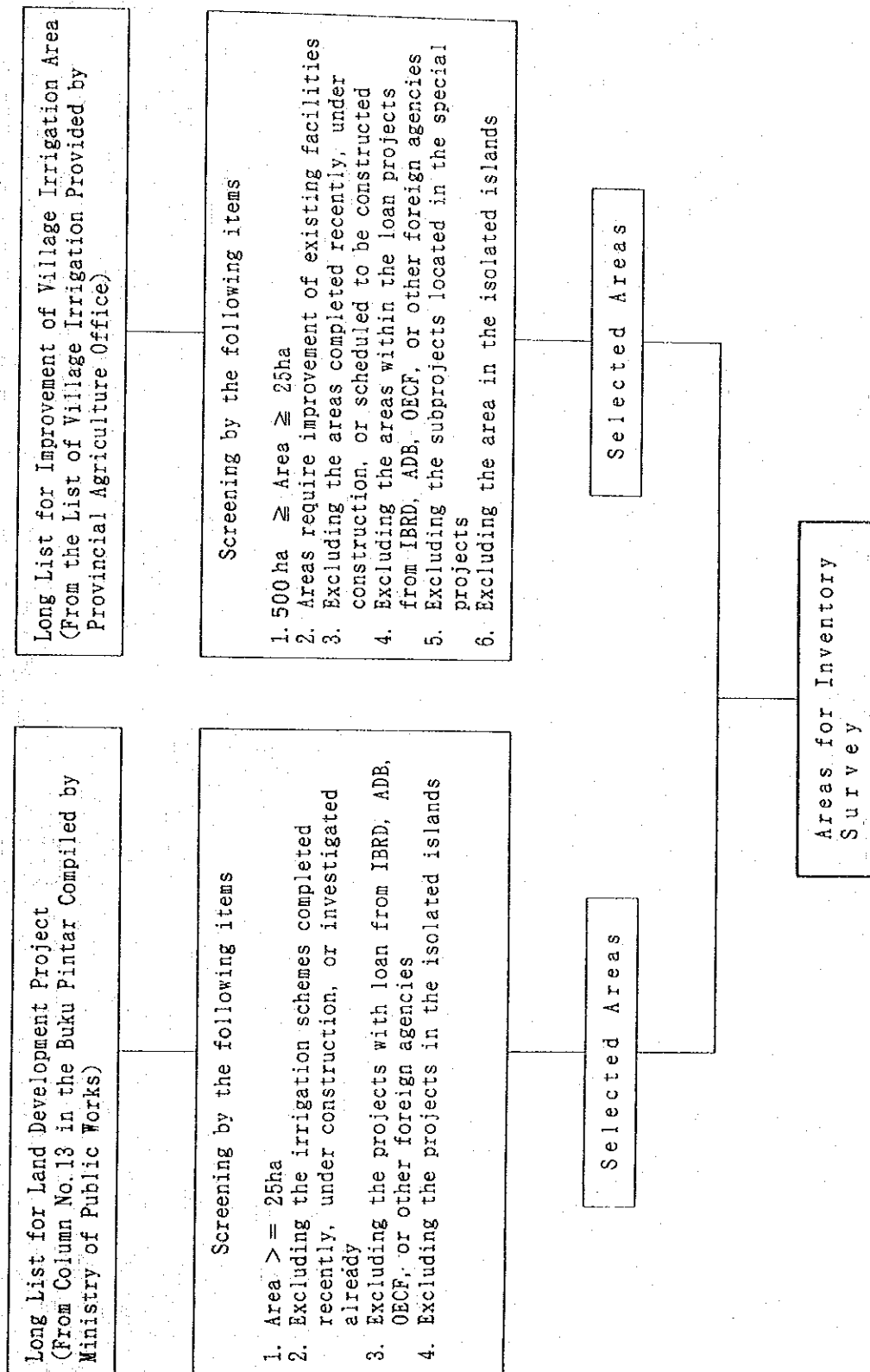
Note; A part of above areas, 142 areas were investigated during Sep. and Oct., 1991.

(2) Preparation of Summary Sheet

The volume of summary sheets was prepared each province, which has about 150 major data out of about 640 answer per one scheme, in order to see the total, mean value and to check the survey data preliminary, also to check unusual data.

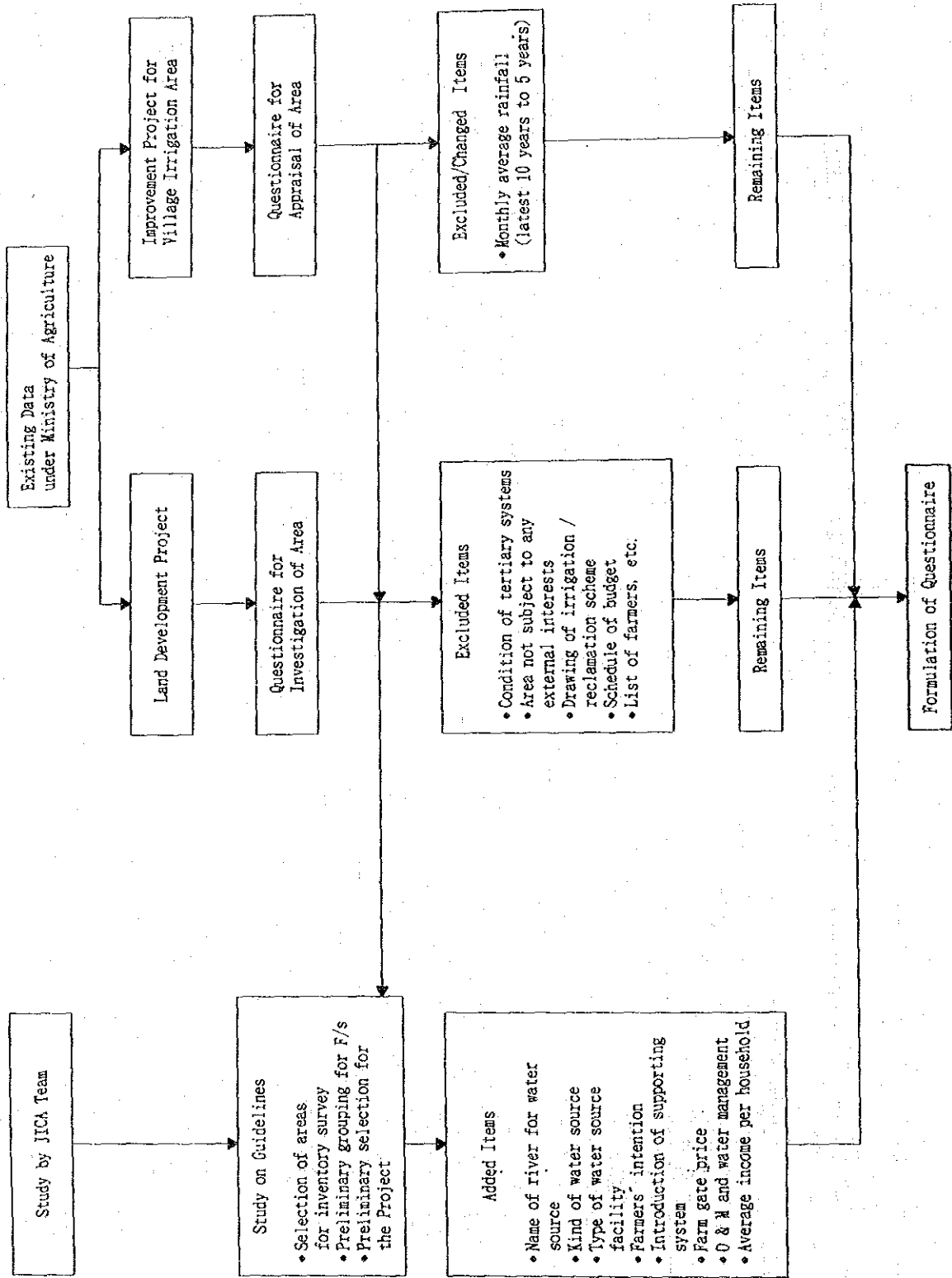
Fig. 3. 2. 1

GUIDELINE FOR SELECTION OF AREAS FOR INVENTORY SURVEY



FORMULATION OF QUESTIONNAIRE FOR INVENTORY SURVEY

FIG. 3. 3. 1



3.4 Data Arrangement of Inventory Survey

3.4.1 Data Base System

A data base system is constructed on the land develop and village irrigation schemes using dBASE IV program on personal computer during Phase I Field Work (II). The data base system is designed and programmed for input, correct, delete, search and output of scheme features.

The data base is used for data arrangement and analysis during succeeding stages, with some modification of the program. On data arrangement, the original data files of dBASE IV can be converted into Lotus 1-2-3 files, because of convenience for other users.

The data base system is not only for the three provinces of the Project but also five provinces surveyed by Indonesian side. Therefore, during the programming and imputing works in Indonesia, basic operation method of the system was guided to counterparts of DGFC. The data base programs, data files of the all eight provinces and also hardware is stocked at DRLD office of DGFC.

By using of the composed programs, data files was prepared by province and project type. The uncertain answers were corrected by asking the original surveyors during inputting process. Then, each expert checked input data with the check lists, and corrected data files. The final data files were used for data analyses and grouping and evaluation of schemes.

3.4.2 Data Arrangement

The inventory data are processed in terms of; 1) data base formulation, 2) second screening on the project criteria, 3) grouping of schemes, and 4) evaluation and prioritizing of schemes, as shown in Fig. 3-4-1. The details of results are described in Chapter VI.

(1) Formulation of Data Base

The all collected data of the inventory survey were kept as master data base files. The files consist of six series, which come from three provinces by two project types, i.e., land development and village irrigation.

(2) Second Screening on the Project Criteria

Prior to the inventory survey, first screening was carried out in line with project criteria explained former Section 3.1. During examination of the inventory results, however, it was found that some schemes did not meet to the criteria of land development and village irrigation project in the Study.

Out of whole 979 schemes, 190 schemes were excluded from succeeding data analyses, grouping and other treatments on several reasons. Master data base including all surveyed schemes is kept on the floppy disks so that the excluded schemes could come into the implementation list when they satisfied the project criteria in future.

(3) Grouping of Schemes

The all objective schemes are categorized into 13 groups. The schemes are firstly divided into three great groups, i.e., A) land development schemes, B) land development, rehabilitation and improvement schemes, and C) rehabilitation and improvement schemes. Then, each group is subdivided by several key factors which would affect construction cost and agricultural benefit.

(4) Evaluation and Prioritizing of Schemes

The schemes are evaluated from the viewpoint of economical, physical, institutional and social aspects. Then, they are prioritized for implementation on the basis of score point on the evaluation criteria.

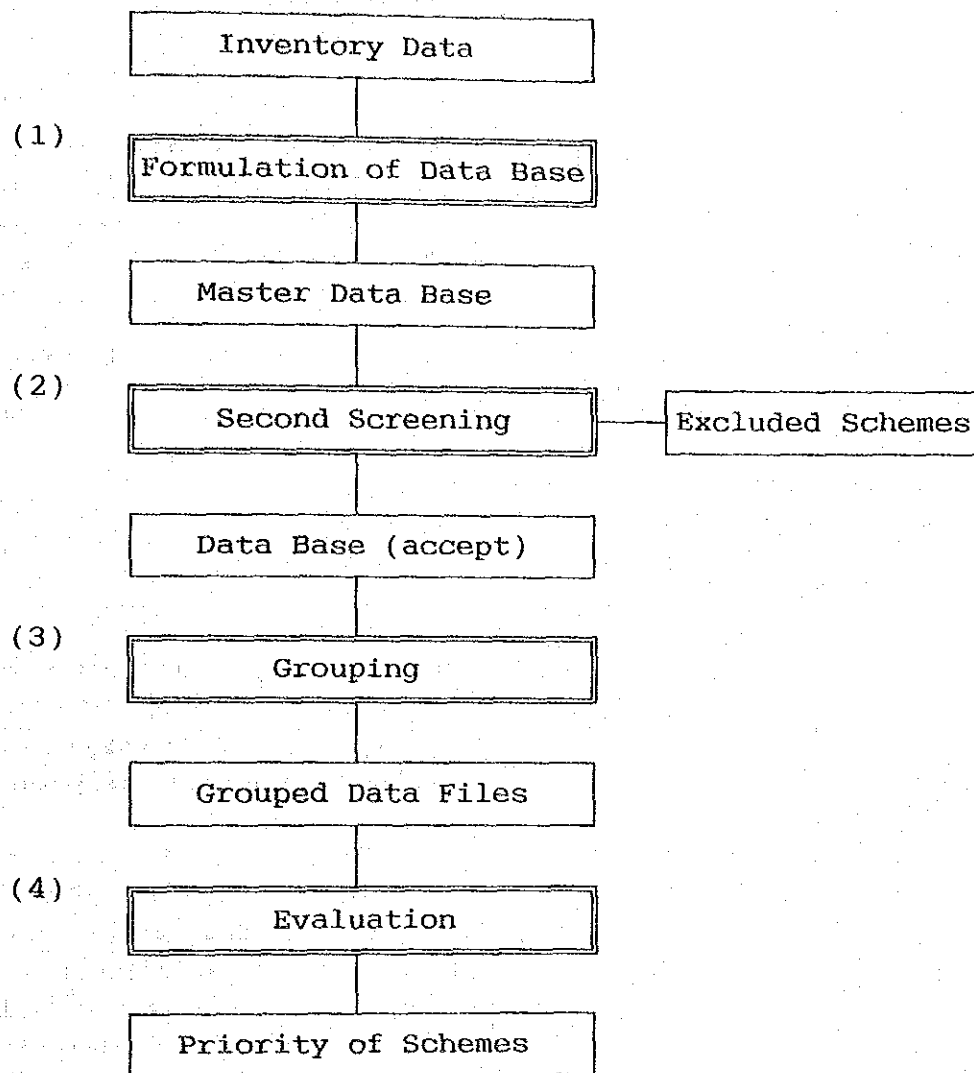


Fig. 3-4-1 GENERAL WORK FLOW ON DATA ARRANGEMENT

3.5 Inventory Survey by Indonesian Side

(1) Summary

In the following five (5) provinces, Ministry of Agriculture is now carrying out the same inventory survey for land development schemes and rehabilitation of village irrigation scheme from May 1991 in accordance with the Scope of Work and Minutes of Understandings for land Development Project between JICA and MOA Indonesia.

1. Aceh
2. Lampung
3. Central Sulawesi
4. Southeast Sulawesi
5. East Nusa Tenggara

After technical guidance by the Study team, each provincial agriculture service has started to carry out the inventory survey using the same questionnaire form. The results of inventory survey are arranged by DRLD in order to make development plan in the above 5 provinces.

Data of each inventory survey table has been already programmed in dBASE4 and printed out. The works were mostly classified by village irrigation. Points to consider are that there were many unsure present and scheduled land utilization areas in data. This requires to confirm such values and modify in future.

(2) Classification and Potential Areas by Inventory Survey Results

a. Classification

Name of Province	Surveyed Kabupaten	Land Development Scheme	Village Irrigation Scheme	Total Scheme
	nos	nos	nos	nos
Aceh	7	4	139	143
Lampung	4	26	117	143
Southeast Sulawesi	4	4	59	63
Central Sulawesi	4	-	82	82
NTT	8	21	43	64
Total	27	55	440	495

b. Excluded Schemes by DLRD

Name of Province	Land Development Scheme	Village Irrigation Scheme	Total Scheme
	nos	nos	nos
Aceh	-	-	-
Lampung	-	-	-
Southeast Sulawesi	-	-	-
Central Sulawesi	-	10	10
NTT	-	10	10
Total	-	20	20

c. Present Irrigated Paddy Field Areas

Name of Province	LD Schemes		VI Schemes		Total	
	No. of Scheme	Paddy Area	No. of Scheme	Paddy Area	No. of Scheme	Paddy Area
	nos	ha	nos	ha	nos	ha
Aceh	4	445	113	9,283	137	9,778
Lampung	25	3,734	115	9,643	140	13,377
Southeast Sulawesi	3	206	45	7,458	48	7,664
Central Sulawesi	-	-	69	6,515	69	6,515
NTT	19	4,974	31	916	50	5,890
Total	51	9,359	393	33,815	444	43,618

Average : 98ha/nos

Note-1; Except for excluded schemes by DLRD.

2; Areas with unsure area excluded.(both of present and future lands have no area data)

d. Potential Development in Inventory Schemes

Rough estimation of potential development from present and future paddy field area of the investigated inventory data provides as follows, except the areas not satisfying the conditions of the guideline to select the objective schemes and having unsure area.

Potential in Land Development Schemes

Name of Province	Number of Scheme	Potential Area	Average Area
	nos	ha	ha/nos
Aceh	1	25	25
Lampung	21	2,938	140
Southeast Sulawesi	3	349	116
Central Sulawesi	-	-	-
NTT	14	1,564	112
Total	39	4,876	125

Potential in Village Irrigation Schemes

Name of Province	Number of Scheme	Potential Area	Average Area
	nos	ha	ha/nos
Aceh	93	8,039	86
Lampung	67	6,218	93
Southeast Sulawesi	44	8,025	182
Central Sulawesi	67	9,396	140
NTT	28	2,088	75
Total	299	33,766	113

VI. PRESENT STATUS OF THE PROJECT AREA

4.1 Meteorology and Hydrology

In the Study area, a lot of meteorological observation station and water level measuring station have been established by Provincial Public Works (DPU) and Agricultural Services (PRAS). Rainfall, temperature, relative humidity, wind velocity, evaporation, sunshine ratio, etc. are observed at meteorological observation stations and at water level measuring stations along rivers, water level, discharge, water quality, etc. are observed.

The collected data of the hydrology on the inventory survey are monthly rainfall, discharge of river, dimension of river, name of river for water source, water quality, flood, draught, etc..

4.1.1 Meteorology

(1) North Sumatera Province

In the North Sumatera Province, north-east monsoon gives annual rainfall over 4,000 mm to the area facing the Indian Sea and annual rainfall of 1,500 mm to 2,000 mm to the side of the Strait of Malacca gentling the influence of the Barisan range.

The area along the Toba lake is the basin surrounded by the mountains more than 2,000 m in elevation and has hardly the influence of the monsoon, and has annual rainfall less than 1,500 mm as shown in Fig. 4-1-1.

The wet season usually occurs in October to March. Actually, however, monthly rainfall of about 100 mm is observed even in the dry season. Especially, in the central Tapanuli District with annual rainfall over 4,000 mm, monthly rainfalls more than 200 mm are recorded throughout the year and make rain-fed paddy cultivation possible twice a year as shown in Table 4-1-1.

The average annual air temperature is 31.7°C at the maximum and 23°C at the minimum.

The average relative humidity is about 83%.

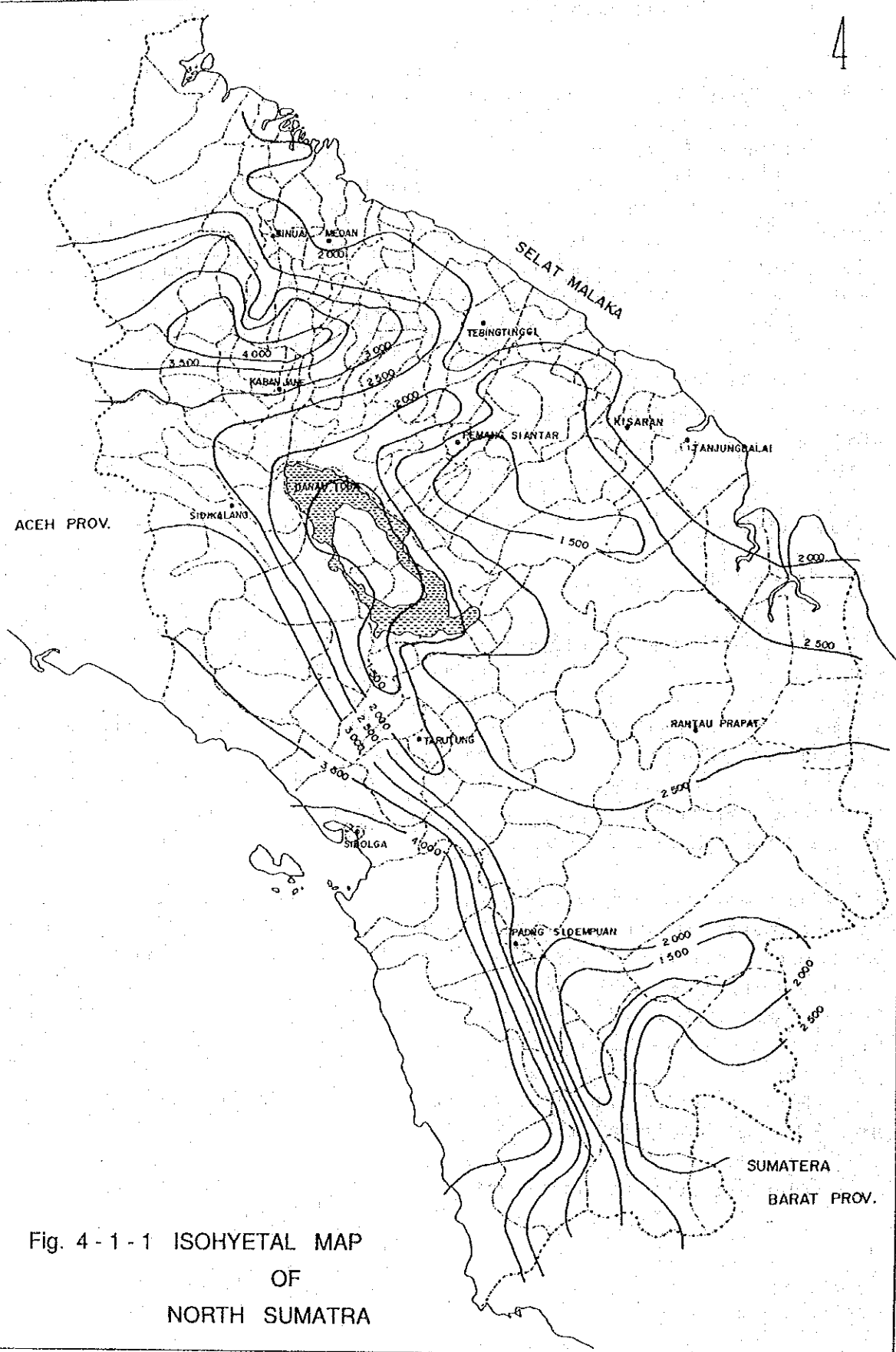


Fig. 4 - 1 - 1 ISOHYETAL MAP OF NORTH SUMATRA

Table 4-1-1 AVERAGE MONTHLY RAINFALL BY REGION
IN NORTH SUMATRA PROVINCE

Unit : mm

MONTH	TAPANULI SELATAN	TAPANULI TENGAH	ASAHAN	LANGKAT
January	163	471	161	44
February	203	150	155	100
March	313	351	33	27
April	112	617	110	135
May	56	197	152	296
June	26	197	104	152
July	100	520	189	256
August	60	223	147	94
September	103	227	703	235
October	155	676	192	276
November	261	305	204	453
December	103	593	156	278
Total	1655	4527	2306	2346
Average(1990)	138	377	192	196
Average(1989)	119	329	210	176
Average(1988)	173	368	181	166
Average(1987)	169	388	195	175
Average(1986)	135	336	-	177

Source: DIPERTA North Sumatra

(2) South Sulawesi Province

The rainfall in the South Sulawesi Province is generally characterized that the annual rainfall of about 3,000 to 4,000 mm is found at the areas centering the north and south mountainous zones and the area between the above two mountainous areas has the annual rainfall of about 1,500 to 2,000 mm as shown in Fig. 4-1-2.

The wet season in the western area of the Province is different from that in the eastern area. The center of the wet season along the west coastal area is December to January and that on the east coastal area April to May. The central part of the Province, for example, at the Soppeng district, has two peaks in the season getting the influences from both the areas as shown in Table 4-1-2.

The average annual air temperature is 31°C at the maximum and 22.9°C at the minimum.

The average relative humidity is about 80%.

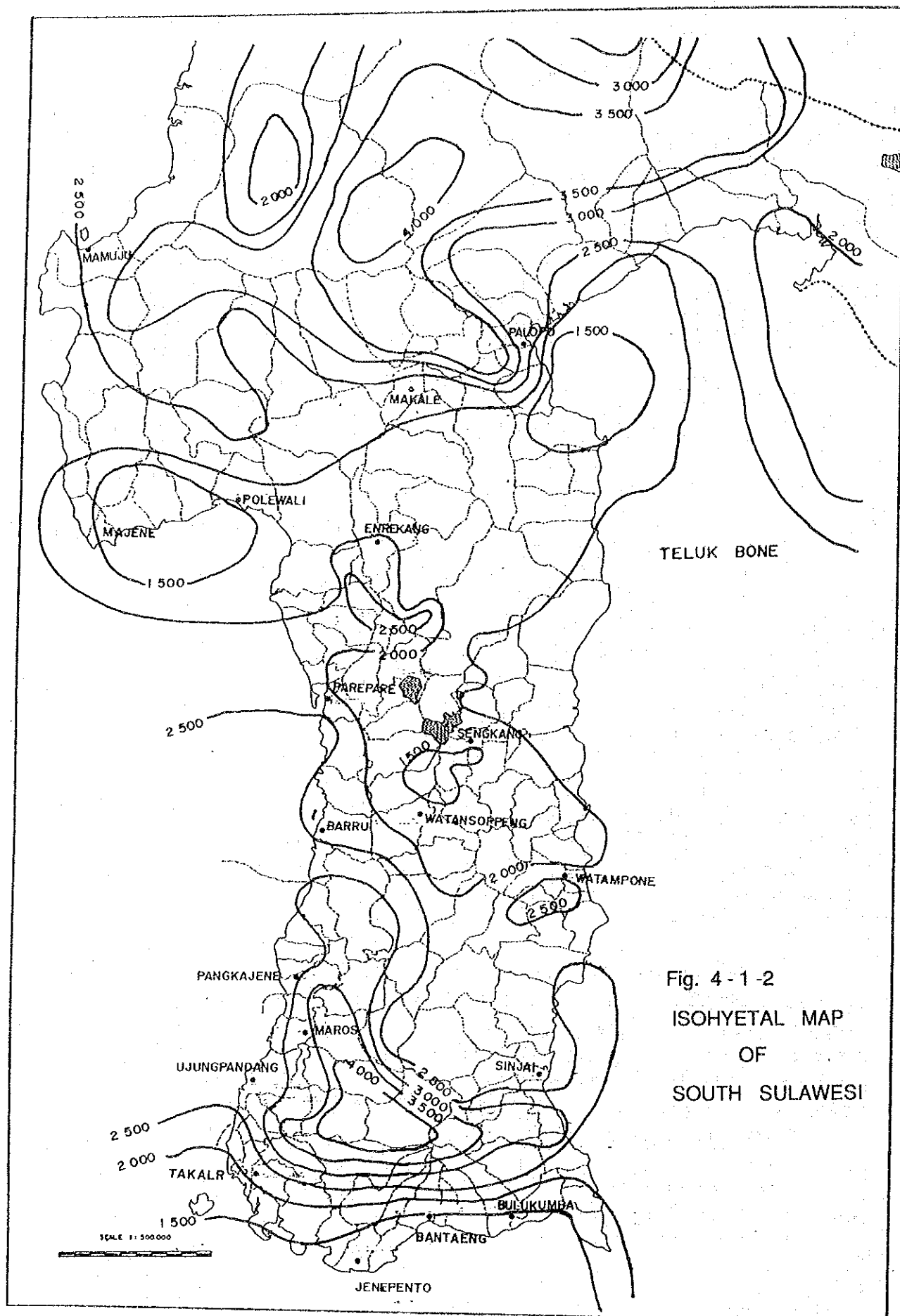


Fig. 4-1-2
 ISOHYETAL MAP
 OF
 SOUTH SULAWESI