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WATER RESOURCES DEVELOPMENT

NEGARA RIVER BASIN
OVERALL IRRIGATION DEVELOPMENT
PLAN STUDY

EXECUTIVE SUMMARY

JUNE 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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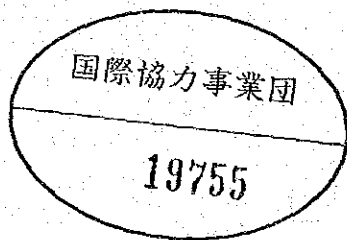
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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a study on Negara River Basin Overall Irrigation Development Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of Indonesia a study team headed by Mr. Yasuhiko Kunihiro, Nippon Koei Co., Ltd., four times from March, 1988 to March, 1989.

The team held discussions with the officials concerned of the Government of the Republic of Indonesia and conducted a field survey in Negara river basin. 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 development of the project and to the promotion of friendly relations between our two countries.

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

June, 1989



Kensuke Yanagiya

President

Japan International Cooperation Agency

ABSTRACT

NEGARA RIVER BASIN OVERALL IRRIGATION DEVELOPMENT PLAN STUDY

1. Scope of Work (S/W)

The "Scope of Work for the Negara River Basin Overall Irrigation Development Plan Study" was concluded between JICA and DGWRD on July 29, 1987. Based on S/W, the Study was commenced in March 1988 and results of the Study were compiled into the final report which JICA submitted to DGWRD in June 1989.

2. Outline of the Proposed Development Plan

- (1) The Study Area is located in the northwestern part of South Kalimantan and has a total area of about 12,680 km².
- (2) The development plan aims at stabilizing crop production and elevating farmers' living standard through consolidation of crop production bases, strengthening of agricultural services and improvement of farmers' abilities by the effective use of land, water and human resources in the Study Area.
- (3) The target year of the development is set up in 2018, the final year of Repelita X.
- (4) From engineering viewpoints, a total of 104 candidate schemes including the existing 68 schemes were identified in the Study Area. Among these schemes, economic comparison is made for the screening of prior development schemes, and 76 schemes are selected for implementation in the next 30 years.
- (5) Based on the development priorities of the 76 selected schemes, the following four package projects are formulated:

(Unit: No. of schemes)

Project	Irrigation Scheme	Drainage Scheme	Polder Scheme	Aquaculture Scheme	Total
Negara Pilot Project	1	3	1	0	5
Negara Irrigation and Drainage Upgrading Project	5	18	0	1	24
Upper Negara Agricultural Development Project	15	8	4	1	28
Lower Negara Agricultural Development Project	9	9	0	1	19
Total	30	38	5	3	76

(6) The total investment for the implementation of these four package projects is estimated to be Rp. 357,629 million in terms of 1988 financial prices:

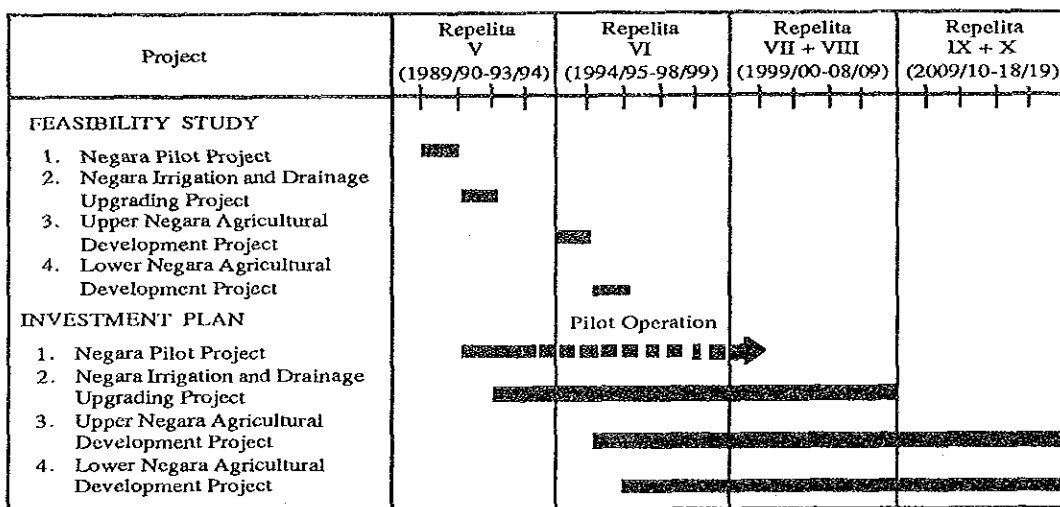
1) Negara Pilot Project	:	Rp. 17,639 million	(11,200 ha)
2) Negara Irrigation and Drainage Upgrading Project	:	Rp. 40,363 million	(26,768 ha)
3) Upper Negara Agriculture Development Project	:	Rp. 140,938 million	(37,080 ha)
4) Lower Negara Agricultural Development Project	:	Rp. 158,689 million	(35,360 ha)
Total	:	Rp. 357,629 million	(110,408 ha)

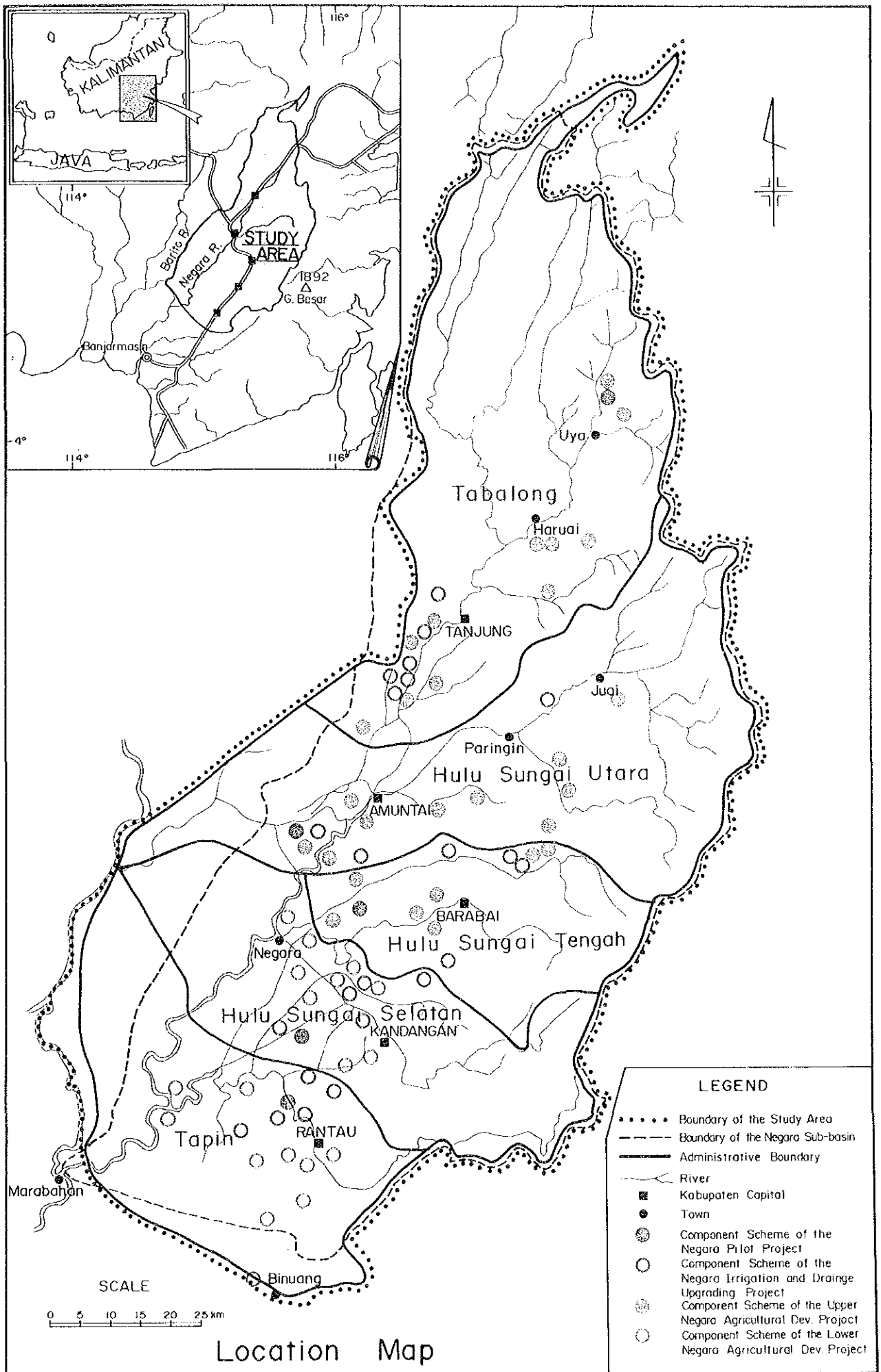
(7) If it is possible to increase public investment for water resources development in the Study Area with an annual growth rate of 10% (at National level it is 7.0% p.a. in IBRD's projection) up to 2018, the total investment available for the next 30 years would be Rp. 397,080 million in terms of 1988 financial prices. This scale of investment would cover the above implementation investment.

(8) The completion of the proposed four package projects would make possible for the production of 880,000 tons of paddy annually, and this amount would meet the projected paddy production (815,600 tons in 2018) required in the Study Area for a well-balanced demand and supply in Kalimantan island. In addition, the completion of the four package projects would bring about the following effects:

- Increase of population growth rate from the projected 0.65% p.a. to 1.18% p.a.,
- Increase of gross income of typical farmers by 70%, and
- Contribution to foreign exchange savings of about US\$74 million and export earnings of US\$ 39 million (1988 constant prices).

3. Proposed Implementation Program





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1. INTRODUCTION

Authority

This Final Report was prepared in accordance with the Scope of Work (S/W) for the Negara River Basin Overall Irrigation Development Plan Study (the Study) agreed upon between the Directorate General of Water Resources Development (DGWRD), Ministry of Public Works, and Japan International Cooperation Agency (JICA) on July 29, 1987. This report presents the results of technical and economic studies on development of agricultural potential in the Negara sub-basin.

This Final Report consists of three volumes as follows.

- 1: Executive Summary
- 2: Main Report
- 3: Annexes
 - Annex A Socio-economy
 - Annex B Hydrology
 - Annex C Land Resources
 - Annex D Agronomy
 - Annex E Agro-economy
 - Annex F Irrigation
 - Annex G Drainage and Polder
 - Annex H Rural Infrastructure
 - Annex I Inland Fishery
 - Annex J Project Evaluation

Background of the Study

In response to the request of the Government of Indonesia (GOI), the Government of Japan (GOJ) conducted a reconnaissance survey to establish a plan for developing potential natural resources of the Barito river basin. From this survey, the Negara and Martapura sub-basins were selected as priority areas for the implementation of land reclamation and irrigation projects in the Barito river basin. The cartography of the two sub-basins were realized by Japan during the period of 19971 to 1973. Moreover, the Martapura-basin hydropower and irrigation projects were studied and implemented by the GOJ assistance.

For the other Negara sub-basin, GOJ undertook the mapping in the upstream part of the Negara sub-basin, and prepared mosaic photos and thematic maps of the middle of part of the Negara sub-basin.

With these in view, the GOI requested the GOJ to carry out the "Negara River Basin Overall Irrigation Development Plan Study". In reply to this request GOJ (JICA) sent preliminary survey team and concluded the S/W with GOI.

Objectives of the Study

The Study aims at the following objectives:

- To formulate a plan for the Negara River Basin Overall Irrigation Development in South Kalimantan, and
- To provide transfer of technology to Indonesian counterpart personnel in the course of the Study.

Study Area

The Study Area covers 12,683 km² as a whole comprising the Negara sub-basin and its affected area in the South Kalimantan Province including the five Kabupatens of Tabalong, Hulu Sungai Utara, Hulu Sungai Tengah, Hulu Sungai Selatan and Tapin.

Target Year of Development

In conformity with the Repelita V and the second 25 Years Long-Term Development Program, the target year for long-term development of the Negara sub-basin is set up for 2018.

Work Activities

On the basis of S/W, the Study was commenced in March 1988. It comprises three phases for a total study period of 15 months as shown below.

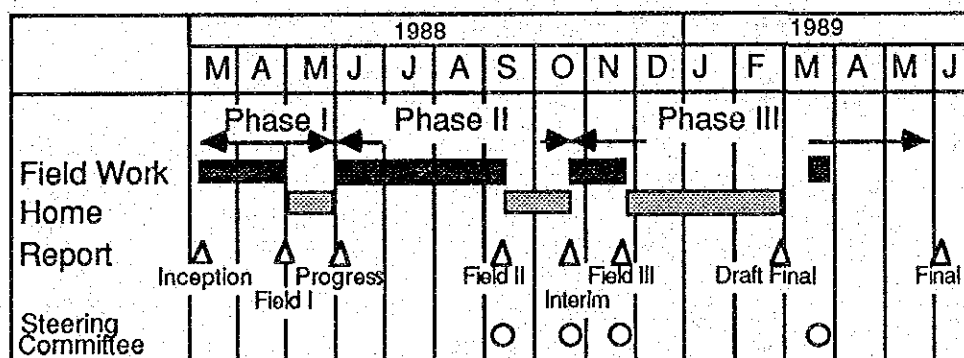


Figure 1 Work Activities

Steering Committee

The Government of Indonesia organized the Steering Committee both at central and provincial levels for this Study to discuss the study results presented in the Reports. All the comments, proposals, and suggestions given by the committee members were reflected in this Final Report.

2. ECONOMIC BACKGROUND

National Economic Background

In Repelita IV (1984-1989), the Government of Indonesia has given priority to the promotion of non-oil exports in consideration of the international oil market price situation. To overcome structural defects of Indonesia's economy, the Government of Indonesia devised a series of countermeasures which include devaluation of domestic currency, acceleration of non-oil exports, encouragement of direct foreign investment and drastic cut in financial budgets. Through the execution of such countermeasures, the Indonesian economy has shown gradual improvement.

Regional Economic Background

The gross regional domestic product (GRDP) in 1983 by major islands is illustrated in Figure 2. In the whole Kalimantan, GRDP at current market price was Rp.5,966 billion in 1983.

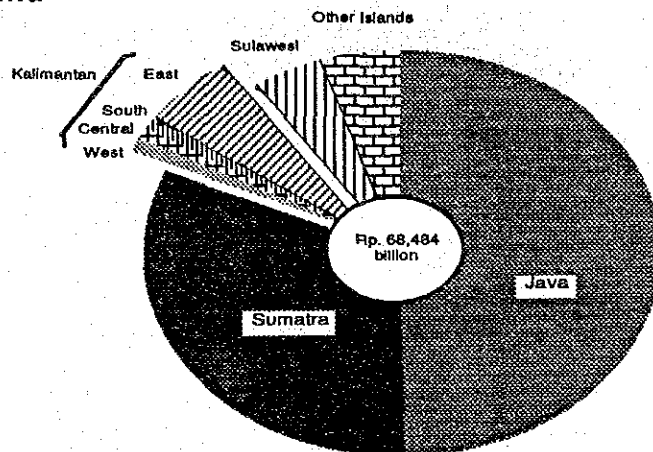


Figure 2 GRDP by Region in 1983

The South Kalimantan Province contributed for 14% of the 1983 current GRDP of Kalimantan as illustrated in Figure 2. Agriculture is the most important sector in the economy of the South Kalimantan Province. The contribution of this sector to real GRDP was maintained at the level of 31% for the last three years as illustrated in Figure 3.

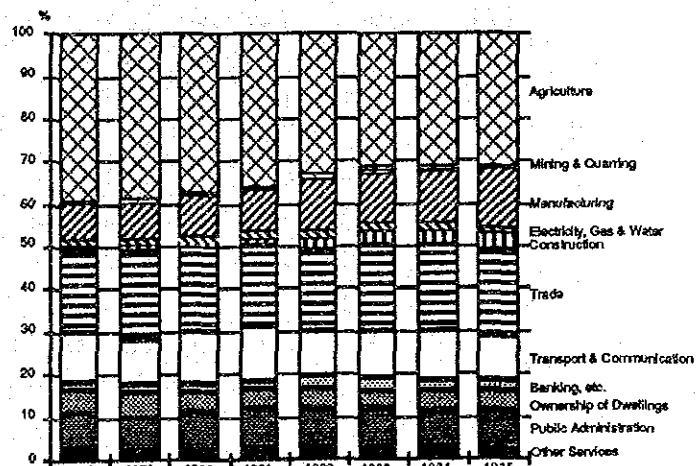


Figure 3 GRDP Share by Sector in South Kalimantan

3. STUDY AREA

Natural Condition

Topography of the Study Area is flat in the southeastern part, hilly in the middle part and mountainous in the north to east. The highest peak is the Gunung Besar with its elevation at 1,901 m, located on the eastern border of the Study Area. While the lower part elevation is about one meter. Geologically, Tertiary and Quaternary sediments predominate over the swamps and alluvial plains, while the hills and mountains are featured by karst and volcanic intrusives, respectively. Soils extending over the hilly area are commonly podzolic soils, while the lower part of the alluvial plains is characterized by alluvial soils. Peat soils develop in the inland swamps.

The Study Area has typical tropical monsoon climate. Average annual rainfall ranges between 2,000 mm and 2,500 mm. The following graph shows monthly rainfall pattern of major towns in the Study Area

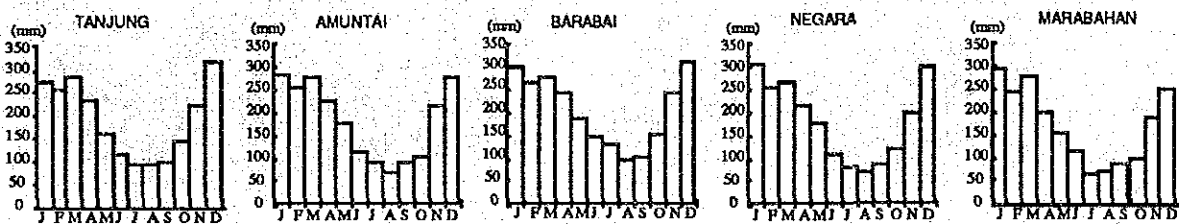


Figure 4 Monthly Rainfall

The Negara sub-basin has 10,842 km² of catchment area with monthly mean runoff of 337 m³/sec at Marabahan. The inland swamps cover one third of the Study Area and extend over the middle to lower reaches of the Negara river. One third of the swamp area has thick peat soil layer.

Socio-economic Status

Administrative divisions and population of the Study Area are shown below:

Kabupaten	Area (km ²)	No. of Kecamatan	No. of Desa	Population	Density (prs/km ²)
Tabalong	3,946	11	183	134,700	34
H.S.U.	2,771	12	397	247,100	89
H.S.T.	1,472	8	435	205,400	140
H.S.S.	1,803	10	228	182,700	101
Tapin	2,663	10	132	120,400	45
Total	12,655	51	1,375	890,200	70

Rural infrastructures in the Study Area consist of a good road network but electric supply and domestic water supply are inadequate compared to the national average.

Item		Study Area	Province	Country
Road condition				
Road density	(m/km ²)	44	30	24
Per capita road length	(m/person)	0.6	0.5	0.3
Road pavement condition	(%)	79	70	65
Electric power supply				
Install capacity per family	(watt)	17	255	125
Domestic water supply				
Water supply per family	(liter)	19	51	41

Agricultural Situation

Land use: The present land use in the Study Area is tabulated below:

(Unit: ha)

Paddy Field	Land Use Swamps	Alluvial Plains	Alluvial Valleys	Plains	Hills	Mountains	Total
Forest	147,535	707	1,060	52,591	59,458	204,385	465,736
Bush	74,217	2,325	-	44,102	36,338	45,585	202,567
Grassland	47,374	-	3,878	70,878	23,646	8,139	153,915
Paddy	91,474	71,700	2,326	-	-	-	165,500
Estate	-	37,686	28,747	75,741	-	-	142,174
Upland & shifting	36,764	4,004	2,788	28,857	7,137	3,880	83,430
Towns & Others	9,382	24,552	4,735	11,023	-	-	49,692
Water	5,254	-	-	-	-	-	5,254
Total	412,000	140,974	43,534	283,192	126,579	261,989	1,268,268

Irrigation facilities: In the Study Area, there are 30 irrigation schemes covering 1,450 ha of simple irrigation, 2,360 ha of semi-technical irrigation and 7,240 ha of technical irrigation.

The present condition of irrigation facilities in the Study Area is explained below:

- As diversion weir sites are located at the foot of hills, diversion weirs of all the simple irrigation systems have collapsed and been carried away. The existing diversion weirs also suffer from leakage from weir bodies, seepage into lower parts of weir bodies and scouring of downstream aprons.
- Main canals running along the foot of hills are heavily sedimented by soils. Leakage from and breakdown of earth canals occur frequently.

Due to improper design or construction, delivery of water to paddy fields is often impaired.

Drainage and polder facilities: There exist 29 drainage schemes and nine polder schemes in the Study Area with command areas of 38,370 ha and 16,330 ha, respectively.

The present drainage facilities are categorized in the following five types:

Type of Drainage System	No. of Schemes	Area
Type A Canal	14	16,955
Type B Water course and gate (stop log)	5	2,425
Type C Dyke and gate (stop log)	7	7,939
Type D Canal and gate (stop log)	3	11,050
Type E Canal, gate and dyke	0	0
Total	29	38,369

Among the nine polder schemes, Alabio polder can be defined as a technical system and the other eight polder schemes are simple type. Bottlenecks in the existing drainage schemes are due mainly to sedimentation, shortage of canals and waterways, damage of dikes and gates and insufficient access roads.

Crop production: Major agricultural products are rice and rubber followed by coconut. Paddy cultivation is broadly conducted in the swamps and alluvial plains. Several types of paddy cropping calendars are observed for different paddy field conditions in the Study Area as shown below.

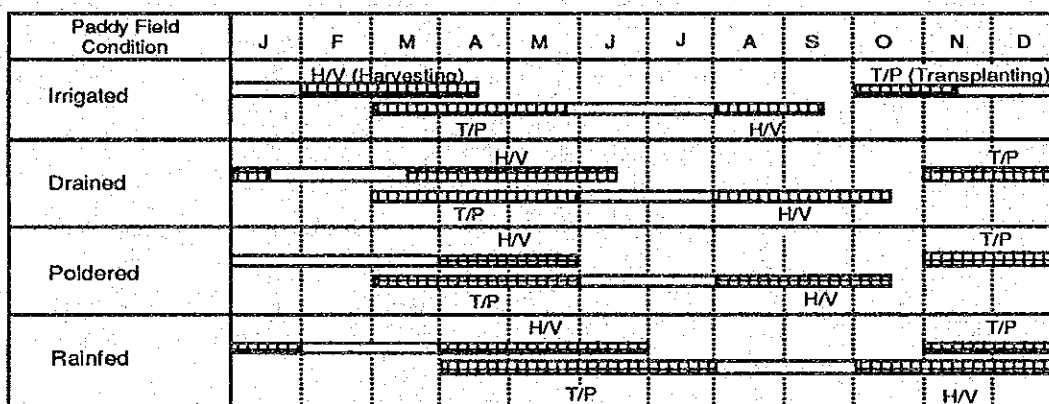


Figure 5 Typical Paddy Cropping

Tree crops are grown by smallholders and estates in the Study Area. Major tree crops comprise rubber, coconut, coffee, cloves and pepper. The average crop yield

and production for the last five years in the Study Area are tabulated in the following table.

	Area Harvested (1000ha)	Production (1000 ton)	Yield (kg/ha)
Paddy (wet land)	116.11	395.57	3,407
Paddy (dry land)	12.68	21.93	1,729
Maize	2.53	1.99	786
Cassava	1.71	12.41	7,236
Sweet potato	1.06	5.28	4,992
Soybeans	0.68	0.57	836
Groundnuts	3.71	3.27	881
Mungbeans	0.40	0.22	561
Vegetables	2.71	4.69	1,731
Rubber	68.65	24.81	361
Coconut	21.28	14.51	682
Coffee	2.23	0.50	223
Cloves	3.50	0.15	42
Pepper	0.43	0.15	347
Banana	1.33	5.04	3,798
Rambutan	0.30	1.18	3,886
Citrus	0.34	1.30	3,793

Inland open fishery: Inland open water fishery production is also one of major income sources in the Study Area. The average annual fish catch is 38,800 tons, 30% of which are processed into dried fish and sold to markets in Java.

	(Unit :ton)		
	1984	1985	1986
Indonesia	269,321	269,266	273,012
Kalimantan	139,962	140,771	144,990
South Kalimantan	52,545	53,153	58,063
Study Area	37,294	38,064	39,554

Agro-economic Situation

Agro-economic features in the Study Area are as follows:

Fam Population (person)	Fam Households (no.)	Family Size (person)	Land Holding Size (ha)	Land Owner (no.)
675,300	158,700	4.3	0.8	138,200

There are a number of agricultural supporting services concerned directly or indirectly to the farmers, however present conditions of agricultural supporting services required further improvement as shown below:

	Research/ Breeding	Extension	Credit	Input Supply	Marketing
Paddy	A	B	A	A	A
Root crops	B	B	C	C	C
Palawija crops	A	A	B	A	A
Vegetables	B	B	B	B	B
Fruit trees	B	B	C	C	B
Inland fishery	A	B	C	C	A
Aquaculture	B	B	B	B	B
Estate crops	B	A	A	A	A
Livestock	B	B	A	B	B

Where, alphabet A, B and C indicate following requirements.

- Requirement A : Present service activities are still behind the national level and further improvement is urgently required,
- Requirement B : Present service activities are still behind the national level and further improvement is required for the future, and
- Requirement C : Present level of service activities are continuously required.

Under DPUP South Kalimantan, Sub-Dinas Water Resources Development is responsible for operating and maintaining public main and secondary irrigation and drainage systems and Water Users' Associations at the village level is responsible for tertiary systems.

In the Study Area, 71 Water User's Associations have been organized, however most Associations are dormant mainly due to poor tertiary system development.

4. DEVELOPMENT STRATEGY

Constraints for Development

Major Constraints at national level are itemized below:

- Considerable increase in population and labor force
- Disparity of population distribution between Java and Off-Java
- Disparity of income distribution among regions
- Maintenance of food self-sufficiency
- Importance of non-oil exports acceleration

Constraints in the Province and the Study Area are also itemized below:

- Population outflow
- Lack of irrigation and drainage facilities for crop production
- Lack of sense about proper utilization of irrigation and drainage facilities
- Insufficient institutional agricultural services

Development Needs

Socio-economic projection: The future population in the year 2018 is estimated below:

(Unit: 1,000 person)

	1985	1998	2008	2018
Indonesia	163,876	212,260	256,220	309,280
Java	99,502	117,090	131,800	148,350
Off-Java	64,374	94,890	123,140	159,800
South Kalimantan	2,315	3,025	3,670	4,450
Study Area	890	980	1,036	1,102

The food balance projection in years 1998, 2008 and 2018 is carried out and evaluated as shown below:

	Indonesia			South Kalimantan			Study Area		
	1998	2008	2018	1998	2008	2018	1998	2008	2018
Rice	0	0	0	+	+	+	+	+	+
Maize	0	+	+	-	-	-	-	-	-
Cassava	0	0	0	-	-	-	-	-	-
Sweet potato	0	0	0	-	-	-	-	-	-
Soybeans	-	-	-	-	-	-	-	-	-
Groundnuts	-	-	-	0	-	-	+	+	+
Coconuts	0	0	0	+	+	+	+	+	+
Vegetables	0	0	0	-	-	-	-	-	-
Fruits	0	0	0	-	-	-	-	-	-
Meat	0	-	-	-	-	-	+	+	+
Eggs	0	0	0	+	+	0	+	+	+
Milk	-	-	-	-	-	-	-	-	-
Fishes	0	0	0	+	+	+	+	+	+

Remarks: +; supply/demand ratio of more than 1.10
 0; supply/demand ratio a ranging between 0.91 and 1.09
 -; supply/demand ratio of less than 0.90

Rice supply/demand in Kalimantan: In the same manner, supply/demand projection for rice alone is carried out for the four provinces in Kalimantan island in order to know the food balance of rice within the island. In the future, rice surplus from South Kalimantan would supplement rice shortage of the neighboring provinces.

Development needs: In order to improve the farmers economy as well as the regional economy, crop productivity has to be increased by adopting following development measures.

- Rehabilitation, upgrading and new development of irrigation system,
- Upgrading and new development of drainage systems in promising parts of the swamp areas keeping pace with the increasing demand of food crops,
- Improvement of operation and maintenance of irrigation and drainage systems,
- Further promotion of crop diversification particularly in the wet paddy field through the strengthening of intensification program for palawija crops, and
- Supplying of more comprehensive and effective institutional agricultural services.

In the non-oil exports sector, agricultural commodities particularly estate crops are playing an important role. Production of estate crops should be increased in the Study Area in order to contribute to Indonesia's economy and farmers economy.

Development needs of estate crops are considered to be followings:

- Completion of on-going NES development schemes which have been stopped due to Indonesia's budget austerity,
- More extensive rehabilitation of the existing smallholders and private estates,
- Improvement of poor processing facilities causing processing losses and low quality of products,
- Promotion of further development of PMU and private estates as far as areas are available, and
- Strengthening of institutional services in order to realize the above development needs.

The Study Area possesses important inland fishing ground. The development needs of fishery by preserving natural environment of the swamp areas can be considered as follows:

- To review fish production system from an economic point of view considering fishery resource condition and artificial propagation measures,

- To increase aquaculture production in the potential areas, and
- To strengthen necessary supporting services in the fishery sector.

In hilly and mountainous regions of the Study Area, there exist vast shifting cultivation area, along-along grassland and bushes. The development needs of watershed management can be considered as follows:

- Promotion of reforestation,
- Acceleration of forest conservation through proper forest resource management, and
- Assistance to shifters for their settlement through the enhancement of job opportunities especially in agricultural sector.

Development Potentials

Potential land resource: The Study Area of 1,268,268 ha is classified by the average steepness as follows:

Average Slope	Area (ha)	Proportion (%)
< 2%	596,508	47.0
2 - 8%	149,753	11.8
9 - 25%	121,561	9.6
26 - 40%	12,848	1.0
40% >	387,598	30.6
Total	1,268,268	100.0

The land with the average steepness of less than 25% is suitable for crop cultivation in the Study Area and covers 867,820 ha in total. This land is categorized into four physiographic types as shown below:

	slope		Total
	less than 2%	2 - 25%	
Swamps	412,000	0	412,000
Alluvial plains	140,974	0	140,974
Alluvial valleys	43,534	0	43,534
Plains	0	271,314	271,314
Total	596,508	271,314	867,822

Land resource development potentials for crop cultivation purposes are summarized below:

- In the swamps of 412,000 ha, potential areas for drainage improvement and polder development are estimated at 125,070 ha.
- In the alluvial plains and alluvial valleys, available land resources for reclaiming new farm land are limited due to full utilization of land for crop cultivation. Out of the paddy field of 71,700 ha in the alluvial plains and 2,330 ha in the alluvial valleys, irrigation facilities are available in only 9,650 ha at present.
- Out of the plains of 283,190 ha, 73,950 ha of grassland and bush areas have land resource development potential for the use of tree crop production.

Potential water resource: Applying mathematical simulation model, 80% dependable low flow are estimated for each seven sub-systems as shown below:

(Unit: m³/sec)

Sub-System	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Tabalong Kiwa	58	56	56	48	39	29	25	22	20	22	33	53	462
Tabalong Kanan	47	45	45	39	32	24	20	18	16	18	26	43	373
Tabalong	41	40	42	37	27	20	15	13	13	14	22	39	324
Balangan	76	75	63	49	47	43	36	29	29	29	46	69	591
Batang Alai	66	69	69	64	55	44	36	28	23	23	34	55	565
Tapin	57	54	61	48	36	25	17	13	12	15	23	42	403
Negara	43	44	47	40	31	21	15	12	11	11	17	32	324

Basic Development Concepts

The following concepts are established as a guideline for the development of the Negara sub-basin:

- Consolidation of food crop production bases with provision of irrigation and drainage facilities which will contribute to the increase of farmer's income, elevation of their living standards and maintenance of food self-sufficiency,
- Development of existing potentials to establish a production center for cash crops and inland freshwater fisheries in line with the policy on enhancement of non-oil income sources, and
- Improvement of agricultural supporting services in order to strengthen farmers' capabilities for utilizing production bases and receiving support services in an effective manner.

Development Measures

Agricultural development: Present cropping intensity of 102% will be increased to 157% by introducing improved farming practice and improvement of irrigation and drainage facilities. Proposed cropping calendars are shown below:

Paddy Field Condition	J	F	M	A	M	J	J	A	S	O	N	D
Irrigated	Paddy		T/P (Transplanting)		Paddy		P (Planting)		T/P		T/P	
	Paddy		P (Palawija)		Paddy		T/P		Paddy		T/P	
Drained	Paddy		P		T/P (Palawija)		Paddy		T/P		T/P	
	Paddy		T/P		Paddy		T/P		Paddy		T/P	
Poldered	Paddy		P		T/P (Palawija)		P		Palawija		T/P	
	Paddy		T/P		Paddy		T/P		Paddy		T/P	
Rainfed (Alluvial plains and valleys)	Paddy		P		T/P		P		Palawija		T/P	
Rainfed (Swamps)	Paddy		P		T/P		P		Palawija		T/P	
	Paddy		P		T/P		P		Palawija		T/P	

Figure 6 Proposed Cropping Calenders

Inland fishery development: For the efficient utilization of fishing grounds and upgrading fishery activity, the following alternative measures are considered:

- Specialization of fisheries for selected fishermen groups,
- Introduction of modern fishing vessels,
- Application of fishery resources improvement measures,
- Utilization of open water areas for aquaculture,
- Introduction of freshwater shrimp aquaculture,
- Formulation of fishery regulation, and
- Formulation of fishery resources monitoring system in order to collect basic data and control of the these fishery activities.

Irrigation water supply: Irrigation development potential areas delineated by topographic condition, water availability and cropping pattern as shown below:

(Unit: ha)

Kabupaten	Rainfed in Alluvial Plain	Bush in Alluvial Plain	Rainfed in Swamp Area	Total
Tabalong	2,840	0	0	2,840
H.S.U.	5,905	0	785	6,690
H.S.T.	8,500	0	1,400	9,900
H.S.S.	6,780	0	0	6,780
Tapin	3,530	2,100	400	6,030
Study Area	27,555	2,100	2,585	32,240

Possibility of dam construction: There exist 13 possible dam sites, though expected benefits are not high enough to cover additional investment costs required for dam construction.

Drainage improvement and polder development: A total of 32,530 ha delineated as possible areas for drainage improvement and polder development considering depth of peat layer, easiness of water level control by drainage facilities, availability of water supply sources and existence of access road as shown below:

(Unit: ha)

Kabupaten	Drainage Improvement		Polder Development	Total
	Planned	New		
Tabalong	-	830	-	830
H.S.U.	4,600	-	2,800	7,400
H.S.T.	600	3,300	-	3,900
H.S.S.	3,500	10,300	600	14,400
Tapin	4,000	2,000	-	6,000
Study Area	12,700	16,430	3,400	32,530

The present and target levels of drainage facilities in existing 29 drainage schemes are illustrated below:

Type of Drainage System	No. of Schemes at Present Level	No. of Schemes at Target Level
Type A Canal	14	(5)
Type B Water course and gate (stop log)	5	(14)
Type C Dyke and gate (stop log)	7	(7)
Type D Canal and gate (stop log)	3	(3)
Type E Canal, gate and dyke	0	19
Total	29	29

As for the possibility of new drainage improvement, the result of technical evaluation reveals that there are nine schemes which have been identified covering 16,430 ha as a whole.

Out of the total existing polder scheme area of 16,329 ha, 2,630 ha have not been developed as wet paddy field. This undeveloped area comprises 1,780 ha for six on-going schemes and 1,450 ha for the Alabio polder scheme. In due consideration of farmers' activities and topographic conditions in the Alabio polder, undeveloped submerged area of 1,450 ha will have to be kept as a fishing ground instead of developing it into wet paddy field. Polder development possibility in the Study Area is evaluated on the basis that the prevailing gravity polder system is applied and without any introduction of mechanical irrigation/drainage measures. Only 3,400 ha are identified as potential areas for polder development in the swamps.

Social infrastructures: The new installation/extension plans of piped water supply systems which are constructed based on the Government's criteria/policy and the future population growth forecast are shown below:

(Unit: liter/sec)

Kabupaten	Kecamatan/ City	Capacity of Facility to be installed
Tapin	Tapin Tengah	2.5
Tapin	Candi Laras Utara	2.5
Tapin	Rantau	10.0
H.S.T.	Labuan Amas Utara	2.5

Road pavement condition of Kabupaten roads in the Study Area is indicated below:

Kabupaten	Total Length of Kabupaten Road (km)	Ratio of Poor and Bad Road to Total Length (%)
Tapin	295	32
H.S.S.	431	32
H.S.T.	343	34
H.S.U.	251	49
Tabalong	434	70
Study Area	1,754	44

Road betterment works are required to maintain the present condition. The minimum requirement of new access road to newly identified irrigation schemes is 1.3 km in total length.

According to the PLN's plan, four power plants with a total installed capacity of 451 MW plants are scheduled to be installed in the region by 2000/01.

Watershed Management Measures

Two countermeasures are taken up for watershed conservation, one is to limit logging activities in the existing forest areas by legal procedures and the other is to promote afforestation in shifting cultivation areas and alang-alang grassland.

5. FORMULATION OF DEVELOPMENT PLAN

Individual Development Plans Identified from Engineering Viewpoints

From the technical viewpoints, individual development schemes are identified as candidates for an overall development plan in the fields of irrigation development, drainage improvement and polder development, agricultural and inland fishery development.

Irrigation development: A total of 45 irrigation schemes, consisting of 30 existing schemes and 15 new schemes are identified in the Study Area as listed below:

Tabalong	H.S.U	H.S.T	H.S.S	Tapin
Existing Schemes				
1 Jaro	4 Paran	8 Talang	16 Telega Langsat	24 Lok Paikat
2 Jaro Bawah	5 Tindakan	9 Tapuk	17 Tayub	25 Pampain
3 Gumba	6 Suapin	10 Tamiyan	18 Nunungin	26 Nupadang
	7 Lok Batu	11 Baruh Hawang	19 Kuangan	27 Tatakan
		12 Intangan	20 Pamujaan	28 Pulau Pinan
		13 Kahakan	21 Hawatu	29 Rampanang
		14 Mangunan	22 Taal	30 Binuang
		15 Haruyan Dayak	23 Jarau	
New Schemes				
31 Sungai Kati	38 Balangan	40 Batang Alai	42 Kayu Habang	44 Tapin
32 Namun	39 Pitap	41 Barabai	43 Amandit	45 Labuhan
33 Kinarum				
34 Mihim				
35 Batupulut				
36 Bilas				
37 Banyu Tajun				

Among the 15 newly identified irrigation schemes, five schemes can be expected to supply water to their neighboring existing schemes. The following six alternative cases can be considered.

- Case 1 : New irrigation scheme only,
- Case 2 : Irrigation water supply to the existing drainage scheme,
- Case 3 : Supplemental water supply to the existing irrigation scheme with a water shortage problem in its water source,
- Case 4 : Water source conversion of the existing irrigation scheme with the same condition of Case 3,

- Case 5 : Maximum utilization of newly developed water source by the neighboring schemes as much as possible, and
- Case 6 : A combination of Case 1, Case 2 and Case 4.

Number of schemes and additional irrigation areas are shown below:

Scheme	Case 1	Case 2		Case 3		Case 4		Case 5	
	(ha)	(No.)	(ha)	(No.)	(ha)	(No.)	(ha)	(No.)	(ha)
Pitap	3,740	1 ^{*1}	790	2 ^{*2}	560	-	-	-	-
Batang Alai	6,220	1	600	2 ^{*3}	400	2	1,220	-	-
Barabal	2,280	1	800	-	-	-	-	-	-
Amandit	6,430	-	-	5	610	5	1,150	9	4,970
Tapin	5,330	1	400	1	490	2	1,180	7	3,710
Total	24,000	4	2,585	10	2,060	9	3,550	16	8,680

Remarks: *1; dry season only
*2; dry season irrigation area of 710 ha
*3; dry season irrigation area of 1,220 ha

Drainage improvement and polder development: A total of 56 schemes is identified for drainage improvement and polder development in the Area. These schemes are composed of 29 existing drainage schemes, 16 new drainage schemes, eight existing polder schemes and two new polder schemes as shown below.

Tabalong	H.S.U	H.S.T	H.S.S	Tapin
Existing Drainage Schemes				
1.S. Gampa	7.S. Pinang Habang	9.Tg. Jaranih	13.Tg. Lungau	20.5bh Pintu Air
2.S. Hampang	8.R. Batu Mandi	10.Tg. Semanggi	14.Tg. Pengambau	21.S. Udul
3.S. Pallat		Kambat	15.S. Kajang	22.R. Muning
4.S. Pimping		11.R. Taras	16.S. Tirtabahalayung	23.S. Garis Halat
5.S. Binitoro		12.R. Bangkau	17.S. Taniran	24.S. Tapin Gadung
6.S. Nanti			18.R. Negara	25.S. Pinang Babaris
			19.S. Balum	26.R. Belanti
				27. S. Damar
				28. S. Selai
				29. S. Masera
Planning Drainage Schemes				
	30. Pinang Kara	31. R. Bangkau II	32. R. Angkinang	35. R. Bahanau
			33. R. Garis	36. R. Muning II
			34. R. Negara II	
New Drainage Schemes				
		40. S. Sirung	42. S. Hadangan	45. R. Muning III
		41. S. Binjai	43. S. Batang Alai	
			44. S. Tinjaulangit	
Existing Polder Schemes				
1.Ampukung	3.Padan Gusti			
2.Tigaron	4.Bakar			
	5.Pakacangan			
	6.Kaludan			
	7.Murung Bayur			
	8.Simpang Empat			
	9.Afabio			
New Polder Schemes				
	10.Lampihong		11.Kalumpang	

Agricultural development:: At present, paddy field covers 165,500 ha in total as shown below:

(Unit: ha)

Land Form	Irrigated	Drained	Poldered	Rainfed	Total
Swamps	-	17,640	13,700	60,130	91,470
Alluvial plains	9,650	-	-	62,050	71,700
Alluvial valleys	-	-	-	2,330	2,330
Total	9,650	17,640	13,700	124,510	165,500

The above existing paddy field area will increase after upgrading rehabilitation of existing schemes and newly opened-up paddy field of 26,400 ha as shown below:

(Unit: ha)

Land Form	Irrigated	Drained	Mechanical Poldered	Gravity Poldered	Rainfed	Total
Swamps	-	67,500	4,500	13,780	29,990	115,770
Alluvial plains	40,430	-	-	-	33,370	73,800
Alluvial valleys	-	-	-	-	2,330	2,330
Total	40,430	67,500	4,500	13,780	65,690	191,900

With expansion/improvement of irrigation and drainage facilities introducing proper farming practices and strengthening of agricultural supporting services, crop yield and production in the Study Area will increase and stabilize year by year. The future crop yields under two conditions, with project and without project, are estimated as below:

(Unit: ton/ha)

Crop	Present	Without Project	With Project
Paddy - Irrigation Scheme	2.5	3.5	5.5
- Drainage Scheme	1.5	1.5	3.0
- Polder Scheme	1.5	1.5	3.0
- Rainfed	-	-	-
Alluvial plains	2.5	2.5	2.5
Swamps	1.5	1.5	1.5
Maize	-	0.8	3.5
Groundnut	-	0.9	2.0
Soybean	-	0.8	2.0
Mungbean	-	0.6	1.2

Aquaculture development in swamp areas: Among the major fishery development plans of open water fishery promotion, development of fish processing industry, shrimp culture development and net cage culture development, high priority is to be given to shrimp culture scheme in consideration of production increase potential and contribution to export enhancement. The following three shrimp culture development plans are to be taken up for high priority promotion.

Scheme	Development Area (ha)
Alabio polder experimental aquaculture scheme	100
Alabio polder aquaculture scheme	1,000
Margasari aquaculture scheme	2,000

Future land use plan in the Study Area is set up as shown in the following table as the results of all engineering and agricultural studies.

(Unit: ha)

Paddy Field	Land Use Swamps	Alluvial Plains	Alluvial Valleys	Plains	Hills	Mountains	Total
Forest	145,093	707	1,060	24,748	90,241	216,404	478,253
Bush	91,743	225	-	23,284	36,338	45,585	197,175
Grassland	44,759	-	273	-	-	-	45,032
Paddy	115,769	73,800	2,326	-	-	-	191,895
Estate	-	37,686	35,027	136,362	-	-	209,075
Upland & shifting	-	4,004	113	1,075	-	-	5,192
Towns & Others	9,382	24,552	4,735	97,723	-	-	136,392
Water	5,254	-	-	-	-	-	5,254
Total	412,000	140,974	43,534	283,192	126,579	261,989	1,268,268

Screening of Candidate Development Scheme from Economic Viewpoint

In order to assess development priorities of these 104 schemes identified, screening of candidate schemes is made by means of economic comparison on the basis of the following assumptions:

- Discount rate is to be 10%
- The life of irrigation, drainage and polder scheme is to be 30 years, and that of fishery scheme is to be 15 years,
- The construction period is to be three years
- The build-up period will be four years after completion of civil works.

Using the calculated B/C as an index, first screening of candidate development schemes is made. Through the screening, 76 development schemes which have B/C of more than 1.0 are selected as the prior development scheme as shown below:

Development Scheme	Candidate Scheme	Prior Scheme	Scheme Without Priority
Irrigation	45	30	15
Drainage	45	38	7
Polder	11	5	6
Fishery	3	3	0
Total	104	76	28

Second screening is made for alternative development plan of irrigation schemes and drainage improvement schemes. In this screening IRR and (B-C)/ha of each cases are compared with each other. The results of this comparison are shown below:

Scheme	Selected Alternative
Irrigation Scheme	
Pitap irrigation scheme	Case 1
Batang Alai irrigation scheme	Case 1
Barabai irrigation scheme	Case 2
Amandit irrigation scheme	Case 1
Tapin irrigation scheme	Case 1
Drainage Scheme	
R. Pinang Kara drainage scheme	Package development
S. Hadangan	Package development
S. Batang Alai	Package development
Tinjau Langit	Package development
R. Muning extension	Package development
R. Muning 2nd extension	Package development

Ranking of Prior Schemes

In the first step of ranking, rank from A to E is given to each scheme according to the following criteria.

EIRR (%)	Rank	(B-C)/ha (Rp. Million)	Rank
More than 20.1	A	More than 2.51	A
18.1 - 20.0	B	2.01 - 2.50	B
14.1 - 18.0	C	1.01 - 2.00	C
12.1 - 14.0	D	0.51 - 1.00	D
Less than 12.0	E	Less than 0.50	E

In the second step, the ranking of the schemes from Rank 1 to Rank 5 is made according to the combination of the above evaluated ranks of EIRR and (B-C)/ha as shown below:

Rank	Combination
1:	AA
2:	AB, AC, BB
3:	AD, BC, BD, CC, AE
4:	BE, CD, CE, DD
5:	DE, EE

Development Priority

According to the above ranking and the recent Government policy giving first priority to the existing schemes, 76 prior development schemes are classified into the following seven development priority groups.

Priority	Rank	Development Stage
1:	1	Existing schemes
2:	2	Existing schemes
3:	1	Planned and new schemes
4:	2	Planned and new schemes
5:	3	Existing schemes
6:	3	Planned and new schemes
7:	4 & 5	Existing, planned and new schemes

The prior development schemes is shown below.

Tabalong	H.S.U	H.S.T	H.S.S	Tapin
PRIORITY 1 (Rank1-Existing)				
I-Jaro Bawah D-S.Rampang D-S.Paliat D-S.Nanti	D-S.P.Habang P-Alabio		D-Tg.Lungkau D-S.Kajang D-S.Tirt.Bahalayu D-R.Negara	D-S.Udul D-R.Muning D-S.Gar.Halat D-S.T.Gadung D-S.P.Babaris D-R.Belanti D-S.Damar
PRIORITY 2 (Rank2 -Existing)				
I-Gumba D-S.Pimping D-S.Bintro	I-Paran	I-Tapuk I-B. Hawang I-Mangunang D-R.Taras D-T.S.Kambat	D-T.Panganbau D-S.Taniran	
PRIORITY 3 (Rank1 -Planned & New)				
I-Kinarum I-Mihim I-Batupulut I-Bilas I-Bany.Tajun	D-R.Pin.Kura F-Alabio F-Alabio	D-S.Sirung D-Binjai	I-Kayu Habang D-R.Ankinang D-R.Garis D-R.Negara Ext D-S.Hadangan D-S.B.Alai D-Tj.Langi	I-Labuhan D-R.Bahanau D-R.Muning Ex D-R.Muni.2ndEx F-Margasari

Tabalong	H.S.U	H.S.T	H.S.S	Tapin
PRIORITY 4 (Rank2 -Planned & New)				
I-Namun	I-Balangan I-Pitap	I-Batang Alai I-Barabai	I-Amandit	
PRIORITY 5 (Rank3 -Existing)				
	D-R.B.Mandi P-Kaludan P-Simp. Empat	I-Tamiyang D-Tg.Jaranih		I-Pul.Pinang
PRIORITY 6 (Rank3 -Planned & New)				
	I-Sunga.Kati D-Bangkiling			I-Tapin
PRIORITY 7 (Rank4 & Rank5)				
D-Tamunti D-Pulau Kuu P-Ampukung	I-Tundakan I-Suapin P-Bakar	I-Talang	I-Tayub I-Pamujaan	I-Pampain I-Tatakan

I: Irrigation scheme D: Drainage scheme P: Polder scheme F: Fishery scheme

Possible Public Investment

Possible public investment for agricultural development in South Kalimantan: The projection of future public investment in agricultural development in South Kalimantan is carried out for four cases of growth rate applying past actual public investment and share of the agricultural sector as shown below:

	Rate of Allocation (%)	Annual Average Investment during 1981-1988
South Kalimantan Total	100.0	105.0
DPUP	15.7	16.5
Sub-Dinas Water Resources Development	4.4	4.6
Agriculture	4.5	4.7

Projection Case	Growth Rate 1987/88 - 2018/19
Case 1	10.0% per annum
Case 2	7.0
Case 3	5.0
Case 4	2.5

The total public investment in terms of 1988 financial prices for the next 30 years to be made available for Sub-Dinas Water Resources Development by case is estimated as follows:

Case 1	:	Rp. 836.0 billion
Case 2	:	Rp. 467.0 billion
Case 3	:	Rp. 323.3 billion
Case 4	:	Rp. 207.9 billion

Possible public investment in agricultural development in the Study Area :Based on the above results, and the ratio of farm households in the Study Area to South Kalimantan Province (47.5% in 1985). The investment of the Sub-Dinas Water Resources Development for the Study area can be estimated as follows:

Case 1	:	Rp. 397.1 billion
Case 2	:	Rp. 221.8 billion
Case 3	:	Rp. 153.1 billion
Case 4	:	Rp. 98.8 billion

6. PROPOSED PROJECTS AND INVESTMENT PLAN

Proposed Projects

Negara Pilot Project: In due consideration of current capabilities of the staff of agencies concerned and farmers' way of thinking and behavior, it is prerequisite to have capable staff involved in and well-trained farmers a participated in development activities for promotion of large investment to the Study Area. For this purpose promotion of pilot projects is indispensable to create opportunities and places to the agencies' staff concerned in terms of how to upgrade and strengthen their capabilities and responsibilities as well as to farmers in respect to how to improve and increase their practices and productivity.

From the 76 prior schemes, the following five schemes are to be selected as training fields for the respective five Kabupatens in the Study Area taking into account technical and topographic features of those schemes. These schemes should be undertaken immediately in a package form as a Negara Pilot Project prior to the promotion to realize the remaining 71 prior schemes.

Component	Kabupaten	Command Area (ha)	Remarks	Required Investment (million Rp.)
Jaro Bawah irrigation	Tabalong	200	Upgrading	620
Alabio polder	H.S.U.	4,500	Proper O&M	8,217
Rawa Taras drainage	H.S.T.	300	Improvement	764
Rawa Negara drainage	H.S.S.	5,200	Rehabilitation	6,299
S. Tapin Gadung drainage	Tapin	1,000	Improvement	1,739
Total		11,200		17,639

Projects following the Pilot Project: As succeeding projects of the Negara Pilot Project, promotion of the following three projects is proposed for the

implementation of remaining 71 prior schemes within the limit of the available investment.

Negara Irrigation and Drainage Upgrading Project

This Project is to be composed of existing prior schemes of first and second priority groups other than the Negara Pilot Project. This project aims to spread of effects of the Negara Pilot Project throughout the Negara sub-basin. A total of 24 prior schemes are proposed. The required investment is estimated at Rp.40,363 million.

Upper Negara Agricultural Development Project

This Project will be composed of the remaining prior schemes identified in Kabupaten Tabalong, Hulu Sungai Utara and Hulu Sungai Tengah. A total of 28 prior schemes are proposed. The required investment is estimated at Rp.140,938 million.

Lower Negara Agricultural Development Project

This Project will be composed of the remaining prior schemes identified in Kabupaten Hulu Sungai Selatan and Tapin. A total of 19 prior schemes are proposed. The required investment is estimated at Rp.357,629 million.

Investment Plan

Public investment to be available in the water resources development in the Study Area for the respective Repelita periods are estimated as follows for each projection case.

(Unit: Rp. million)

	Repelita V	Repelita VI	Repelita VII + VIII	Repelita IX + X	Total
Case 1	28,612	15,940	81,778	270,750	397,080
Case 2	28,612	14,190	54,203	124,800	221,805
Case 3	28,612	13,049	40,330	71,099	153,090
Case 4	28,612	11,593	26,612	31,936	98,753

Based on the above estimated public investment, the investment plans for Case 1, Case 2, Case 3 and Case 4 are prepared as summarized in Table 1 in the next page.

As a result, it is proposed to increase the investment with an annual growth rate of 10% so as to implement all the prior schemes within the next 30 years.

Table 1 Investment Plan for each Case

	Case 1		Case 2		Case 3		Case 4	
	Scheme	Cost (Rp.MN)	Scheme	Cost (Rp.MN)	Scheme	Cost (Rp.MN)	Scheme	Cost (Rp.MN)
REPELITA V	I Jaro Bawah	620	I Jaro Bawah	620	I Jaro Bawah	620	I Jaro Bawah	620
	P Alabio	8,217	P Alabio	8,217	P Alabio	8,217	P Alabio	8,217
	D R.Taras	764	D R.Taras	764	D R.Taras	764	D R.Taras	764
	I Tapuk	270	I Tapuk	270	I Tapuk	270	I Tapuk	270
	I B. Hawang	237	I B. Hawang	237	I B. Hawang	237	I B. Hawang	237
	I Mangunang	586	I Mangunang	586	I Mangunang	586	I Mangunang	586
	D T.S.Kambat	3,362	D T.S.Kambat	3,362	D T.S.Kambat	3,362	D T.S.Kambat	3,362
	D R.Negara	6,299	D R.Negara	6,299	D R.Negara	6,299	D R.Negara	6,299
	D S.Taniran	699	D S.Taniran	699	D S.Taniran	699	D S.Taniran	699
	D S.T.Gadung	1,739	D S.T.Gadung	1,739	D S.T.Gadung	1,739	D S.T.Gadung	1,739
	D S.Gar.Halat	1,468	D S.Gar.Halat	1,468	D S.Gar.Halat	1,468	D S.Gar.Halat	1,468
	D S.P.Babaris	591	D S.P.Babaris	591	D S.P.Babaris	591	D S.P.Babaris	591
	D S.Udul	1,412	D S.Udul	1,412	D S.Udul	1,412	D S.Udul	1,412
	D S.Damar	1,746	D S.Damar	1,746	D S.Damar	1,746	D S.Damar	1,746
Sub-total	28,010	Sub-total	28,010	Sub-total	28,010	Sub-total	28,010	
REPELITA VI	D S.Rampang	886	D S.Rampang	886	D S.Rampang	886	D S.Rampang	886
	F Alabio	522	F Alabio	522	D Binjal	1,833	D Binjal	1,833
	I Paran	358	D Binjal	1,833	D S.Kajang	1,844	D S.Kajang	1,844
	D Binjal	1,833	D S.Kajang	1,844	D Penganbau	1,135	D R.Belanti	4,205
	D S.Kajang	1,844	D Penganbau	1,135	D R.Belanti	4,205	I Labuhan	975
	D Penganbau	1,135	D R.Belanti	4,205	I Labuhan	975		
	D R.Belanti	4,205	I Labuhan	975				
	I Labuhan	975						
Sub-total	11,758	Sub-total	11,400	Sub-total	10,878	Sub-total	8,768	
Accumulate	39,768	Accumulate	39,410	Accumulate	38,888	Accumulate	36,778	
REPELITA VII + VIII	D S.Paliat	737	I Paran	358	F Alabio	522	F Alabio	522
	D S.Nanti	370	D S.Paliat	737	I Paran	358	I Paran	358
	D S.Pimping	309	D S.Nanti	370	D S.Paliat	737	D Penganbau	1,135
	D S.Bintro	175	D S.Pimping	309	D S.Nanti	370	I Labuhan	975
	I Gumba	361	D S.Bintro	175	D S.Pimping	309	D S.Paliat	737
	I Mihim	659	I Gumba	361	D S.Bintro	175	D S.Nanti	370
	D S.P.Habang	3,191	I Mihim	659	D S.P.Habang	3,191	D S.P.Haban	3,191
	F Alabio	8,816	D S.P.Habang	3,191	D S.Sirung	5,719	D S.Sirung	5,719
	D S.Sirung	5,719	D S.Sirung	5,719	D S.Tirt.Baha	1,248	D S.Tirt.Baha	1,248
	I Barabai	14,041	D S.Tirt.Baha	1,248	D Tg.Lungkau	2,995	D Tg.Lungka	2,995
	D S.Tirt.Baha	1,248	D Tg.Lungkau	2,995	I Kayu Habang	1,128	I Kayu Habang	1,128
	D Tg.Lungkau	2,995	I Kayu Habang	1,128	D R.Ankinang	3,525		
	I Kayu Habang	1,128	D R.Ankinang	3,525	D R.Muning	11,656		
	D R.Ankinang	3,525	D R.Garis	3,525				
	D R.Garis	3,525	D R.Muning	11,656				
	D R.Negara Ext	1,067	D R.Bahanau	3,991				
D R.Muning	11,656							
D R.Bahanau	3,991							
D R.Muning Ex	6,082							
Sub-total	69,595	Sub-total	39,947	Sub-total	31,933	Sub-total	18,378	
Accumulate	109,363	Accumulate	79,357	Accumulate	70,821	Accumulate	55,156	
REPELITA IX + X	I Bilas	2,089	F Alabio	8,816	I Gumba	361	D S.Pimping	309
	I Kinarum	1,325	I Barabai	14,041	I Mihim	659	D S.Bintro	175
	I Batupulut	634	D R.Negara Ext	1,067	F Alabio	8,816	I Gumba	361
	I Bany.Tajun	2,487	D R.Muning Ex	6,082	I Barabai	14,041	I Mihim	659
	I Sunga.Kati	790	I Bilas	2,089	D R.Garis	3,525	D R.Ankinang	3,525
	D Bangkiling	1,457	I Kinarum	1,325	D R.Negara Ex	1,067	D R.Garis	3,525
	I Namun	207	I Batupulut	634	D R.Bahanau	3,991	D R.Negara E	1,067
	D Tamunti	585	I Bany.Tajun	2,487	D R.Muning Ex	6,082	D R.Muning	11,656
	D Pulau Kuu	1,457	I Sunga.Kati	790	I Bilas	2,089	D R.Bahanau	3,991
	P Ampukung	348	D Bangkiling	1,457	I Kinarum	1,325		
	D R.Pin.Kura	11,892	I Namun	207	D R.Pin.Kura	11,892		
	I Pitap	23,015	D Tamunti	585	D S.Hadangan	8,095		
	I Batangan	13,388	D R.Pin.Kura	11,892	D S.B. Alai	3,195		
	D R.B.Mandi	1,846	D S.Hadangan	8,095	D R.Muni.2dE	6,020		
	P Kaludan	26	D S.B. Alai	3,195				
	P Simp. Empat	39	D Tj.Langi	10,652				
	I Tundakan	369	D R.Muni.2dEx	6,020				
	I Suapin	207						
	P Bakar	1,723						
	I Batang Alai	38,754						
	I Tamiyang	283						
	D Tg.Jararih	6,623						
	I Talang	326						
	D S.Hadangan	8,095						
	D S.B. Alai	3,195						
	D Tj.Langi	10,652						
	I Amandit	41,387						
I Tayub	250							
I Pamujaan	399							
D R.Muni.2dEx	6,020							
F Margasari	32,448							
I Pul.Pinang	267							
I Tapin	34,960							
I Pampain	549							
I Tatakan	174							
Sub-total	248,266	Sub-total	79,434	Sub-total	71,158	Sub-total	25,268	
Accumulate	357,629	Accumulate	158,791	Accumulate	141,979	Accumulate	80,424	

Implementation Program

For the Negara Pilot Project, undertaking of feasibility study is proposed as the first step. After completion of civil works, intensive training programs for operation and maintenance works for this project will be provided to officials concerned and leading farmers through foreign technical cooperation. The implementation schedule of this Pilot Project and three other proposed projects is as shown in below.

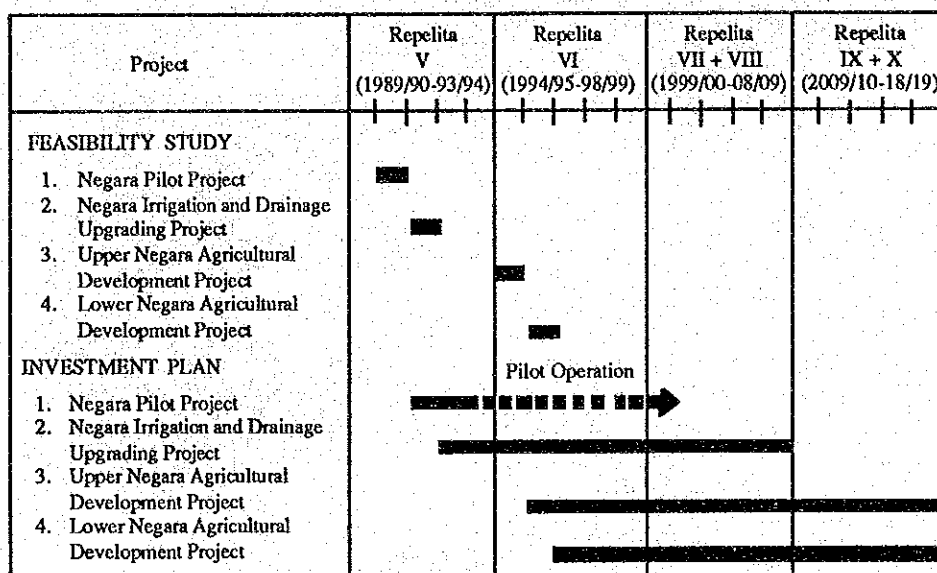


Figure 7 Implementation Program

Table 2 shows the development matrix which indicates the present constraints, basic requirements, development target, required investment and action programs for the Negara Basin overall development project.

Effect and Social and Environmental Impact

Increment of paddy production and foreign exchange savings: Total paddy production in 2018 at the end of Repelita X is estimated on the basis of the anticipated paddy yield and cropped area.

Production in 1985 (ton)	Production in 2018 (ton)	Production Increase (ton)	Annual Growth Rate (%)
417,500	880,060	462,560	2.29

According to the food balance projection, paddy production from the proposed project would almost correspond with the demand in Kalimantan and a small excess of 64,470 tons would cover the needs of other paddy deficit regions in Indonesia. By applying the estimated CIF price of rice (US\$ 243/ton) at 1988

constant prices to the said incremental paddy production, foreign exchange savings in 2018 would be US\$ 76.4 million as shown below:

Incremental		CIF Price (US\$/ton)	Foreign Exchange Savings (US\$ million)
Paddy (1000 tons)	Rice * (1000 tons)		
462.6	314.5	243	76.4

*: Milling rate of 0.68 is applied.

Improvement of Farmers' Economy: The farm budget analysis is made for two typical farmers; a farmer in the Rawa Negara Drainage Scheme with 1.0 ha of farm land and a farmer in the Jaro Bawa Irrigation Scheme with 0.5 ha of farm land. As a result, the farm income of a typical farmer under with project condition would increase 4.5 times of that under without project condition in the Rawa Negara Drainage Scheme and 4.4 times in the Jaro Bawa Irrigation Scheme. The expected increase in the net reserve is then estimated to be from subsistence level to about Rp.500,000 in both schemes.

Environmental Impact Assessment

Possible impact of the proposed projects on the environment in the Negara sub-basin is assessed at preliminary level as shown below.

Projects/ Countermeasures	Swamps	Alluvial Plains, Alluvial Valleys and Plains	Hills Mountains	Rivers	Water Quality	Fauna/ Flora	Prediction
1. Irrigation	0	0	0	0	0	0	No effects on all the selected environmental fields are expected, because the proposed new schemes are concentrated on the existing rainfed paddy fields.
2. Drainage	-	0	0	0	0	-	Due to the introduction of gravity drainage system, these would be less affected.
3. Polder	0	0	0	0	0	0	No effects on all the selected environmental fields are expected, because of no new development. The candidate new schemes are all excluded from the proposed project due to their lower economic viability.
4. Fishery (Aquaculture)	0	0	0	0	0	+	Positive effects particularly on the fish resources are expected from the development of aquaculture.
5. Intensive Agriculture	0	0	0	0	-	-	Negative effects on water quality and fauna/flora are expected, proper use of chemicals should be introduced.
6. Watershed Management	0	+	+	+	+	+	The proposed countermeasures would mitigate the present soil erosion, sedimentation and flood problems.

Remarks: + : Positive effect 0 : No effect - : Negative effect

It is necessary to pay particular attention to the negative effects predicted on water quality and fauna/flora from the intensive agriculture development which requires agro-chemicals. Accordingly, strategic guidance to the farmers about proper use of agro-chemicals is required from the extension services. Drainage development has less negative effects, because new development schemes are rather small, only 6% of swamp areas.

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