REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS

DIRECTORATE GENERAL
OF
WATER RESOURCES DEVELOPMENT

NEGARA RIVER BASIN
OVERALL IRRIGATION DEVELOPMENT PLAN STUDY

MAIN REPORT

JUNE 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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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.

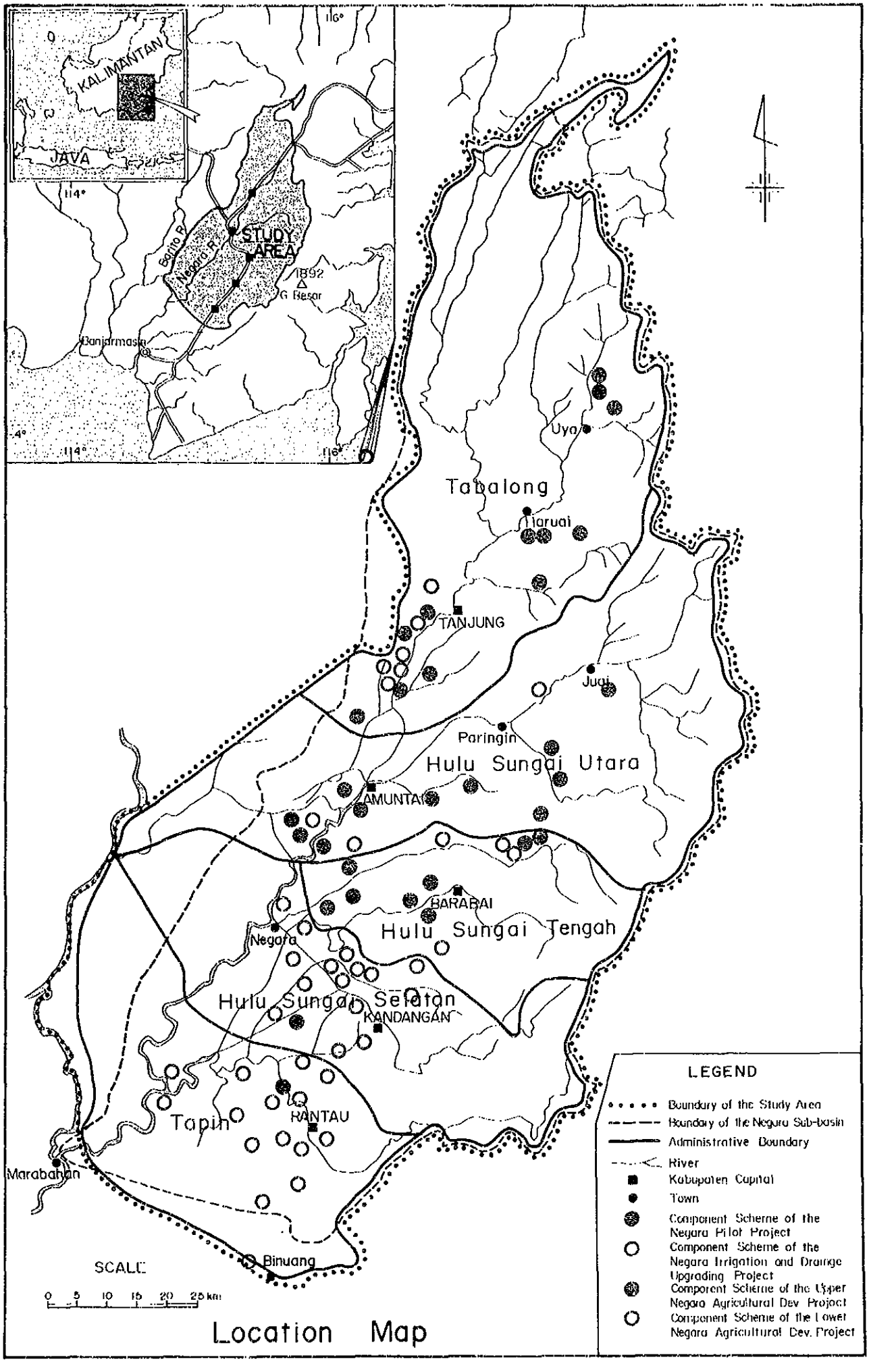
I hope that this report will contribute to the development of the project and to the promotion of friendly relations between our two countries.

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

Kensuke Yanagiya
President
Japan International Cooperation Agency



Location Map

NEGARA RIVER BASIN
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ABBREVIATIONS

BAPPEDA	Badan Perencanaan Pembangunan Daerah - Regional Development Planning Agency
BIMAS	Bimbingan Massal Swa Sembada Bahan Makanan, "Mass Guidance for Self-Sufficiency in Foodstuffs"
DGWRD	Directorate General of Water Resources Development
DPU	Department Pekerjaan Umum
DPUP	Department Pekerjaan Umum Propinsi
IUIDP	Integrated Urban Infrastructure Development Programme Preparation
JICA	Japan International Cooperation Agency
KUD	Koperasi Unit Desa - Village Unit Cooperative
NES	Nucleus Estates and Smallholder
OTCA	Overseas Technical Cooperation Agency
P3SA	Proyek Perencanaan Pengembangan Sumber-Sumber Air
PLN	Perusahaan Listrik Negara
PMU	Project Management Unit

ABBREVIATIONS OF MEASUREMENT

Length

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

Area

cm^2	=	square centimeter
m^2	=	square meter
ha	=	hectare
km^2	=	square kilometer

Volume

cm^3	=	cubic centimeter
lit	=	liter
m^3	=	cubic meter

Weight

mg	=	milligram
g	=	gram
kg	=	kilogram
ton	=	metric ton

Time

s	=	second
min	=	minute
h	=	hour
d	=	day
y	=	year

Electrical Measures

V	=	Volt
A	=	Ampere
W	=	Watt
kW	=	Kilowatt
MW	=	Megawatt
GW	=	Gigawatt

Other Measures

%	=	percent
PS	=	horsepower
°	=	degree
'	=	minute
"	=	second
°C	=	degree centigrade
10^3	=	thousand
10^6	=	million
10^9	=	billion (milliard)
ppm	=	parts per million
pH	=	scale for acidity

Derived Measures

m^3/s	=	cubic meter per second
micromhos/cm	=	Scale for electrical conductivity
kWh	=	kilowatt hour
MWh	=	Megawatt hour
GWh	=	Gigawatt hour
kWh/y	=	kilowatt hour per year
kVA	=	kilovolt ampere

Money

Rp	=	Rupiah
US$	=	US dollar (US$1 = Rp 1,730)

1. INTRODUCTION

1.1 Authority

This Final Report was prepared in accordance with the Scope of Work (S/W, see Attachment) for the Negara River Basin Overall Irrigation Development Plan Study (the Study) agreed upon between Directorate General of Water Resources Development (DGWRD), Ministry of Public Works, and Japan International Cooperation Agency (JICA) on July 29, 1987.

The report presents the results of technical and economic studies on development of agricultural potential in the Negara sub-basin. It covers current physical and economic conditions, the proposed development plans including the pilot project plan, and their economic and financial analyses. All comments on the Draft Final Report submitted previously to the Government of Indonesia are incorporated in this Final Report.

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

1.2 Background of the Study

In response to the request of the Government of Indonesia, the Government of Japan, in 1971, conducted a reconnaissance survey in the Barito river basin covering around 60,000 km^2 through the then Overseas Technical Cooperation Agency (OTCA). The main purpose of that study was to establish a plan for collecting basic data and to assess the possibilities to develop the potential natural resources of the Barito river basin. The study was of preliminary nature. In accordance with the recommendation presented in the final

report of "Survey for Development of Barito River Basin", the Negara and Martapura sub-basins were selected as priority areas for implementation of land reclamation and irrigation projects in the Barito river basin. From 1971 to 1973, OTCA undertook the mapping of 16,800 km^2 in the two sub-basins and prepared a series of topographic maps at 1/50,000 scale. In parallel with these undertakings, the Government of Indonesia made various investigations including the establishment of gauging stations, hydrological and geological studies, land survey and so on. Their elements were used in the implementation of the Riam Kanan Irrigation Project which was commenced in the Martapura sub-basin in 1978.

As the first step in implementing further study in the Negara sub-basin, JICA undertook the "Photo Mapping for Negara River Basin" through 1983 to 1985 based on the terms of reference prepared by DGWRD. The final products comprise a series of topographic maps at 1/50,000 scale covering an area of 6,500 km^2 in the upstream part of the Negara sub-basin, and mosaic photo and the thematic maps at 1/10,000 scale covering an area of 1,200 km^2 centering around the middle of part of the Negara sub-basin.

With the above-mentioned background, the Government of Indonesia requested the Government of Japan to carry out the "Negara River Basin Overall Irrigation Development Plan Study" in November 1985. In reply to this request, JICA sent a preliminary survey team for the Study in July 1987 and agreed with DGWRD on S/W for the Study in July 1987.

1.3 Objectives of the Study

(1) Objectives

The objectives of the Study are:

- 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.

(2) Study Area

The Study covers 12,683 km^2 as a whole comprising the Negara sub-basin and its affected area in the South Kalimantan Province. As for socio-economic study, the area studied

covers 12,655 km^2 which includes the administrative territories of five Kabupatens, Tabalong, Hulu Sungai Utara, Hulu Sungai Tengah, Hulu Sungai Selatan and Tapin. Hydrological study is concentrated into a catchment area of the Negara sub-basin with a total coverage of 10,842 km^2. These three areas are shown together in Figure 1.

(3) Target Year of Development

The Fifth Five-Year Development Plan (Repelita V) has covers the period from 1989/90 to 1993/94 corresponding to the final stage of the first 25 Year Long-Term Development. This Repelita V bears very close relation with the definite formulation of the basic concept of the second 25 Year Long-Term Development. In conformity with both frameworks, the target year for long-term development of the Negara sub-basin is set up in 2018 under the present Study.

1.4 Work Activities

Based on the agreed S/W, the Study commenced in March 1988 and is spread over three phases for a total study period of 15 months. For the execution of the Study, JICA organized a Study Team consisting of 10 experts. A total of 16 Indonesian counterparts were involved in the Study. Table 1 shows the list of members of the JICA Study Team and Indonesian counterparts.

The Phase I study was completed at the end of May 1988. It comprised field work for one and a half months and home office work for one month. Focal points were to clarify the present condition and prevailing constraints of agricultural activities for the wet season in the Study Area and to review collected data. Two reports, Field Report (I) and Progress Report, were prepared during the Phase I study period.

The Phase II study was carried out between June and October 1988. It included field work for three and a half months and home office work for one month. Major activities were dry season field reconnaissance, detailed field investigation for the evaluation of the development potential, determination of the basic development concept, formulation of the basic development plan, and preliminary planning of individual development projects. Two reports, Field Report (II) and Interim Report, were submitted during the Phase II Study period.

The Phase III study was conducted from October 1988 to March 1989. It included field work for one month and home office work for two months. Main efforts were made to

invite opinions from officials of the central and local Government agencies concerned; to perform comprehensive assessment of individual and integrated development projects, and to formulate an overall development plan. Two reports, Field Report (III) and Draft Final Report, were made for during the Phase III Study period. Discussions on the Draft Final Report were held in March this year in Banjarmasin and Jakarta.

The Final Report was prepared with due consideration to the comments on the Draft Final Report received from the Government of Indonesia.

1.5 Steering Committee

The Government of Indonesia has specially established Steering Committees both at central and provincial levels for the present Study with the aim to promote agricultural development projects to be formulated under the Study in the Negara sub-basin.

The Central Steering Committee comprised the Assistant to the Minister of PU for water resources development as chairman, Director of BPP in DGWRD as secretary, and Directors of Irrigation I, Swamps and Rivers in DGWRD, Chief of Planning Bureau, Directors of BPP and Urban & Region in Directorate General of Construction, Heads of BAPPEDA, DPUP, Head of Sub-Dinas for water resources development in DPUP in South Kalimantan and expert of the Study Team as members. Its first and second meetings were held in Jakarta in October 1988 and March 1989 to discuss the study results presented in the Interim Report and Draft Final Report, respectively.

The Provincial Steering Committee comprised the Assistant Governor in charge of economy and development as chairman, Head of DPUP as secretary and Head of BAPPEDA, Head of Agriculture, Heads of five Kabupatens located in the Study Area, Chiefs in charge of communication, life environment, regional development and rural development in the Governor's Office, Chiefs of Regional Departments of Food Crops, Fishery, Forestry and Estate Crops, Faculty Chiefs of Civil Engineering, Agriculture, Fishery and Forestry of UNLAM, Heads of DPUP's five branch offices in the Study Area, Indonesian counterparts and experts of the Study Team as members. Its meetings were held three times in Banjarmasin. The first meeting was held in September 1988 to exchange such views on the Field Report (II) as what has been done and what has to be done. The second and third meetings were held in November 1988 and March 1989 to discuss the study results presented in the Interim Report and Draft Final Report, respectively.

All comments, proposals, and suggestions given by the committee members through the discussion in the Steering Committee meetings both at central and provincial levels were reflected in the Final Report.

1.6 Acknowledgement

In undertaking the present Study, the Study Team has attached great importance to the incorporation of the views of departments and agencies concerned of the Government of Indonesia relating to the various aspects covered by the Study. The contribution to the Study by the officials concerned who have provided information and data, participated in discussions, given valuable advices and provided other forms of assistance to the Study are gratefully acknowledged. Heartful gratitude is also made to the members of Central and Provincial Steering Committees who have given advices in performing the Study. In fact, the Study can be regarded as a joint effort by the Indonesian officials concerned and counterparts and the Study Team. Further the Study Team sincerely hopes that this joint effort would contribute to future agricultural development in the Negara sub-basin in particular and its socio-economic development and well-being in general.

2. ECONOMIC BACKGROUND

2.1 National Economic Background

(1) Economic growth

Economic development in Indonesia is closely linked with the price trend in the international oil market. Indonesia's real gross domestic product (GDP) grew at an average annual rate of 8.1% during the 1970s. Since the early 1980s when export prices of oil and other commodities began to fall, however, Indonesian economy was faced with worsening environment such as increase in interest payment and capital repayment of foreign debts borne from the positive development policy in the 1970s, diminution of revenues due to decrease in oil export earnings, and pressure upon balance of international payments. The real growth of GDP 4.5% per annum on an average during the Repelita III period of 1979/80 to 1983/84 and was stagnant in 1982. The figure was below the target annual growth rate of 6.5% under Repelita III.

In Repelita IV of 1984/85 to 1988/89, therefore, the Government of Indonesia has given priority to the promotion of non-oil exports by revising its policy on economic development based on oil export earnings. In the first year of Repelita IV of 1984, the manufacturing sector grew at 19.0% per annum in real GDP term and the agricultural sector grew steady by 4.2% per annum. As a result, the growth of real GDP attained to 6.0% per annum. Due to sharp drop in international oil market prices, however, Indonesian economy was again forced to deal with the worst crisis from 1985 to 1986. To overcome structural defects in the Indonesia's economy, the Government of Indonesia devised a series of countermeasures which include devaluation of domestic currency, acceleration of non-oil export, encouragement of direct foreign investment and drastic cut of financial budget. Through the execution of such countermeasures, the annual growth rate of real GDP increased slightly from 2.3% in 1985 to 3.2% in 1986. Such economic condition was prudently maintained in 1987 and 1988 and the Indonesian economy recovered gradually. Real GDP at 1983 constant price grew from Rp.58.2 trillion in 1978 to Rp.66.7 trillion in 1980 and Rp.82.5 trillion in 1986 as shown in Figure 2. (Details are presented in Annex A.)

(2) Role of agriculture sector

Agriculture plays a very important role in Indonesian economy. More than 75% of the population live in rural areas and agriculture directly employs more than 50% of the labour

force. The agriculture sector has accounted for about 25% of GDP every year and contributed to almost 50% of the non-oil export earnings since 1980.

Real GDP of the agricultural sector grew steadily at an annual average rate of 3.8% during the 1970s and at 3.1% from 1980 to 1986. This growth was derived from the undertaking of the Government's program for increasing paddy production to a large extent. Paddy production increased from 18 million tons in 1969, the first year of Repelita I, to 41 million tons in 1988 as indicated in Figure 3. Since self-sufficiency in rice was realized in 1985, there has been no increase in the annual paddy production of the country due mainly to the conversion of high-productive paddy field in Java into urban and industrial areas. Thus, domestic paddy demand has gradually gained upon domestic production. The maintenance of self-sufficiency in rice is therefore still very important subject in the agricultural sector of Indonesian economy.

During the period from 1980 to 1986, subsectors of food crops, non-food crops, livestock and fishery grew at an average annual rate of more than 3%, while the forestry subsector showed minus growth of 12.4% due to the ban on log exports. Because of recent low export prices of agricultural commodities, the estate subsector grew at an average annual rate of 0.5%. (Details are presented in Annex E.)

2.2 Regional Economic Background

(1) Economy of Kalimantan

Gross regional domestic product (GRDP) by major islands is illustrated in Figure 4. In the whole Kalimantan, GRDP at current market price was Rp.2,164 billion in 1978 and Rp.5,966 billion in 1983. The current GRDP during this period increased by 2.8 times in Kalimantan, while the increase was 3.2 times in Java and 3.8 times in Sumatra. Accordingly, Kalimantan's contribution to Indonesia's current GRDP declined from 10.2% in 1978 to 8.7% in 1983. Because of depopulated areas, per capita GRDP in Kalimantan becomes the highest in the country. In 1983, its per capita GRDP at current price was Rp.770,000 exceeding the national average of Rp.420,000, as well as Java's average of Rp.340,000 and Sumatra's average of Rp.670,000. This was mainly derived from earning by oil and natural gas production in the East Kalimantan Province.

Current GRDP in the agricultural sector during the above period showed the same increasing tendency. The share of Kalimantan in the agricultural GDP of Indonesia dropped from 7.9% in 1978 to 6.4% in 1983.

As depicted in Figure 5, Sumatra and Sulawesi were the key bases for receiving Government sponsored transmigrants since Repelita I was commenced. In Repelita IV, however, Kalimantan took the place of Sulawesi in the number of transmigrants from Java. During the past 18 years, around 230,000 families transmigrated to Kalimantan, corresponding to 23% of the sponsored transmigrants in the whole country.

(2) Economy of South Kalimantan

The South Kalimantan Province covers 36,986 km^2 in area and is the smallest among the four provinces in Kalimantan. Its population was 2.3 million in 1985 and is the second largest in Kalimantan as shown in Figure 6. Population density is 63 person/km^2 and far beyond the average population density of 14 person/km^2 in Kalimantan. Of the 230,000 families transmigrated to Kalimantan under the Government sponsored program, a total of 60,000 families settled in the South Kalimantan Province.

The South Kalimantan Province contributed to 14% of the 1983 current GRDP of Kalimantan as illustrated in Figure 4. The overall GRDP grew at 6.8% per annum during the period from 1980 to 1985. Agriculture is the most important sector in the economy of the South Kalimantan Province. Real GRDP at 1983 constant price was Rp.972 billion in 1985 as indicated in Figure 7. Of this, Rp.305 billion were earned by the agricultural sector. The contribution of this sector to real GRDP was maintained at the level of 31% for the last three years.

3. STUDY AREA

3.1 Natural Condition

3.1.1 Land

The Study Area is situated in the northern to middle part of the South Kalimantan Province. Its geographical area is 12,683 km^2 as a whole. It extends from 1°15' to 3°15' south latitude and from 114°45' to 115°50' east longitude. It is bounded by the Central and East Kalimantan Provinces from the northwest to the northeast, by the boundary of the Kabupaten Kota Baru in the east, by the boundary of the Kabupaten Banjar from the southeast to the southwest and by the Barito river in the west. It is 60 km distant on a straight line from Banjarmasin, the capital of the South Kalimantan Province, to the southernmost corner of the Study Area.

Topography is rather simple. It is flat in the southeastern part, hilly in the middle part and mountainous in the north to the east side. The highest peak is the Gunung Besar with its elevation of 1,901 m, on the eastern border of the Study Area. The flat part is featured by inland swamps and alluvial plains with elevation of around one to two meter. In the hilly and mountainous parts, karst plains and ridges are predominant. The former is undulating to gently rolling, while the latter has steep slopes of more than 40%. Figure 8 depicts the distribution of physiographic types in the Study Area.

Geology is intricate in the north to the middle of the Study Area. On the contrary, its geological formation in the southern part is superposed monoclinically from east to west as illustrated in Figure 9. The geology in the northern part of the Study Area consists of Mesozoic in the mountain area and limestone of Paleogene period in most of the hilly area. In the middle part, volcanic intrusives are common. In the southern part, Quaternary deposit is predominant in the inland swamps. Alluvial plains adjacent to the inland swamps are featured by Miocene deposits.

Soils extending over steep slopes of the mountain area are of lithosol, latosol and association of both soils as shown in Figure 10. From the hilly area to a higher part of the alluvial plains, podzolic soils are common, while the lower part of the alluvial plains is characterized by alluvial soils. Podsols occur in a very limited part of the hilly area. Peat soils develop in the inland swamps and are mixed with sediments along rivers and water courses. (Details are presented in Annex C.)

Vegetation in the flat and hilly parts of the Study Area are affected to a large extent by man's activities. Among these activities, shifting cultivation practices which have been let left unchecked, are now beyond the control of forest resources management. Presently, forests remain in mountainous parts and in the inland swamps. Montane forests comprise mostly of mature primary forest ecosystem. There is one gazetted forest reserve called CA. Gn. Kentawan in Kabupaten Hulu Sungai Selatan covering only 245 ha. In Kabupaten Tabalong, a Tanjung oil field concession occupies 86,700 ha in total area.

3.1.2 Climate

Climate in the Study Area is characterized by typical tropical monsoons. The northwest monsoon brings heavy rainfall from November to April and is defined as the wet season. The dry period occurs between May and October influenced by the southeast monsoon and is called the dry season.

Average annual rainfall in the Study Area varies from 2,000 to 2,500 mm. Monthly rainfall during the wet season is between 200 and 250 mm in the southeastern part, while it increases to 250 to 300 mm in the other parts. In the driest month mostly in August, rainfall of 50 to 100 mm is common. (Details are presented in Annex B.)

In Amuntai which is the central spot of the Study Area, monthly mean air temperature ranges from 27.7°C in May to 26.6°C in December and the annual mean is 27.2°C. Monthly mean relative humidity varies from 87.6% in October to 92.3% in April and the annual mean is 90.5%. Monthly mean evaporation measured by Class A pan is between 2.1 mm/day in January and 3.2 mm/day in August, and the annual mean evaporation is 2.6 mm/day. Average wind velocity ranges from 27.2 km/day in July to 38.3 km/day in January and the annual mean wind speed is 34.4 km/day. Monthly sunshine duration varies from 29.7% in December to 50.8% in August and the annual mean sunshine duration is 39.0%. Figure 11 shows monthly patterns of the above climatological features.

According to a series of agroclimatic maps prepared by the Central Research Institute of Agriculture in Bogor, the Study Area is almost defined as a climatic zone with five to six consecutive wet months and two to three dry months. In other words, double cropping of paddy can be made during the wet months only if the first crops is planted or sown as a dry land crop. Careful planning is needed to grow crops throughout the year.

3.1.3 Rivers

The Negara river is one of the main tributaries of the Barito river. According to the DPU regulation, the Barito river basin is divided into seven sub-basins. The Study Area falls with in the Negara sub-basin. As several tributaries branch off from the Negara river, the Negara sub-basin is divided into seven sub-systems and further into 24 tertio-systems as shown in Figure 12.

The catchment area of the Negara sub-basin is 10,842 km^2 at the confluence of the Barito and Negara rivers. Figure 13 depicts the configuration of the Negara sub-basin. It occupies 85% of the Study Area and has an annual mean runoff of 10,550 million m^3. The rest of the Study Area is drained by minor rivers flowing directly into the Barito river or the East Kalimantan Province.

Recently, flood has often occurred in the Study Area during May. Probable flood flow along the Negara river is estimated by storage function model. The estimated probable flood peak discharge at Amuntai varies from 1,500 m^3/sec in case of a return period of 50 years to 2,620 m^3/sec in case of 500 years. Up to now, no channel improvement works have been undertaken on the Negara river.

3.1.4 Swamps and lakes

Inland swamps spread over 4,120 km^2 and account for 32% of the Study Area. All areas along the middle to lower reaches of the Negara river are included with in the swamps with a total coverage of 3,987 km^2. They are divided into seven swamp areas as shown in Figure 14 such as Tabalong of 190 km^2, West Amuntai of 668 km^2, East Amuntai of 663 km^2, West Negara of 1,262 km^2, East Negara of 540 km^2, Tapin of 175 km^2 and North Muning of 490 km^2. The remaining inland swamps of 130 km^2 are scattered along the uppermost reaches and tributaries of the Negara river.

In areas defined as inland swamps, direct effects of the tide and tidal backwater are observed to a limited extent along the lowest reaches of the Negara river. The inland swamps consist of deep peat swamps, shallow peat swamps, permanently water logged flood plains, coalescent riverine plains and coalescent inland riverine plains. The deep peat swamps with peat depth of more than 200 cm cover about 195 km^2, while the shallow peat swamps with a range of peat depth from 50 to 200 cm occupy around 1,260 km^2. Figure 14 also indicates the distribution of deep and shallow peat swamps in the Study Area.

In the inland swamps, there are six lakes such as Bitin, Maningti, Datu, Panggasam, Panggang and Bankau. The first five lakes become a unified water body called Danau Panggang in the wet season, while they revert to a form of independent water bodies in the dry season. The areal extent of these lakes is over 50 km^2.

3.2 Socio-economic Status

3.2.1 Administrative divisions

Administratively, the South Kalimantan Province consists of 10 Kabupatens, 109 Kecamatans and 2,267 Desas. The Study Area comprises the whole areas of five Kabupatens of Tabalong, Hulu Sungai Utara (H.S.U.), Hulu Sungai Tengah (H.S.T.), Hulu Sungai Selatan (H.S.S.) and Tapin, and also includes small parts of Kabupatens Banjar and Barito Kuala. These five Kabupatens have a total land area of 12,655 km^2 corresponding to 34% of the South Kalimantan Province. The following table shows area, number of Kecamatan and Desa, and capital town of the five Kabupatens.

Kabupaten	Area (km^2)	No. of Kecamatan	No. of Desa	Capital Town
Tabalong	3,946	11	183	Tanjung
H.S.U.	2,771	12	397	Amuntai
H.S.T.	1,472	8	435	Barabai
H.S.S.	1,803	10	228	Kandangan
Tapin	2,663	10	132	Rantau
Total	12,655	51	1,375	

3.2.2 Population

Population of the five Kabupatens as of 1985 was 890,200 in total or 38% of that of the South Kalimantan Province as shown in Table 2. Population density of the Study Area is estimated to be 70 person/km^2 which is above the density of 63 person/km^2 of the South Kalimantan Province. It ranges from 34 person/km^2 in Kabupaten Tabalong to 140 person/km^2 in Kabupaten Hulu Sungai Tengah. Population growth rate during the period from 1980 to 1985 was 0.96% per annum on an average in the Study Area. This is less than half of that in the South Kalimantan Province. Average population growth rates of five Kabupatens ranged between 0.49% per annum in Hulu Sungai Tengah and 2.13% per annum in Tapin. Such low population growth rates, the lowest among the Provincial

average, indicate the population outflow from the Study Area to other areas inside and outside of the Province. The total number of households in 1985 was 209,700 of which 158,700 or 76% consisted of farm households. The average family size was 4.3 persons per household.

3.2.3 Transmigration

Since Repelita I, 2,131 families of sponsored transmigrants have moved into the Study Area, while the South Kalimantan Province has received 60,405 families in total. For a long time before starting the Government transmigration program, aborigines and spontaneous transmigrants had already developed land in the Study Area themselves. In connection with such non-sponsored transmigration performance, suitable land for agricultural use had almost been developed when the sponsored transmigration program was commenced. This results in a big difference in the receipt of sponsored transmigrants.

3.2.4 Rural infrastructures

(1) Road and inland navigation

The Study Area has a relatively well maintained road network consisting of a trunk line as national road connecting Banjarmasin, the capital of the South Kalimantan Province, with Balikpapan, that of the East Kalimantan Province. This main route links such rural commercial centers as Rantau, Kandangan, Barabai, Amuntai and Tanjung. The total length of the national and provincial roads in the Study Area is 535 km corresponding to about 50% of that in the South Kalimantan Province. The following table shows road density, per capita road length and road pavement condition. (Details are presented in Annex H.)

Item	Study Area	Province	Country
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

In swamp areas, man made water courses have been extended for a long time. However, these water courses are generally narrow and shallow. At present, small rivers, artificial water courses and drainage canals play a very important role in inland navigation system for rural inhabitants. River transportation boats registered at the Regional Office of Inland

Transport South Kalimantan in 1986 were 15,573 in total number for the whole Province. About two-thirds consist of motorized rafts.

(2) Electric power supply

A 20 kV transmission line of the Public Corporation of Electricity (PLN) connects Rantau, Kandangan, Barabai, Negara and Amuntai. But this system is isolated from other PLN's power systems. The present installed capacities of nine diesel power plants with 36 generators amount to 15,184 kW serve Binuang, Parinjin, Tanjung, Haruai and Kelua in addition to the above five towns.

The total installation capacity of power generation as of 1985 was 44.9 GW in the whole country and 136 MW in the South Kalimantan Province, while it is only 15 MW in the Study Area. The installed capacity per one family is estimated to be 125 Watt for Indonesia as a whole and 255 Watt for the South Kalimantan Province. But it is only 71 Watt in the Study Area.

(3) Domestic water supply

Piped water supply services are still on a low level in the Study Area. The average daily water supply amount per family in 1985 was 19 liters in the Study Area, while it was 41 liters in the whole country and 51 liters in the South Kalimantan Province. According to DPUP, the total supply capacity of the existing domestic water supply systems is 125 liter/sec. Piped water is supplied to each capital town of the five Kabupatens and to another 11 small towns.

In the rural area, simple water supply facilities consist of hand/electric pumps, water tanks for storing rainfall and spring water, out of which hand pumps are widely utilized.

River water is commonly used for drinking purposes by local inhabitants living in villages nearby the swamp areas and along the main stream of the Negara river. During the dry season when the stream flow velocity becomes almost nil, they are compelled to use preserved water in containers and often suffer from shortage of domestic water sources.

3.3 Agricultural Situation

3.3.1 Land use

The present land use condition is grouped into four categories which are further divided into 18 patterns. As shown in Table 3, the Study Area of 12,683 km^2 is categorized into forests of 4,657 km^2, cultivated land of 3,911 km^2, bush and grassland of 3,565 km^2 and villages and others of 550 km^2. The cultivated land consists of 165,500 ha of paddy field, 142,170 ha of estate crop areas and 83,430 ha of upland crop and shifting cultivation areas.

As illustrated in Figure 15 and shown in Table 3, the distribution of paddy field is 91,470 ha in the swamps, 71,700 ha in the alluvial plains and 2,330 ha in the alluvial valleys. Estate crops are planted in 37,680 ha in the alluvial plains, 28,750 ha in the alluvial valleys and 75,740 ha in the plains. Upland crop and shifting cultivation areas extend over 36,760 ha in the swamps, 4,000 ha in the alluvial plains, 2,790 ha in the alluvial valleys, 28,860 ha in the plains, 7,140 ha in the hills and 3,880 ha in the mountains.

3.3.2 Irrigation facilities

In the Study Area, there are 30 irrigation schemes which have been fully or partly completed by DPUP. According to the DPUP's original plan, the irrigation command area was 16,150 ha as a whole. However, it was assessed through the Study that this command area is over- or under-estimated. This fact is caused by improper plans and designs due to insufficient planning materials such as hydrological and topographical data. Therefore, it was re-evaluated from the hydrological viewpoints and revised to 11,050 ha under the present Study. The existing irrigation schemes are listed in Table 4. (Details are presented in Annex F.)

At present, irrigation water is supplied to 9,650 ha in the wet season and 2,750 ha in the dry season. The irrigation area accounts for only 5.8% of the whole paddy field and the remaining areas are used under rainfed condition. Water sources of the existing irrigation schemes are derived from the left bank small tributaries of the Negara river. Intake weir sites are mostly located on such tributaries at the skirts of hills, and catchment areas at the respective intake weir sites are small due to topographic limitations. Further, shortage of available intake water results in small size of the irrigation command area below 400 ha in 20 irrigation schemes.

According to the DPU's classification standard, facilities in the existing irrigation schemes in the Study Area consist of nine simple irrigation systems, 11 semi-technical irrigation systems and 10 technical irrigation systems. In the Study Area, the simple irrigation system is equipped with only water intake facilities so that no water level control is possible after passing through intake weirs. The semi-technical irrigation system possesses usually control facilities but no measurement equipment at intake sites. The technical irrigation scheme is in principle to control water level of its canal system as designed, although it does not function well and has not been equipped with tertiary system. The irrigation command area of 11,050 ha comprises 1,450 ha of simple irrigation schemes, 2,360 ha of semi-technical ones and 7,240 ha of technical ones.

The present condition of irrigation facilities in the Study Area is described 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, and

- Main canals running along the foot of hills are heavily sedimented by soils washed away from hill slopes resulting in reduction of canal cross section. Leakage from and breakdown of sidewalls of earth canals are also common. Due to improper design or construction, no delivery of water to paddy fields occurs frequently where the canal bed is upturned in gradient or lower in elevation. Canal water is drawn by fish pond owners causing no inflow to downstream paddy fields in places where proper water management by DPUP is disregarded by non farmers.

Beneficial farmers have not been provided with any opportunities of learning methods on how to use irrigation water effectively as well as how to operate and manage irrigation facilities because of lack of well-trained and experienced staff in DPUP South Kalimantan.

3.3.3 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, according to the DPUP's plan. As shown in Table 5, completed parts of the command areas are 17,640 ha for the drainage schemes and 13,700 ha for the polder schemes. In these completed parts, paddy is grown once a year without any supply of irrigation water. Farmers also plant paddy in some uncompleted

parts of the drainage schemes at their own risk. The average size of scheme is 1,323 ha for the drainage schemes and 1,814 ha for the polder schemes. (Details are presented in Annex G.)

The drainage facilities are featured by the following five types:

- Type A; Most simple type having only an excavated drainage canal. In this system, drainage control is not effectively done,
- Type B; Combination of a natural water course and gate (stop logs) constructed at the downstream end of the natural water course flowing into the main river. With dual functions, one is to prevent reverse flow from the main river during the flood period and the other is to keep field submerged during the wetland paddy growing period,
- Type C; Combination of a dyke and gate (stop logs). The dyke is constructed along the main river to protect inflow of flood water. The gate with intake and drainage functions is facilitated at a point where a natural water course crosses the dyke, and
- Type D; Combination of a drainage canal and gate (stop logs) to make drainage control more effective. The gate is constructed at the end point of the drainage canal where the canal connects with the main river.
- Type E; Combination of drainage canals, gates and a dyke as the ultimate system when natural drainage is a precondition. The dyke is constructed along the main river to protect inflow of flood water and to function as inspection and access road. The gates are equipped at both end points of primary and secondary drainage canals.

Number and command areas of the respective types consist of 14 schemes commanding 16,955 ha of Type A, five schemes covering 2,425 ha of Type B, seven schemes benefiting 7,939 ha of Type C and three schemes having command areas of 11,050 ha of Type D. In the Study Area, Type E is not practiced at present. The average drainage canal density is 18 m/ha with a wide range from 8 to 22 m/ha.

As for the existing nine polder schemes, a total of 2,630 ha has not been cultivated to date out of the command areas originally planned. Among the polder schemes, Alabio polder can be defined as the technical system and the other eight polder schemes as simple type.

The Alabio polder scheme constructed in 1930's is equipped with dyke of 45 km long and two pumping stations. One is an irrigation pumping station with a capacity of 90 m^3/min for the low water level season and of 116 m^3/min for the high water level season. The uncultivated area of 1,450 ha in the Alabio polder is of open water space throughout the year. Farmers of the Alabio polder utilize the open water space as their fishing ground.

Bottlenecks in the existing drainage schemes are sedimentation, shortage of canals and waterways, damage of dikes and gates and insufficient access roads. At present, sedimentation in drainage canals is the most serious problem causing the extremely poor drainage functions. In the 16 schemes with drainage problems, 160 km of canals are sedimented with more than 50 cm in thickness with an estimated volume of 900,000 m^3.

3.3.4 Crop production

(1) Production pattern

Paddy cultivation plays an important role in the agricultural sector of the Study Area. Next to this, rubber and coconut plantings contribute to the boost of regional economy. Salient features of crop production patterns are briefly described below:

- Kabupaten Tabalong is specified as tree and upland crops cultivation area centering on rubber planting,
- Kabupaten Hulu Sungai Utara is characterized by wet-season paddy cultivation in the alluvial plains, dry season one in the swamp areas and single cropping of palawija in the wet season in close correlation with hydrological environment. Rubber planting predominates in the plains,
- Kabupaten Hulu Sungai Tengah is featured by high productive paddy cultivation in the alluvial plains,
- Kabupaten Hulu Sungai Selatan is characteristic of the wet season paddy cultivation in the alluvial plains and the dry season paddy cultivation in the swamps, and
- Kabupaten Tapin possesses special features of paddy cultivation such as the wet season paddy predominating in the alluvial plains and also in the existing drainage scheme areas and the dry season paddy common in non-improved paddy field in the swamps.

Several types of paddy cropping calendars are observed for different paddy field conditions in the Study Area as shown in Table 6. These are illustrated in Figure 16. These calendars are specifically adapted to hydrological conditions in the swamps. Under the circumstance without drainage control facilities, paddy cultivation starts from the later part of the wet season and harvesting work is completed before starting the next wet planting season. The following table and Table 7 indicate the seasonal paddy planted area estimated by type of paddy field condition in the Study Area.

(Unit: ha)

Field Condition	Wet Season	Dry Season	Total Planted Area
Irrigated	9,650	2,750	12,400
Drained	15,900	1,740	17,640
Poldered	4,500	9,200	13,700
Rainfed	64,480	60,030	124,510
(Swamps)	(100)	(60,030)	(60,130)
(Alluvial plains)	(62,050)	(-)	(62,050)
(Alluvial valleys)	(2,330)	(-)	(2,330)
Total	94,530	73,720	168,250

As the total area of paddy field is 165,500 ha, the present cropping intensity in the Study Area is estimated at 102%.

Tree crops are grown by smallholders and estates in the Study area. Major tree crops comprise rubber, coconut, coffee, cloves and pepper with a total coverage of 96,090 ha according to statistical data as shown in Table 8. Fruits and vegetables have a very small share, only 1% in the total cropped area of the Study Area, while their production contributes to nearly half of the production value in the South Kalimantan Province.

The estates in the Study Area can be classified into the following four types according to their development and management systems:

- Individual smallholders estates occupy 79% of rubber area and 98% of coconut area without any particular assistance from the Government. Out of rubber trees, 68% is productive, while 19% is young and 13% is old,
- Project Management Units (PMUs) cover 4% of rubber area providing the existing smallholders with such government's assistance to replant rubber and

coconuts in the form of credits and extension services. As PMUs have recently been started, all rubber trees are not yet productive,

- Nucleus Estates and Smallholders (NESs) account for about 14% of the total rubber area. The Government plants and maintains tree crops on previously undeveloped land until they reach maturity, using selected prospective settlers as employees. After the plant maturity, farmers have to take responsibility in their management as smallholders. Due to the recent implementation of this system, all rubber trees under NESs are still young, and
- Private estates developed and managed by the private sector cover 4% of the rubber tree area. Farmers are hired as labor forces for the production. Renewal of old rubber trees shows good progress so that the present proportion is 36% for productive, 49% for young and 15% for old trees.

(2) Prevailing farming practices

Single cropping of paddy for the wet season is broadly prevailing in the alluvial plains and valleys, while paddy cultivation is possible only in the dry season in the swamps unless drainage control facilities are provided. Palawija crops are partly grown as the dry season crop after harvesting paddy. About 6% of wet paddy field is provided with irrigation facilities. Most of paddy is therefore grown under rainfed cultivation. As a result, the time of planting shows a wide range of fluctuation according to the impounded period and depth of rain water in the alluvial plains and inundation period and depth of river and rain water in the swamps. Farmers are usually forced to cut the top of seedlings twice to three times on nurseries before transplanting into main paddy field. Local varieties are grown with a growing period of about 10 months and are not subject to intensive farming practices.

The average amount of fertilizers applied in the Study Area is estimated to be 8.7 kg/ha of nitrogen and 5.6 kg/ha of phosphate for paddy and estate crops.

(3) Crop yield and production

Based on five years crop statistical data of 1982-1986, crop yields and production in the Study Area are calculated on the basis of harvested area and the results are given in Table 8.

The average unit yield of paddy of the above period is 3.4 ton/ha in the Study Area ranging from 2.8 ton/ha in Kabupaten Hulu Sungai Utara to 4.2 ton/ha in Kabupaten Hulu Sungai

Tengah. If based on crop planted area, the average unit yield of paddy becomes 2.4 ton/ha. Taking into account irrigation area, fertilizer application amount and performance of the intensification extension service program, these average paddy yield data at present in the Study Area seem to be overestimated to a certain extent in comparison with paddy yields in Java and Indonesia.

	Indonesia	Java	Study Area
Yield (ton/ha)	4.1	4.5	3.4
Irrigated Area (%)	47	73	6
Nitrogen Fertilizer (kg/ha)	163	232	9
Area Covered by Intensification Program (%)	91	99	75

3.3.5 Inland open fishery

Fishery resources in the Study Area have annually provided local fishermen with about 38,300 tons of inland open water fishery production on an average for three years between 1984 and 1986. The highest production was recorded at 44,568 tons in 1982. Traditional and small scale fishing methods are predominant. Major fishing grounds in the Study Area are located in the middle and lower reaches of the Negara river as well as Lakes Panggang and Bankau. Major fishing gears consist of gill nets and portable nets. From interviews with local fishermen, fish size has gradually become smaller and the fish catch per unit effort has also been decreasing. The average production by species for the above period is 37,500 tons of fish, 500 tons of shrimps and 300 tons of snails. Major fish species are gouramies, snake heads, anabas, catfishes and carps. (Details are presented in Annex I.)

Fresh water aquaculture development has recently started in the Study Area, but its activity still remains at a very low level. The annual production in 1986 was only 90 tons.

About 30% of freshwater fish catch is used in dried fish processing popularly practiced by many fishermen families in the Study Area. The production of dried fish reached 7,256 tons in 1984 contributing to 16.3% of the national production.

3.4 Agro-economic Situation

3.4.1 Agro-economic features

(1) Farm households

Farm population in the Study Area as of 1985 is estimated at 675,300 in total of which 270,100 are working population. Total farm households and the average farm family size as of 1985 are also estimated at 158,700 and 4.3 persons, respectively. (Details are presented in Annex E.)

(2) Land tenure and holding size

According to the 1983 Agricultural Census, the average size of land controlled by one farm household is 0.8 ha in the Study Area and 1.1 ha in South Kalimantan.

The number of owner farm households is estimated at 138,200. They own about 99,900 ha of land, while tenant farm households work on 23,400 ha. About 50% of the total farm households cultivate less than 0.5 ha, while 23% cultivate more than 1.0 ha. These figures indicate rapid fragmentation of land in the Study Area compared with the average holding size in South Kalimantan.

(3) Food balance

Based on the Indonesia's per capita food consumption data prepared by the Central Bureau of Statistics, the present food balance in the Study Area has been preliminary estimated. Among the food crops, only rice has a sufficient surplus of about 150,700 tons. Productions of other palawija crops, vegetables and fruits are insufficient in the Study Area. Freshwater fish has a large surplus of about 28,400 tons.

3.4.2 Agricultural supporting services

(1) Institutions concerned

Institutions providing agricultural supporting services directly and indirectly to farmers are listed in Table 9.

The regional office of agriculture of Kanwil (Kantor Wilaya) under the aegis of the Secretary General of the Ministry of Agriculture, plays a leading role in agricultural supporting services in South Kalimantan. Regional Departments of Food Crops, Estate Crops, Livestock and Fishery known as Dinas are the provincial representative organizations of the respective Directorates General of the Ministry of Agriculture. These Dinas offices are administratively responsible to the Governor and Provincial Government, but in general they are responsible to the respective Central Directorates General for implementation of national programs and technical matters. Each Dinas maintains branch offices at Kabupaten level known as Cabang Dinas.

The Ministry of Forestry has both Kanwil and Dinas in the South Kalimantan Province and is responsible for identifying, demarcating and protecting forest areas. The Ministry of Cooperatives maintains Kanwil at province level and regency offices at Kabupaten level known as Kandep. Much of its emphasis has been put on Village Cooperatives (KUDs). The Ministry of Transmigration provides Kanwil at province level in South Kalimantan and field offices at the transmigration sites in order to give training services to migrants. For the development of water resources including irrigation, the Ministry of Public Works maintains the Provincial Office. Services for development of irrigation, drainage and polder and for operation and maintenance of these works are carried out under the responsibility of DPUP.

(2) Agricultural intensification program

The agricultural intensification program promoted by the Government aims to increase food crop production by coordinating all the efforts of agricultural supporting services so as to provide a "package" of agricultural inputs to farmers. In South Kalimantan, however, consolidation of this program has been enforced only recently. In 1980, the intensification program covered only about 27% of wet paddy field in the Province, and this rate was increased to about 75% in 1986.

(3) Research

There are a research institute for food crops and a veterinary research station both located in Banjarbaru. The Banjarbaru Research Institute for Food Crops is responsible for research on use and management of tidal and freshwater swamp resources. Under this research institute, there are 10 experimental farms of which four are located in the Study Area. Their main activities are research works on soil and its fertility, food crops production, rice varietal improvement, crop diseases and pests, and cropping systems in the tidal swamp.

(4) Extension

At the province level, the Governor is administratively responsible for the execution of agricultural extension services. As for the programming and daily operations of the services, the Kanwil Agriculture, provincial agricultural services (Dinas) and BIMAS Secretariat play a leading role. The Provincial Coordination Forum chaired by the Kanwil Agriculture coordinates agricultural extension services in the Province. At the Kabupaten level, Bupati who is the head of Kabupaten has the administrative responsibility for agricultural extension services. Extension programming and technical matters at the Kabupaten level are controlled by the District Coordination Forum headed by Bupati. The Rural Extension Center functions as a base camp for extension services and is responsible for agricultural extension services at field level, it covers one to three Kecamatans. In the Study Area, 25 Rural Extension Centers are under operation as shown in Table 10.

Daily agricultural extension services are carried out by means of the Training and Visit System. Field extension supervisors and workers staying at the Center visit farmers' groups once in two weeks. They are technically supported by subject matter specialists. In the Study Area, extension services are provided by 12 subject matter specialists, 177 extension supervisors and 317 extension workers. Their service field covers food crops, estate crops, livestock and fishery. One extension officer assists about 320 farm households in the Study Area.

(5) Credit

Major credit programs available in South Kalimantan are Integrated Farmer Credit, General Rural Credit, Small Investment Credit, Permanent Working Capital Credit and Regional Development Credit. These programs are handled by Bank Rayat Indonesia and Bank Pembangunan Daerah through their branches and village units.

Among these programs, the Integrated Farmer Credit is considered to be most important working capital credit scheme. Average loan amount of the recent two years, 1985 and 1986, was about Rp.1,010/farm household/year in the Study Area. This loan amount was 13% higher than that in South Kalimantan and 77% higher than that of Indonesia as a whole. However, KUDs, which obligation is to extend this credit, are still weak in management, and only 16% of KUDs handled this credit in the Study Area in 1986/87.

(6) Input supply

In South Kalimantan, there are three Provincial Seed Centers and three Kabupaten Seed Stations under the Dinas Food Crops. These produce and distribute annually about 570 tons of paddy extension seeds, around 60 tons of palawija crop seeds and 63,000 estate crop seedlings of coconut, coffee, pepper and cocoa.

Supply of fertilizers and agro-chemicals are handled by the government enterprises of P.T. Pusri and P.T. Pertani, respectively. Their regional branches are located in Banjarmasin. The total amount of fertilizers distributed to South Kalimantan was about 60,200 tons in 1987. the Study Area received about 20,500 tons. Most of the fertilizers are urea and triple superphosphate with shares of 56% and 36%, respectively.

(7) Marketing/Processing

Government interventions in the market of agricultural products have concentrated in rice with the object of fostering production and expanding farm incomes through the National Logistics Agency at the national level and through the Regional Logistics Depot at the province level. In South Kalimantan, the Regional Logistic Depot procured about 13,200 tons of rice on an average in the recent five years from 1983/84 to 1987/88. This procurement corresponded to only about 2% of the total production and 4% of the estimated rice marketable surplus from farmers in South Kalimantan.

There are 1,247 rice mill units in South Kalimantan, and 526 units are located in the Study Area. The total milling capacity in terms of rice is estimated to be 859,000 tons/year in South Kalimantan and 340,000 tons/year in the Study Area. Both milling capacities are enough to cover the present rice production with some extra capacities remaining. Such extra capacities are estimated to be about 272,800 tons of rice in South Kalimantan and 56,100 tons in the Study Area.

Marketable surpluses of other crops from the Study Area are all handled by the private sector in general. The marketing system of rubber in the Study Area is featured by direct trading of roughly processed ribbed smoked sheets or coagulated rubber from small holders to the market. Annual rubber exports from South Kalimantan were about 33,000 tons in 1987 including rubber produced from other provinces.

The total rubber processing capacity is estimated at about 37,000 tons/year in the Study Area. Out of this capacity, about 26,000 tons/year come from traditional small scale

facilities with an average processing capacity of 15 tons/year/facility. Most large scale new facilities for rubber processing are located in Banjarmasin and the total processing capacity in South Kalimantan.is estimated at 70,300 tons/year. This capacity is quite sufficient cover the regions total rubber production of 28,000 tons/year.

(8) Evaluation of agricultural supporting services

Based on the analyses on the present condition of agricultural supporting services, further improvement requirements are evaluated through the following criteria:

- 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 in the future, and
- Requirement C : Present level of service activities are continuously required.

The results of evaluation are as follows:

	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

3.4.3 Farmers' organization

According to the Law on basic regulations for cooperatives enacted in 1967, the Government has been promoting the establishment of KUD at the village level to support agricultural development. Its functions cover agricultural extension particularly related to the agricultural intensification program, channeling credits to farmers, channeling farm

inputs and essential goods such as rice, cooking oil and sugar, and processing and marketing of products. Its activity area covers from 600 to 1,000 ha of paddy field.

In South Kalimantan, 218 KUDs have been already established and 99 KUDs are located in the Study Area. However, most KUDs are inactive in the Study Area. Only four KUDs are classified as "excellent" and 34 KUDs as "good" in their activities.

3.4.4 Operation and maintenance system for irrigation and drainage facilities

(1) Sub-Dinas Water Resources Development

Under DPUP South Kalimantan, Sub-Dinas Water Resources Development is responsible for operating and maintaining public irrigation and drainage systems. It has various sections for planning and programming, implementation, and operation and maintenance (O&M) as illustrated in Figure 17. The O&M section is involved in preparing operation plans and guidelines and O&M budgets, and in ensuring adequate O&M in the Province.

O&M services for the main irrigation and drainage systems are carried out mostly by the Cabang Dinas Water Resources Development located in each Kabupaten under which about three Inspectors are assigned in order to provide O&M services at Kecamatan level with the average command area of about 4,560 ha. Further under each Inspector, about two Overseers are assigned with the average command area of about 1,950 ha. Only 32 gate-keepers are available under Overseers in Kabupaten Hulu Sungai Utara, and no such personnel is provided in other four Kabupatens in the Study Area.

The Cabang Dinas Water Resources Developments duties are to estimate crop areas, stages of crop growth, crop water requirement, field application and conveyance loses, and water inflows and outflows in offtakes and structures. Such activities require more staffs and higher technical capabilities.

(2) Water User's Association

In 1975, the Government of Indonesia decreed the establishment of Water Users' Associations at the village level. Main functions are to manage water distribution properly and equitably for every part of the field, to maintain the irrigation system regularly, to rehabilitate damaged facilities, to propagate agricultural technique especially on cultivation

and irrigation, to collect contributions and funds for maintenance and development of irrigation facilities, to comply with regulations and set punishments to its member farmers.

In the Study Area, 71 Water User's Associations have been organized with membership of 5,700 farmers corresponding to about 4% of the total farm households. Among these Associations, only about 9% are active, 54% are semi-active and the rest are inactive. Such situation is mainly due to poor tertiary system development in South Kalimantan.

4. DEVELOPMENT STRATEGY

4.1 Constraints to Development

(1) Constraints at national level

Considerable increase in population and labor force: Indonesia had a total population of 164 million in 1985. Several recent forecasts suggest that Indonesia's population is likely to increase to a level of 210 to 223 million by 2000. Careful attention should be paid to this increasing trend of the population particularly in programming food crop production. Because of high birth rates in the 1960s and 1970s, a very large number of people will enter the labor force before the end of the century. Such future increase in the labor force should also be considered in formulating development plans in order to create additional job opportunities.

Disparity of population distribution between Java and Off-Java: Out of Indonesia's total population, about 100 million live on the island of Java with about 7% of the nation's land. This results in a high population density of 753 person/km^2 in Java and low density of 36 person/km^2 in Off-Java.

Disparity of income distribution among regions: Due to maldistribution of population, there are certain disparities in GRDP per capita and agricultural GRDP per farm household among regions in the country. Per capita GRDP in Java was Rp.342,000 at 1983 current prices, while that in Off-Java was Rp.525,000. Agricultural GRDP per farm household at 1983 current prices was Rp.743,000 in Java and Rp.960,000 in Off-Java.

Maintenance of food self-sufficiency: Increase in food requirement derives from increases in the total population and the average annual per capita consumption. Food self-sufficiency is a dynamic process and follows the balance between the demand and supply of food. Rice production in Indonesia has been maintained at a level of around 27 million tons since 1985 and the Government's stock of rice declined from 2.4 million tons in 1985 to 0.8 million tons in 1988. Rice production requirement in 1988 is estimated at 28 million tons to fully meet local demands in 1988/89.

Importance of non-oil exports acceleration: Since the early 1980s, Indonesian economy has faced a worsening economic environment due mainly to sharp decrease in oil prices in the

international market. For the recovery and growth of Indonesian economy, increase in non-oil exports is considered as one of the most important countermeasures.

(2) Constraints in the Province and the Study Area

Population outflow: The total population in the Study Area was 890,200 in 1985. The population growth rate was 0.93% per annum from 1971 to 1985 in the Study Area and 2.23% per annum in South Kalimantan. This comparatively lower rate of population increase indicates a continuation of population outflow from the Study Area to other areas inside and outside the Province. The reasons of this population outflow are considered to be difficulty of further land exploitation for agriculture by farmers and relatively low crop productivity. Because of these two reasons, farmers can not expand and split the land for their next generation. Such low population growth in the Study Area also bring about a labor shortage particularly during the crop planting and harvesting seasons.

Low productivity of crop production: Food crops are the most important products in the Study Area, accounting for about 50% of the estimated agricultural gross production value. Among food crops, paddy has the biggest share of 45% in the said value. However, it can be pointed out by comparing the yield index based on official statistics that crop productivity is still considerably low at present as shown below:

Crop	Indonesia/a	South Kalimantan/b	Study Area/b
Wetland paddy	100	66	80
Dryland paddy	100	91	92
Maize	100	43	40
Rubber	100	82	93

/a: 1981-85 average, /b: 1982-86 average, Indonesia = 100

The main reasons of this low level of crop productivity in the Study Area are considered to be the lack of irrigation and drainage facilities for crop production and insufficient institutional agricultural supporting services.

Lack of irrigation and drainage facilities for crop production: In the Study Area, facilities required for increasing and stabilizing crop production have been insufficiently arranged. As an example, irrigated areas in the Study Area are extremely small at only 6% of the total wet paddy field compared with 48% in Indonesia.

	Wet paddy Field (1,000 ha)	Irrigated Area (1,000 ha)	Proportion of Irrigated Area (%)
Indonesia	7,613	3,674	48
South Kalimantan	403	10	2
Study Area	165	9.7	6

Lack of sense about proper utilization of irrigation and drainage facilities: In the Study Area, the existing facilities supply irrigation water to 9,650 ha and control drainage condition in 17,660 ha under drainage improvement schemes and 13,700 ha under polder schemes. Although these service areas are very limited in areal extent, utilization manner by beneficiary farmers and operation and maintenance methods by technical and administrative staff of DPUP South Kalimantan are quite far inadequate in all of the existing 30 irrigation, 29 drainage and nine polder schemes, if compared with the Indonesia's standard. Thus, rehabilitation and replacement works are urgently required in 60 schemes out of the above 68 DPUP's schemes.

Insufficient institutional agricultural services: Consolidation of agricultural institutional services has been lately enforced in the Study Area as they are considered to be one reason of the low crop productivity. Another reason is low privation of high yielding rice variety in the Study Area.

Compared with the average rate of 70% in high yielding rice cultivation area throughout the country, the Study Area accounted for only 56% in 1985/86. This is mainly caused by insufficiency of input supply services to produce and distribute high yielding variety seeds to farmers and extension services to promote improved cultivation technic of high yielding paddy.

4.2 Development Needs

4.2.1 Socio-economic projection

(1) Population projection

Based on the results of the population projection made by the Central Bureau of Statistics, the total population is estimated for the year 1998, 2008 and 2018. The projected population increase rates adopted for the Study are as follows:

(Unit: % per annum)

	1985-1998	1998-2018	1985-2018
Indonesia	2.01	1.90	1.94
Java	1.26	1.19	1.22
Off-Java	3.03	2.64	2.79
South Kalimantan	2.08	1.95	2.00
Study Area	0.74	0.59	0.65

The estimated population outflow rate from the Study Area to other places is 1.27% per annum for the 1985-1998 period, 1.31% p.a. for 1998-2018 period and 1.29% p.a. for the 1985-2018 period.

Future population to 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

(2) Food balance projection

The food balance projection in the year 1998, 2008 and 2018 is carried out for Indonesia, South Kalimantan and the Study Area by referring to the following:

- Price and Investment Policies in the Indonesian Food Crop Sector, 1987, International Food Policy Research Institute, Washington, D.C. and Center for Agro-Economic Research, Bogor, Indonesia,
- Food Balance Sheet in Indonesia 1983, Central Bureau of Statistics, and
- Food Balance Sheets 1979-81 Average, FAO.

Based on the projected supply of and demand for major agricultural products as shown in Tables 11 to 13 and detailedly in Annex A, the status of future food balance is evaluated by taking the supply/demand ratio into account. From the results of evaluation, future flood balance situation can be summarized as follows:

- In Indonesia, crops with balanced tendency are rice, maize, cassava, sweet potato, coconuts, vegetables, fruits, eggs and fish. While, crops with continuous shortage are soybeans, groundnuts, meat and milk,
- In South Kalimantan, surpluses of rice, coconuts, eggs and fish can be expected. However, actual production of all palawija crops, vegetables, fruits, meat and milk would not cover the demand, and
- In the Study Area, the future trend of food balance would show the same tendency in South Kalimantan except for groundnuts and meat.

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

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

(3) 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 assess the food balance of rice within the island. As shown in Table 14, rice production in the Central and East Kalimantan Provinces is insufficient for meeting the present demand of each province, and sufficient rice surplus from South Kalimantan is playing an important role in fulfilling local demands in these provinces. In the future, rice surplus from South Kalimantan would continuously supplement shortage in neighboring provinces.

4.2.2 Development needs

(1) Food crops

The Study Area is the production center of rice in South Kalimantan and plays the same role in Central and East Kalimantan. However, the productivity and economic profitability of rice is still low in the Study Area compared with those in other regions in Indonesia. In order to improve farmers' economy as well as the regional economy, rice productivity has to be increased through necessary measures.

The results of food balance projection indicate the necessity of continuous increase of palawija crops such as maize, soybeans and groundnuts, although these crops are not the main income source of the farmers in the Study Area at present. The production surplus of these crops would also improve farmers' economy and supplement the increasing demand in South Kalimantan.

Taking the above discussions into consideration, development needs of food crops would be as follows:

- Rehabilitation, upgrading and new development of irrigation system,
- Upgrading and new development of drainage systems in the promising parts of the swamp areas keeping pace with the increasing demand of food crops,
- Improvement of the 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.

(2) Estate crops

Further growth of non-oil exports would become more important in the future Indonesia's economy. In the non-oil exports sector, agricultural commodities particularly estate crops have traditionally played an important role. From this point of view, it is necessary to increase the production of estate crops in the Study Area. Production increase of these crops would also improve farmers' economy.

Development needs of estate crops are considered to be as follows:

- Completion of on-going NES development schemes which were stopped due to the 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.

(3) Fishery

The Study Area possesses important inland fishing ground. In Repelita V prepared by BAPPEDA, target fishery production is set up at 147,200 tons in South Kalimantan. For the Study Area, the target production increase expected is 5,100 tons for inland open water fishery and 130 tons for fresh water aquaculture. As natural fishery resources in the Study Area have been well exploited, special attention should be paid to increase inland open water fishery productivity on one side and to maintain the existing fishery resources without serious damage on the other side.

Under such situation, development needs of fishery by preserving the 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 potential areas, and
- To strengthen necessary supporting services of the fishery sector.

(4) Watershed management

In hilly and mountainous regions of the Study Area, there exist vast shifting cultivation area, alang-alang grassland and regrowing bushes causing increase in sediment deposits in the

Negara sub-basin. In consideration of such land use situation in the Study Area, development needs can be considered as follows:

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

4.3 Development Potentials

4.3.1 Potential land resource

The Study Area of 1,268,268 ha is classified by the average land 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

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 which are swamps, alluvial plains, alluvial valleys and plains. Of these, the first three types are less than 2% in the average slope, while the plains have the average steepness of 2 to 25%.

The land resource development potentials for the crop cultivation purposes are summarized below:

- In swamp area of 412,000 ha, deep and shallow peat swamps, villages and lakes which have no suitability for agricultural development cover 156,430 ha. The remaining areas include 91,470 ha of paddy field, 36,760 ha of upland and shifting cultivation area and 28,190 ha of uncultivated area. Among these land

use patterns, upland and shifting cultivation areas are periodically cultivated field where either paddy or palawija crops are intermittently grown. Of the paddy field, drainage or polder facility is provided for 31,350 ha. In the remaining paddy field, farmers grow paddy at their own risk. Under such land use and soil conditions, potential areas for drainage improvement and polder development are estimated at 125,070 ha consisting of unimproved paddy field, upland and shifting cultivation area and uncultivated areas.

- In the 140,980 ha of alluvial plains, available land resources for reclaiming new farm land are limited to 2,300 ha due to full utilization of land for crop cultivation. The same situation is observed in the 43,530 ha of alluvial valleys. Out of the 71,700 ha of paddy field in the alluvial plains and 2,330 ha in the alluvial valleys, irrigation facilities are available to only 9,650 ha at present. Such vast rainfed paddy field areas constitute development potential land of the Study Area.

- In the 283,190 ha of plains, land with the average steepness of less than 25% occupies 271,300 ha of which grassland and bush areas cover 73,950 ha. These areas have development potential for the use of tree crop production.

4.3.2 Potential water resource

(1) Long term flow

Water resource potential in the Study Area is expressed as long term flow. For the analysis of long term flow, mathematical simulation model (Tank model) has been employed using rainfall records from 1917 to 1941 and from 1951 to 1987. In this simulation, the following assumptions were considered:

- Runoff from upper tank is inflow of lower tank,
- Floods from the Barito river are neglected, and
- All the runoff from the Negara sub-basin flow into the Barito river at Marabahan.

The results of simulation are summarized below:

(Unit: m^3/sec)

Sub-system	Monthly Mean Runoff												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Tabalong Kiwa	74	70	71	61	50	37	32	28	26	28	41	68	586
Tabalong Kanan	60	57	57	49	40	30	26	23	21	23	33	54	473
Tabalong	54	54	56	49	36	26	20	17	17	19	30	52	433
Balangan	94	92	78	61	58	54	44	36	35	36	57	85	732
Batang Alai	86	90	90	84	72	57	47	37	30	30	44	72	740
Tapin	84	80	90	71	54	37	25	19	18	22	34	62	596
Negara	64	66	70	59	46	31	22	18	17	17	26	47	484

Low monthly flows occurring once in five years were also estimated from simulation results applying the Type III extremal distribution (Gumbel). The results are shown below:

(Unit: m^3/sec)

Sub-system	80% Probable Monthly Mean Runoff												
	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

(2) Flood flow

Probable flood flow along the Negara river is estimated by storage function model with the following conditions and data:

- Probable areal rainfall estimated,
- Probable rainfall poured in Tabalong Kiwa and Kanan sub-systems,
- Topographic information obtained from 1/50,000 scale topographic maps,
- Typical cross sections of the Negara river obtained from P3SA, and
- Coefficients of the model employed by the empirical value.

The calculation results of probable flood peak discharge at Amuntai, Negara, Margasari and Marabahan are summarized below:

(Unit: m^3/sec)

Place	Return Period (year)			
	500	200	100	50
Amuntai	2,620	2,210	1,890	1,520
Negara	2,610	2,200	1,870	1,470
Margasuri	2,580	2,110	1,750	1,310
Marabahan	2,490	1,980	1,600	1,190

(3) Groundwater

No hydrogeological study has been carried out in the Study Area, hence little can be said of the groundwater potential. Field inspection of village wells shows that most shallow wells are dug for the purpose of domestic use. As shown in latter section of water balance, the Study Area has enough surface water potential that is freely available. As such the exploitation of ground water for other than domestic use seems to be not worthwhile. In this Study, groundwater potential is disregarded as water resource potential.

4.4 Basic Development Concepts

The main development objectives of South Kalimantan are linked to the national targets of economic growth, equitable distribution of development and national stability.

They are translated for provincial conditions and requirements as follows:

- To increase living standard,
- To increase education level,
- To increase physical and spiritual well-being of people, and
- To establish a firm base for future economic development.

Development plans should aim to increase the living standard of people by stimulating agricultural production, mining and quarrying, and industrialization. The base for future economic development will be strengthened by developing physical infrastructures and by increasing the industrial sector's share in the regional product. Education and physical and spiritual well-being are to be improved with the provision of educational and health services.

Taking into account the above-mentioned background and development progress in the Study Area, the following concepts are established as direction of development for the Negara sub-basin:

- Consolidation of food crop production bases with provision of irrigation and drainage facilities to contribute to the increase in farmers' 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.

4.5 Development Measures

4.5.1 Agricultural development

The food balance projection reveals that demand and supply condition of rice will be balanced in Indonesia as a whole in the next 30 years. In other words, it is needed to increase paddy production every year at an average growth rate of around 2% per annum. When special attention is paid to the latest situation concerning paddy production bases in the country, it should be understood that maintenance of self-sufficiency of rice as the Indonesia's staple food is a larger issues of national policy to be tackled with great effort. According to information within DGWRD and the Ministry of Agriculture, highly productive paddy field of around 20,000 ha has been annually converted to other use in Java due to the rapid progress of urbanization and industrialization activities. In terms of land productivity, such lost paddy field is equivalent to newly opened paddy field of 100,000 ha in Off-Java areas. Another important issue is the slow down of new investment to implement large-scale irrigation development in Off-Java areas as a result of the recent policy of retrenchment by the Government of Indonesia.

From the above circumstances, it can be clearly said that there is no possibility to increase drastically paddy production within Java in future and on the contrary there exists increasing requirements to overcome the imbalance of rice demand and supply in Java by supplying Off-Java's surplus paddy production to rice consuming areas in Java. It will also take a longer time until priority is given to huge investments to new irrigation development in the government's financial policy. In this regard, it is worthy to adopt improvement measures of crop production bases with less investment to the existing paddy producing areas in Off-Java such as the Negara sub-basin in South Kalimantan.

In order to make paddy production more attractive to local farmers in the Study Area, intensification of land use is a prerequisite by expanding irrigated double cropping areas of paddy. In parts of paddy field where the dry season irrigation water supply are impossible, introduction of palawija crops as the second crop should be promoted.

(1) Selection of crops

In the swamps, land covered with thick alluvial soils has suitabilities for wetland arable crops such as paddy. If drainage condition is improved, the land becomes suitable for growing wetland crops in the wet season and dryland crops in the dry season. In this case, palawija crops are to be selected as second crops.

In the alluvial plains and valleys, land has a wide range of suitabilities for both wetland and dryland crops. As the land has already been used for paddy and rubber cultivation, no more expansion of farm land can be expected. In this connection, land productivity of the existing rainfed paddy field is to be fully utilized with provision of irrigation water. If irrigation development is impossible in some parts of rainfed paddy cultivation areas, citrus is to be selected as a more profitable crop under drainage condition, while palawija crops are to be selected as the dry season crops grown under good drainage condition.

In the plains, land is suitable for growing dryland and estate crops. In principle, rubber is to be selected for expanding and developing Government sponsored estates in the plains.

(2) Proposed cropping calendars

In the swamps, the cropping calendar proposed for paddy field with drainage facilities constitutes of paddy in the wet season and palawija crops in the dry season. Paddy is grown on the main field for four months December/January to March/April. Therefore, the cultivation period of palawija crops is limited to two to three months after harvesting paddy. In this regard, short-term palawija crops to be introduced are maize, soybean, groundnut and mungbean. As some drainage schemes can receive irrigation water from the engineering viewpoint, double cropping of paddy is proposed with such calendar as either irrigated double cropping or combination of rainfed wet season paddy and irrigated dry season paddy. In the gravity polder scheme areas and in some drainage scheme areas where inundation water control is difficult during the wet season, the proposed cropping calendar comprises single cropping of paddy in the dry season. For the Alabio polder scheme, the proposed cropping calendar is of irrigated double cropping of paddy.

In the alluvial plains, the cropping calendar proposed for paddy field with irrigation facilities comprises double cropping of paddy. The growing period of paddy is 130 to 140 days in the wet season and 110 to 120 days in the dry season. The wet season cropping starts from the beginning of December, while the dry season cropping starts from the beginning of June. High yielding varieties such as IR36, IR46, IR56 and IR60 are to be introduced. In irrigation water shortage areas of the alluvial plains, the proposed cropping calendar is irrigated paddy in the wet season and rainfed palawija crops in the dry season.

Crop diversification is proposed for paddy field to be left under rainfed condition in the alluvial plains and valleys. Mixed planting of tree crops such as citrus with high profitability and marketability could be practiced by making high ridges along or mounds within paddy field with poor drainage condition. Either the dry season palawija cropping or a combination of two palawija crops is proposed as to diversify the current single cropping of paddy in paddy field with good drainage condition. Palawija crops to be taken up are groundnut and soybean for the first crop and watermelon and maize for the second crop.

The proposed cropping calenders are illustrated in Figure 18 and the target cropping intensity is as follows:

Schemes	Crops		Intensity (%)
	Wet Season	Dry Season	
Irrigation			
- Sufficient water supply	Paddy	Paddy	200
- Insufficient water supply	Paddy	Palawija	200
Drainage			
- Well drainage control	Paddy	Palawija	200
- Poor drainage control	-	Paddy	100
- Irrigation water supply	Paddy	Paddy	200
Polder			
- Gravity polder	-	Paddy	100
- Mechanical	Paddy	Paddy	200
Diversification under rainfed condition			
- Poor drainage	Mixed Paddy with Citrus		-
- Good drainage	Palawija/(Palawija)	-	100

(3) Improved farming practices

With provision or improvement of irrigation and drainage facilities, farming practices for paddy cultivation should be improved by means of supply of qualified seed of high yielding varieties, proper fertilizer application, timely pest and disease control, and proper management of irrigation water supply and drainage control.

The following shows farm input and labour requirements for growing paddy in one hectare under the present and future conditions.

Item	Present			Future	
	Irrigation and Rainfed Areas	Drainage and Polder Areas	Rainfed Areas	Irrigation Areas	Drainage and Polder Areas
1. Farm Input					
- Seed (kg)	25	20	25	40	25
- Fertilizer					
Urea (kg)	100	0	100	200	100
TSP (kg)	50	0	50	150	80
KCl (kg)	0	0	0	100	0
- Agro-chemicals					
Pesticide (lit)	3	0	3	3	3
Rodenticide (kg)	3	0	3	3	3
2. Labour Input (man-day)					
- Land preparation	25	20	25	30	30
- Transplanting	25	25	25	35	30
- Harvesting	30	30	30	40	30
- Others	60	45	60	105	70
- Total	140	120	140	210	160

Farming practices for palawija crop cultivation should be modernized through the introduction of high yielding varieties in combination with qualified seed supply, reasonable fertilizer application and proper control of pest and diseases.

4.5.2 Inland fishery development

(1) Inland open water fishery development

Any harmful effects on the existing fishing grounds will not be allowed through artificial development of the swamps. The rich inland fishery resources of these fishing grounds are sustained by broad swamps, which furnish many swamp dwelling species with their spawning and nursery areas as well as grow-out areas. The preservation of the natural environment should be taken into account before considering the development procedure of potential land and water resources in the swamps.

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

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

(2) Aquaculture

For the development of shrimp culture, overcoming of the following technical problems and issues is indispensable:

Production of shrimp fry: At present, shrimp fry can be easily collected by scoop net in the Barito river and its tributaries, but adult shrimp catch is gradually decreasing. It is presumed that the amount of natural fry will decrease when intensive fry collection is carried out to meet the demand of large scale shrimp farms if operated. It is therefore required to produce shrimp fry artificially and distribute it for aquaculture ponds.

Training and extension of aquaculture techniques: The present extension services should be strengthened and systemized by upgrading technical knowledge of the training staff. Technical transfer through experts or training in countries advanced in shrimp culture is a prerequisite to master the shrimp culture technique and pond design. For extension services to local farmers, practical training and instruction courses are indispensable.

Pilot operation: Pilot and trial operation has to be carried out to clarify technical problems on the productivity such as stocking density, survival rate, feeding intensity and water quality and to minimize the risk of large scale development. It is necessary to grasp the productivities for several different sites and culture methods. Experimental ponds can be set up in the Alabio polder and other potential areas in the swamps, and in existing ponds and irrigated paddy field on the alluvial plains.

4.5.3 Irrigation water supply

(1) Development scale

Irrigation development potential areas are concentrically distributed in the alluvial plains and in parts of the swamps located adjacent to the alluvial plains. Irrigation water will be

supplied to irrigation command areas by gravity. Based on this concept, there is no possibility to convert the present smallholders rubber estates to new irrigation command areas. The reason is that these estates occupy higher parts of the alluvial plains and have topographical limitation for receiving irrigation water by gravity.

The existing 30 irrigation water source facilities have water supply capacity to command 11,050 ha in total. In case that river discharge at these source facility sites have extra water quantity, new intake sites can be planned on the same river course instead of paying attention to expansion of the present intake and conveyance capacities of existing schemes.

Possible water source facilities are identified at 16 sites throughout the Study Area including one DPUP's planned site in Kabupaten Tapin. The 32,240 ha of rainfed paddy fields are demarcated as topographically irrigable area as 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

Because of limitations of water resources, the proper development scale of irrigation potential becomes 31,190 ha out of the selected area as topographically irrigable of 32,240 ha. Irrigated double cropping of paddy can be expected in 28,370 ha in total among the finally delineated irrigable area of 31,190 ha.

(2) Alternative considerations on irrigation water supply

Besides rainfed paddy field to be newly irrigated in the alluvial plains, some of the existing irrigation and drainage scheme areas can be expected to get irrigation water from four new irrigation water source facilities. The followings are alternative irrigation water supply measures:

- Water supply to the drainage scheme areas,
- Supplemental water supply to the existing irrigation scheme areas,

- Water source conversion of the above irrigation scheme areas, and
- Maximum utilization of newly developed water sources.

As described in Section 4.5.3(1), the topographically irrigable areas of the drainage schemes are to be 2,580 ha to which the wet season water supply is reduced to 1,800 ha. Supplement water supply to the irrigation schemes are to be 2,060 ha to which the dry season water supply is reduced to 1,930 ha. In case of water source conversion, a total of 3,550 ha will be covered by three new water sources of which 1,220 ha will be able to get dry season irrigation water.

(3) Improvement and early completion of existing irrigation system

Among the existing 30 irrigation schemes, the level of irrigation facilities is categorized as simple or semi-technical in 20 irrigation schemes with a total command area of 5,640 ha.

No effective utilization of insufficient river discharge can be achieved by simple or semi-technical irrigation methods. Besides improvement of main intake facilities, therefore, it is necessary to improve canal systems and to take consistent measures in proper operation and management. These measures will make it possible to flow water to tertiary level aiming at timely, uniform and efficient supply and distribution of water. For such purposes, the following measures are to be taken up in order to improve the existing irrigation system:

- Diversion facilities with permanent condition,
- Measurement facilities for water intake just below intake,
- Structures which can measure and control flow in canal systems,
- Tertiary networks to be thoroughly furnished in all schemes,
- Independent setting of irrigation and drainage canals at farm level, and
- Systematic and technical support systems for operation and maintenance.

In consideration of the present irrigation facilities condition in the technical irrigation schemes in the Study Area, it is also indispensable for realizing the above-mentioned measures to carry out further improvement works of tertiary system. From this technical viewpoints, tertiary irrigation system will be constructed in 28 schemes and tertiary drain system will be introduced to 29 schemes as a whole. In addition, construction works of uncompleted parts of the main irrigation system will be immediately finished in four irrigation schemes.

4.5.4 Possibility of dam construction

In the Study Area, a total of 13 possible dam sites was identified by means of map study through the National Water Power Resources survey conducted by PLN in 1983.

These possible dam sites are located in the northern and eastern parts of the Study Area as shown in Figure 19. As a result of site reconnaissance and preliminary geologically study, it is identified that seven dam sites distributed in the northern part of the Study Area fall in with karstic topography and six dam sites in the eastern part are geologically featured by diorite. The latter group has possibility for the construction of a high dam from geological viewpoints. However, each dam site of this group has a very small pocket due to topographical limitations.

In consideration of such condition, possibility of dam construction is examined on two possible sites, Amandit and Tapin. Creation of regulated flow at the both possible dam sites can be expected to expand the dry season irrigation area to a some extent. The estimated increase in the dry season irrigation vary from 1,040 ha to 4,690 ha for Amandit and from 3,030 to 5,990 ha for Tapin. However, such expected increase in the dry season irrigation areas is not enough to cover additional investment costs required for dam construction.

4.5.5 Drainage improvement and polder development

(1) Potential area

In examining swamp development potential in the Study Area, the swamps as divided into seven swamp areas and then sub-divided into 59 drainage blocks as shown in Figure 20 by taking into account the existing natural and man-made drainage networks and also the hydrological divisions. These seven swamp areas cover 398,680 ha in total. The remaining 13,320 ha are defined as scattered swamps isolated from these seven swamps.

For the evaluation of drainage improvement possibility, such factors are employed as depth of peat layer, easiness of water level control by providing drainage facilities, availability of water supply sources and existence of access roads. Through this examination of drainage improvement possibility, a total of 32,530 ha delineated as possible areas for drainage improvement and polder development in the seven swamp areas and the scattered swamps. The present land use patterns are of non-improved paddy field, upland/shifting cultivation area, grassland, bush and forest. The distribution of possible areas is shown below:

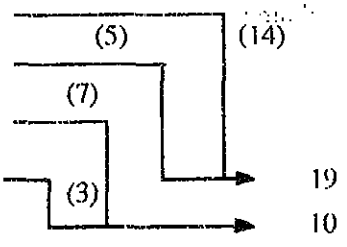
(Unit: ha)

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

(2) Improvement of drainage facilities

The drainage improvement level is to target a combination of either drainage canal and gate (stop log) or a combination of drainage canal, gate (stop log) and dyke. Newly identified possible areas of drainage improvement are to be equipped with one of the above two combinations according to the field condition depicted in Figure 21. The present drainage facility levels of 29 drainage schemes are far behind the above as discussed in Section 3.3.3. The present and target levels of drainage facilities in these 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	
Type B	Water course and gate (stop log)	5	
Type C	Dyke and gate (stop log)	7	
Type D	Canal and gate (stop log)	3	19
Type E	Canal, gate and dyke	0	10
	Total	29	29



(3) Rehabilitation and early completion of the existing drainage schemes

In order to guarantee the designed functions of the existing drainage facilities, rehabilitation and supplemental works are to be undertaken in the 23 existing drainage schemes covering 13,770 ha in total. Required works consist of sediment removal at 16 drainage schemes, gate rehabilitation at nine drainage schemes and dike rehabilitation at four drainage schemes.

Further, early completion of undeveloped command areas of the 24 existing drainage schemes is to be promoted with a total coverage of 20,730 ha.

(4) New drainage improvement

From the DPUP's planned and designed drainage schemes, thick peat layer areas of 4,400 ha are deleted through the technical review under the present Study. Total areas of the seven planned drainage improvement schemes thus becomes 12,700 ha. As for the possibility of new drainage improvement, the result of technical evaluation reveals that there are nine schemes identified covering 16,430 ha as a whole. Of these, eight schemes are distributed in the Tabalong, East Amuntai, East Negara and North Muning Swamp Areas with total scheme areas of 16,280 ha, while one scheme is located in a scattered swamp with the scheme coverage of 150 ha in Kabupaten Tabalong.

(5) Improvement of existing polder

Out of total scheme area of 16,329 ha under the existing nine polder development schemes, 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. The former group is to be accelerated for early completion in parallel with rehabilitation of completed facilities.

The Alabio polder scheme was constructed in 1930's. Presently, it is under the management of DPUP. A total of 1,450 ha is still left under submerged condition throughout the year. In due consideration of farmers' activities and topographic conditions in the Alabio polder, this open water space will have to be maintained as fishing ground instead of developing it into wet paddy field. Besides this submerged area, the remaining arable land has never been fully utilized even though mechanical irrigation and drainage facilities are provided. Special guidance to technicians in charge of operation and maintenance and to farmers in this polder shall be given on how to utilize this polder for intensified farming under close cooperation between polder engineers and agronomists.

(6) New polder development

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. The gravity polder development method makes it possible to grow paddy only during the dry season.

With the following requirements, possible polder development areas are examined for 59 drainage blocks:

- Peat layer with a thickness of less than 50 cm,
- Sufficient water supply is possible during the transplanting season of paddy,
- Land can be drained in the dry season,
- Dry season cropping is possible, and
- Ineffective influence on inland water fishery is anticipated.

In the swamps, only 3,400 ha are identified as potential areas of polder development to meet these requirements. These identified areas are situated in the East Amuntai Swamp.

4.5.6 Inundation control

The following two measures are considered for mitigation of stagnant water in the swamp areas:

- To provide a drain connecting the upstream of the Negara river and the Barito river, and
- To provide a drain along the right bank of the Negara river.

A case study was carried out for evaluating above two measures by using computer simulation model. The Tank Model[1/] was employed for this simulation. In this Model, the area is divided into some swamp/paddy field tanks and some river/channel tanks. Water level or flow discharge is obtained by solving simultaneous equation of water levels for each tank applying equation of momentum, law of flow continuity, Manning's formula and so on.

The simulation model was prepared by taking into consideration the flow from the Barito river. In this model, the Barito river basin was divided into 16 river/upper basin tanks and six field/swamp tanks and the Negara river into 11 river/upper basin tanks and three field/swamp tanks.

1/: This Tank Model is not so called Tank Model for low flow analysis, detailed explanation is presented in Appendix of Annex B.

Simulation was performed on the following three cases:

Case-1 Without any preventive measures for inundation which are the same condition at present,

Case-2 Construct a short cut bypass channel between Amuntai and Paminggil, and

Case-3 Construct a bypass channel along the Negara river between Amuntai and Marababan.

Case-1: Present facilities and natural conditions are kept intact. This Case-1 is the base of inundation condition in the Study Area.

Case-2: As shown in Figure 22, a short cut bypass is provided connecting the upstream of the Negara river and the Barito river. This bypass channel has trapezoidal cross section with 100 m bed width and 1:1.5 inside slope. The channel length is about 50 km.

Case-3: Same size of bypass channel of Case-2 is provided along the right bank of the Negara river as shown in Figure 22. The channel length is about 90 km.

Simulation was carried out for a period of one month of March which represent typical wet season condition. Results of simulation are shown in Figure 23. Case-2 and Case-3 give almost the same result and these two preventive measures for inundation are effective measures to mitigate those stagnant water in the swamps. However, a further study will be required for justification of these measures from the engineering and environmental viewpoints.

4.5.7 Social infrastructures

(1) Domestic water supply

Domestic water supply target in Repelita IV aims to supply drinking water to 75% of the urban population at 60 liter/capita/day in the minimum. Further, the policy aims at installation of new piped water supply systems for towns with a population of more than 3,000 of Kecamatan capitals. On the other hand, according to the Guidelines for Integrated Urban Infrastructure Development Programme Preparation 1988 to 1989 (IUIDP), water supply targets in future are formulated based on analysis of minimum requirements for cities of different size classes and domestic/non-domestic demand.

A new installation plan of water supply system and extension plans of the existing ones in the Study Area are established based on the following criteria and policy.

- A piped water supply system, in principle, is to be installed/extended in accordance with the IUIDP's guideline,
- Regarding towns where river water is quite inferior in quality, a piped water supply system with treatment facility is to be installed with a water supply target of 45 liter/capita/day for served population of more than 3,000, and
- As for other rural areas, simple water supply facilities consisting of hand/electric pump, water tank and others are to be installed.

The new installation/extension plans of piped water supply systems which are constructed based on the above 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

(2) Public road

The surface 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

The ratio of poor and bad road to the total length in the Study Area is 44%, which is 10% higher than the national average. Road betterment works are therefore required to maintain the present condition.

Access roads to newly identified 13 irrigation schemes are little required because of availability of rural road networks. The minimum requirement of new access road is 1.3 km in total length in Kabupatens Tabalong and Hulu Sungai Utara.

(3) Electric power supply

According to the PLN's power and demand forecast made in 1987, total power demand in 2018/19 is estimated to be around 913 MW. To meet such increase, PLN plans to develop four power plants with a total installed capacity of 451 MW. Diesel power plants account for 62% of the total installed capacities of power plants. These power plants are scheduled to be installed in the region by 2000/01. Therefore, the total installed capacity is expected to be augmented up to around 680 MW at the beginning of the coming century.

4.5.8 Watershed management measures

Land with the average steepness of more than 25% is not suitable for use in agricultural production activities. To meet urgent requirements to solve the pressing sedimentation problems and for preventive measures against flood in the Negara sub-basin, introduction and practice of soil conservation are indispensable from the viewpoint of watershed management. Thus, two countermeasures are taken up for further consideration: 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.

The following indicates the present vegetation over an area of 400,450 ha with the average land steepness of more than 25%.

(Unit: ha)

Kabupaten	Primary Forest	Logget Forest	Reforested Area	Shifting Cultivation Area	Grass-land	Bush	Total
Tabalong	147,930	8,940	-	11,020	4,710	15,030	187,630
H.S.U.	60,130	-	-	-	2,620	15,120	77,870
H.S.T.	23,370	-	-	-	1,120	22,900	47,390
H.S.S.	8,180	-	-	-	16,090	22,970	47,240
Tapin	15,380	-	940	-	11,370	12,630	40,320
Study Area	254,990	8,940	940	11,020	35,910	88,650	400,450

On the other hand, promotion of agro-industries is also a prerequisite to boost the regional economy and to provide shifters with new job opportunities. Rattan processing is playing a

key role in stimulating small scale industries in the Study Area. Guarantee of constant raw material supply is a prerequisite to further promotion of such type of rural industrialization. In connection with this situation, the regenerated bush areas are to be reserved as the growing ground of natural rattan.

4.5.9 Water balance

Water balance between demand and supply is calculated to find areas which will be in short supply of water and those which will have surplus of water in 2018. Water demands in 2018 are estimated for irrigation, industry, livestock and domestic use based on the projected population and irrigation study, while river runoffs of 80% dependability are applied for water supplies in 2018.

Water balance calculation is performed from an upstream tertio-system to a downstream tertio-system by following a river configuration as shown in Figure 13. Calculation results are graphed in Figure 24. This figure shows the monthly water utilization ratio for each tertio-system. This figure implies, high utilization ratio areas such as No.21, No.16, No.22, etc. have less potential for water resources development in 2018 and other tertio-system still have enough potential in 2018 even after developing all the proposed water resource development projects in the Study Area.

4.5.10 Environmental aspect

The above presented development measures are set up by taking the environmental conditions in the Negara sub-basin into account so as to make minimize harmful environmental impacts.

The following measures are the typical ones from the viewpoint of environmental conservation.

- The amount of agro-chemicals to be required for intensive agriculture is proposed according to the guideline of Dinas Food Crops, South Kalimantan. Over use of agro-chemicals should be avoided, in order to conserve the natural environment. With this view, strengthening of extension services is indispensable.

- Development of irrigation schemes are concentrated upon the existing schemes or rainfed paddy fields, and so negative effects on land and vegetation are to be

lessened. In addition, because the dam construction plan is excluded from the proposed projects due to its low economic viability, negative effect of reservoir on the forest is not expected.

- For the drainage and polder schemes, large scale development with pump stations is not recommended. Instead, gravity drainage system which would bring minimum environmental impact of development is proposed.

- Over production of the inland open water fishery is one of the constraints in the Negara sub-basin. The introduction of shrimp culture would be beneficial for the conservation of inland fishery resources.

- Proposed countermeasures for watershed management would produce good results on the present problems of soil erosion, sedimentation and flood.

5. FORMULATION OF DEVELOPMENT PLAN

5.1 Individual Development Plans Identified from Engineering Viewpoints

The future development plan has been prepared as a guideline on how to realize development potentials of the Negara sub-basin for the next 30 year period. In formulating this plan, particular attention was paid to the Government's current development goals in the agricultural sector which include consolidating rice production, broadening agricultural base, creating rural employment opportunities, and balancing regional development. The objectives of the future individual development plans are: to accelerate, rehabilitate and upgrade existing irrigation and drainage schemes; to construct new gravity irrigation and drainage systems; to increase crop and freshwater fishery products; to provide support services; and to strengthen the Provincial, Kabupaten and Kecamatan level agencies related to irrigation, drainage, agriculture and inland open water fishery development. From the technical viewpoints, individual development schemes are identified as integral parts of an overall development plan in the fields of irrigation development, drainage improvement and polder development, agricultural and inland fishery development, watershed management, and institution building.

5.1.1 Irrigation development

(1) Accelerating, rehabilitating and upgrading existing irrigation schemes

This aims at early completion, rehabilitation/replacement and upgrading of irrigation facilities covering 11,050 ha of the existing 30 irrigation schemes. As summarized below, accelerating of main irrigation system construction work covers 380 ha, while rehabilitation/replacement and upgrading works cover 11,050 ha and 10,420 ha, respectively.

Kabupaten	Acceleration		Rehabilitation		Upgrading	
	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)
Tabalong	1	200	3	1,079	2	454
H.S.U.	1	64	4	653	4	653
H.S.T.	1	47	8	4,231	8	4,231
H.S.S.	1	71	8	2,426	8	2,426
Tapin	-	-	7	2,658	7	2,658
Study Area	4	382	30	11,047	29	10,422

(2) Construction of new irrigation schemes

The scope of work for 15 new schemes is to construct gravity intake and canal facilities, to irrigate 26,990 ha of rainfed paddy field and 2,100 ha of newly opened paddy field. The command areas of new irrigation schemes are summarized below:

Kabupaten	No. of Scheme	New Command Area (ha) Wet Season	Dry Season
Tabalong	7	2,570	2,230
H.S.U.	2	5,910	5,910
H.S.T.	2	8,500	8,500
H.S.S.	2	6,780	5,540
Tapin	2	5,330	3,450
Study Area	15	29,090	25,630

(3) Alternative irrigation water supply areas

Among the newly identified 15 irrigation schemes, additional water supply can be expected from Pitap, Batang Alai, Barabai, Amandit and Tapin irrigation schemes to their neighboring existing schemes which topographically can receive irrigation water. As for irrigation water supply areas, the following cases are 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 in Table 15 and summarized 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	-	-
Barabai	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

(4) Cost estimate

Required costs are estimated by referring to the unit costs of the on-going Riam Kanan Irrigation Project in South Kalimantan. The estimated financial costs are given in Table 16 for the existing irrigation schemes and in Table 17 for the new irrigation development. The summary of total costs is as follows:

(Unit: million Rp.)

Kabupaten	Existing Schemes				New Schemes	Total
	Acceleration	Rehabilitation	Upgrading	Sub-total		
Tabalong	315	202	472	989	8,192	9,181
H.S.U.	77	562	650	1,289	36,403	37,692
H.S.T.	57	842	4,412	5,311	52,795	58,106
H.S.S.	403	995	3,092	4,490	42,515	47,005
Tapin	-	475	4,501	4,976	35,935	40,911
Study Area	852	3,076	13,127	17,055	175,840	192,895

Additional costs required for alternative irrigation water supply measures are summarized below:

(Unit: million Rp.)

New Scheme	New Scheme Only	Water Supply to Drainage Schemes	Supplement of Water to Irrigation Schemes	Water Source Conversion of Irrigation Schemes	Maximum Utilization of Water Source
Pitap	23,015	11,689	7,111	-	-
Batang Alai	38,754	14,745	8,447	12,990	-
Barabai	14,041	4,931	-	-	-
Amandit	41,387	-	3,617	6,701	11,199
Tapin	34,960	2,294	2,809	6,779	28,643
Total	152,157	33,659	21,984	26,470	39,842

5.1.2 Drainage improvement and polder development

(1) Early completion of existing drainage schemes

The purpose is to accelerate completion of on-going works in the existing 24 drainage improvement schemes covering about 20,730 ha.

(2) Rehabilitation of existing drainage schemes

The main objectives are to recover the design capacity of drainage canal networks by means of dredging of sediments and rehabilitation of gates and dikes. Such rehabilitation works cover 13,770 ha in the existing 23 schemes.

(3) Improvement of drainage facilities

The scope of work is to improve existing drainage facilities to the target levels of 38,370 ha. Table 18 shows required work items for the existing drainage schemes and its summary is given below.

	Total Scheme		Early Completion		Rehabilitation		Upgrading
	(No.)	(ha)	(No.)	(ha)	(No.)	(ha)	(No.)
Tabalong	6	3,030	6	1,390	4	870	6
H.S.U.	2	3,350	6	2,500	1	200	2
H.S.T.	4	5,030	4	3,720	4	1,310	4
H.S.S.	7	10,710	5	5,210	5	3,450	7
Tapin	10	16,250	7	7,910	9	7,940	10
Study Area	29	38,370	24	20,730	23	13,770	29

(4) New drainage improvement schemes

This aims at providing 16 new drainage improvement schemes totaling 29,130 ha with drainage facilities. Table 19 shows list of new drainage schemes and its summary is as follows:

	DPUP's Planned Scheme		Newly Identified Scheme	
	(No.)	(ha)	(No.)	(ha)
Tabalong	-	-	3	830
H.S.U.	1	4,600	-	-
H.S.T.	1	600	2	3,300
H.S.S.	3	3,500	3	10,300
Tapin	2	4,000	1	2,000
Study Area	7	12,700	9	16,430

(5) Rehabilitation and new development of polder schemes

With provision of gravity polder system which is common in the Study Area, two new polder development schemes are to be undertaken covering 3,400 ha in total. Rehabilitation of polder facilities are also to be promoted over 13,140 ha as shown below:

	Total Scheme		Rehabilitation		New	
	(No.)	(ha)	(No.)	(ha)	(No.)	(ha)
Tabalong	2	560	2	560	-	-
H.S.U.	8	17,120	6	12,580	1	2,800
H.S.T.	-	-	-	-	-	-
H.S.S.	1	600	-	-	1	600
Tapin	-	-	-	-	-	-
Study Area	11	18,280	8	13,140	2	3,400

(6) Cost estimate

Necessary costs are estimated on the basis of unit costs employed by the on-going Riam Kanan Irrigation Project. The estimated financial costs are presented in Table 20 for the existing drainage schemes. Table 19 for the new drainage schemes and Table 21 for the polder schemes. The summary of cost estimate is as follows:

(Unit: million Rp.)

Kabupaten	Drainage Scheme			Polder Scheme		Total
	Early Completion	Rehabilitation and Upgrading	New Construction	Rehabilitation	New Construction	
Tabalong	395	5,435	3,075	631	-	9,536
H.S.U.	743	4,294	11,892	13,697	24,391	55,017
H.S.T.	1,609	5,800	8,924	-	-	16,333
H.S.S.	364	14,691	30,059	-	7,733	52,847
Tapin	1,117	23,240	16,093	-	-	40,450
Study Area	4,228	53,460	70,043	14,327	32,124	174,183

5.1.3 Agricultural development

(1) Expansion of double cropping of paddy

With provision of irrigation water supply to the presently rainfed paddy cultivation areas, double cropping of paddy using high yielding varieties is to be promoted to the maximum

extent unless irrigation water resources are limited. The following shows the expansion of double cropping of paddy in the existing and new irrigation schemes.

Kabupaten	Double Cropping of Paddy				Two Cropping of Paddy/Palawija			
	Existing Scheme		New Scheme		Existing Scheme		New Scheme	
	(No.)	(ha)	(No.)	(ha)	(No.)	(ha)	(No.)	(ha)
Tabalong	3	670	7	2,230	1	410	3	340
H.S.U.	4	350	2	5,910	3	300	0	0
H.S.T.	8	3,390	2	8,500	4	840	0	0
H.S.S.	8	770	2	5,540	8	1,660	2	1,240
Tapin	7	960	2	3,610	7	1,700	2	2,020
Study Area		6,140		25,790		4,910		3,600

Of the existing nine polder schemes, irrigated double cropping of paddy will be carried out in the Alabio polder in Kabupaten Hulu Sungai Utara with a total area of 4,500 ha.

In addition, new irrigation water source development will enable the expansion of irrigated double cropping areas of 1,800 ha in the existing three drainage schemes for Case 2 of alternative irrigation water supply, 1,930 ha in the existing four irrigation schemes for Case 3 and 1,220 ha in the existing two irrigation schemes for Case 4 as below.

Kabupaten	Case 2		Case 3		Case 4	
	(No.)	(ha)	(No.)	(ha)	(No.)	(ha)
Tabalong	-	-	-	-	-	-
H.S.U.	-	-	2	710	-	-
H.S.T.	1	600	2	1,220	2	1,220
H.S.S.	1	800	-	-	-	-
Tapin	1	400	-	-	-	-
Study Area	3	1,800	4	1,930	2	1,220

(2) Expansion of improved and new paddy field

Beside the existing rainfed paddy field to be provided with either irrigation or drainage/polder facility of 58,820 ha, 26,400 ha of paddy field will be newly developed as a component of new irrigation and drainage/polder schemes. The newly developed paddy field is mainly composed of upland and shifting cultivation areas and bush at present.

Its distribution pattern is summarized below:

- In Kabupaten Tabalong, the present rainfed paddy field will be provided with improved irrigation facilities for 2,830 ha, drainage facilities for 2,200 ha and polder facilities for 80 ha,

- In Kabupaten Hulu Sungai Utara, the existing rainfed paddy field will be newly provided with improved irrigation facilities for 5,960 ha, drainage facilities for 3,510 ha and poldered facilities for 1,100 ha. In addition, new paddy field will be developed in the swamps for drainage schemes of 3,600 ha and polder schemes of 2,800 ha,

- In Kabupaten Hulu Sungai Tengah, the current rainfed paddy field will be newly provided with improved irrigation facilities for 9,760 ha and drainage facilities for 5,220 ha. Further, new paddy field of 2,400 ha will be developed in the swamps for drainage schemes,

- In Kabupaten Hulu Sungai Selatan, the present rainfed paddy field will be provided with improved irrigation facilities for 5,360 ha, drainage facilities for 7,500 ha and polder facilities for 600 ha. Additionally, new paddy field of 11,500 ha will be developed in the swamps for drainage schemes, and

- In Kabupaten Tapin, the existing rainfed paddy field will be provided with irrigation facilities for 4,770 ha and drainage facilities for 9,910 ha. In addition, new paddy field will be developed in the alluvial plains for an irrigation scheme of 2,100 ha and drainage schemes of 4,000 ha.

(3) Change in paddy field area

At present, paddy field covers 165,500 ha in total out of the Study Area of 1,268,270 ha. It is composed of 9,650 ha of irrigated paddy field, 17,640 ha of drained paddy field, 13,700 ha of poldered paddy field and 124,510 ha of rainfed paddy field. Its land distribution form is 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

In addition to the newly developed paddy field of 26,400 ha as described in the above, existing rainfed paddy field will be equipped with irrigation facilities in 28,680 ha in the alluvial plains, drainage facilities in 28,360 ha in the swamps and polder facilities in 1,780 ha in the swamps. As the total areas to be converted from the existing rainfed paddy field amount to 58,820 ha, the balance of 65,690 ha will be left as it is, comprising 29,990 ha in the swamps, 33,370 ha in the alluvial plains and 2,330 ha in the alluvial valleys as shown in Table 22 and summarized 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

(4) Crop diversification

With provision of upgraded drainage facilities for the existing and new drainage schemes, diversified cropping will be promoted to realize the target cropping intensity of 200%. In the irrigation scheme areas, palawija crops will be introduced to the non-irrigated paddy field for the wet or dry season because of shortage of irrigation water source as mentioned above.

In the remaining rainfed paddy field extending over the alluvial plains and valleys, the present single cropping of paddy will be diversified to increase farm income. As for the remaining paddy field without any drainage or polder facility in the swamps, single cropping of paddy will be done during the dry season as it is. The summary of paddy and palawija cropping areas for Case 1 of alternative irrigation water supply is as shown in Table 23 and summarized below:

(Unit: ha)

Field Condition	Paddy			Palawija			Total Planted Area
	Wet Season	Dry Season	Total	Wet Season	Dry Season	Total	
Irrigated	40,430	31,120	71,550	-	9,310	9,310	80,860
Drained	63,950	3,550	67,500	-	63,950	63,950	131,450
Poldered	4,500	18,280	22,780	-	-	-	22,780
Rainfed	2,500	29,990	32,490	33,200	-	33,200	65,690
(Swamps)	(-)	(29,990)	(29,990)	(-)	(-)	(-)	(29,990)
(Alluvial Plains)	(2,500)	(-)	(2,500)	(30,870)	(-)	(30,870)	(33,370)
(Alluvial valleys)	(-)	(-)	(-)	(2,330)	(-)	(2,330)	(2,330)
Total	111,380	82,940	194,320	33,200	73,260	106,460	300,780

The cropping intensity of paddy field in the Study area is estimated to increase from 102% at present to 157% in future.

(5) Anticipated crop yield

With expansion/improvement of irrigation and drainage facilities coupled with extension of proper farming practices and strengthening of the agricultural supporting services, crop yield and production in the Study Area will increase and stabilize year by year. In anticipating the future crop yield, available statistics are examined from agronomic viewpoints. Yield data obtained from the Riam Kanan Pilot area among others, reveal that paddy yield has been kept at a level of around 6.0 ton/ha in the past five year period. In this area, high-yielding rice varieties are grown with normal fertilizer application and proper irrigation water supply. Taking this examination result into account, 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

In case of drainage schemes, actual paddy yield is modified to some extent by taking into account the effect of inundated condition which occurs frequently in May.

5.1.4 Aquaculture development in swamp areas

The major proposed fishery development plans are open water fishery promotion, development of fish processing industry, shrimp culture development and net cage culture development. For their further promotion, such supporting facilities shall be established as fishery resources monitoring center, open water fishery supporting facility, fish processing and distribution center and shrimp fry production center. Among the development plans,

high priority shall be given to shrimp culture scheme in consideration of its potential and contribution to exports. The locations of major proposed development and supporting facility sites are summarized below.

Kabupaten	Tabalong	H.S.U.	H.S.T.	H.S.S.	Tapin
Development scheme					
Open water fishery promotion	-	o	o	o	-
Fish processing industry development	-	-	-	o	-
Shrimp culture development	-	o	-	-	o
Net cage culture development	-	o	-	-	-
Supporting facilities					
Fishery resources monitoring center	-	o	-	-	-
Open water fishery supporting facilities	-	o	o	o	-
Fish processing and distribution center	-	-	-	o	-
Shrimp fry production center	-	-	-	-	o

Freshwater shrimp culture is are of the most promising schemes in aquaculture development. In this context, the following three development plans shall be given high priority for their undertakings:

- Inside Alabio Polder for short term development with the target yield of shrimp at 0.4 ton/ha/year,

- Inside Alabio Polder for middle and long term development with the target yield of shrimp at 1.2 ton/ha/year, and

- In the vicinity of Margasari for long term development with the target yield of 2.4 ton/ha/year.

The required costs for the above development are estimated as below:

New Scheme	Development Area (ha)	Cost (Rp. million)	Remarks
Alabio	100	522	Without project to short-term development
	1,000	8,816	Short-term to mid-term development
Margasarri	2,000	32,448	Long-term development

5.1.5 Watershed management

In the existing primary forests, some parts extending over steep slope areas shall be designated as nature reserves. The proposed nature reserves are Meratus and Muala Uya cover 50,800 ha in Kabupaten Tabalong and Meratus Hulu Barabai and 36,800 ha in Kabupaten Hulu Sungai Utara.

Reafforestation shall be realized in grassland and shifting cultivation areas. These target areas cover 53,470 ha in total and distributed as follows: 15,730 ha in Kabupaten Tabalong, 2,620 ha in Kabupaten Hulu Sungai Utara, 3,360 ha in Kabupaten Hulu Sungai Tengah, 22,900 ha in Kabupaten Hulu Sungai Selatan and 8,860 ha in Kabupaten Tapin.

5.1.6 Future land use pattern

The future land use pattern in the Study Area is set up by taking into account the results of all engineering and agricultural studies. Table 24 shows the distribution of land use pattern and the main points are summarized below.

- Paddy field increases from 165,500 ha at present to 191,900 ha in future of which 24,300 ha will be developed in the swamps and 2,100 ha in the alluvial plains,

- Estate crop area increases from 142,170 ha at present to 209,080 ha in future by accelerating the existing development plans of NES and PMU schemes, and

- Upland and shifting cultivation area decrease from 83,430 ha at present to 5,190 ha in future by promoting conversion to permanent cultivated area and reafforestation.

5.2 Screening of Candidate Development Scheme from Economic Viewpoint

(1) Basic condition

From engineering viewpoints, a total of 104 schemes is identified as candidate development schemes in the Study Area (see Figure 25). They comprise 45 irrigation schemes, 45 drainage schemes, 11 polder schemes and three inland fishery schemes. In order to assess development priorities of the identified 104 schemes, screening of candidate schemes is made by economic comparison in terms of benefit-cost ratio (B/C).

For economic comparison, all the financial costs estimated are converted to economic costs by applying the standard conversion factor of 0.8. In the economic cost, the following two items are not included:

- Land acquisition cost, and
- Initial investment cost required for early completion of main irrigation and drainage systems.

Tables 25 to 28 show the candidate development schemes with the estimated financial costs and their breakdown by scheme component as well as economic costs. Replacement and annual operation and maintenance cots are also converted to economic costs by applying the same factor. (Details are given in Annex J.)

The economic benefit is defined as the difference between the annual net production value under without project condition and that under with project condition. In this regard, the condition without project means that uncompleted parts of the main irrigation and drainage systems will have been fully realized and be functional. As the net production value is defined as the difference between the gross production value and the crop production cost, crop budgets are calculated for both conditions with and without project.

All the financial and economic prices of agricultural inputs and outputs are based on 1988 constant prices. The economic prices of internationally traded commodities are estimated taking into account the recent World Bank's projections made in September 1988, while those of non-traded commodities are equivalent to the financial prices. The exchange rate between US dollar and Indonesian Rupiah is taken as US$1.00 = Rp.1,730 based on the market rate as of the end of 1988.

By referring to crop budgets for both with- and without-project conditions as shown in Tables 29 and 30, the annual net production value of each candidate development scheme is calculated.

In performing the economic comparison, present values of costs and benefits are calculated by using the discount rate of 10% and cash flows prepared on the basis of the following assumptions:

- 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 works are to start in the first year and be completed in the third year, and the one third of the works is to be completed in each year,
- The benefits is to be derived from the fourth year. The build-up period is to be four years. Benefits during build-up are to increase linearly; 60% of the full benefits in the fourth year, 70% in the fifth year, 80% in the sixth year, 90% in the seventh year 100% from the eight year onward, and
- The O&M cost is to be required from the fourth year for the whole areas of each candidate scheme.

(2) Screening

The screening of candidate development schemes is made by using the calculated B/C as an index. In this screening, the candidate schemes with B/C of more than 1.0 are assumed as prior development schemes. The result is as shown in Tables 31 to 33. Through the screening, 76 prior development schemes are selected as shown below:

(unit : No.)

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

5.3 Ranking of Prior Schemes

Ranking of the above selected prior schemes is carried out in order to grasp the development priority of each development scheme. In the first step, rank from A to E is given to each scheme according to characteristics of the calculated economic internal rate of return (EIRR) and net present value per hectare, (B-C)/ha, as shown below:

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

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

The result of the ranking is shown in Tables 34 to 37, and the number of prior development schemes by ranking can be summarized as follows:

(unit : No.)

Rank	No. of Scheme				
	Irrigation	Drainage	Polder	Fishery	Total
1:	8	27	1	3	39
2:	11	6	0	0	17
3:	4	3	2	0	9
4:	4	1	1	0	6
5:	3	1	1	0	5
Total	30	38	5	3	76

5.4 Alternative Study

Alternative development plans are made for five new irrigation schemes such as Pitap, Batang Alai, Barabai, Amandit and Tapin for assessing possibilities of additional water supply to the existing irrigation and drainage schemes as discussed in Section 5.1.1(3). The list of alternative development plans of each scheme is summarized below:

Irrigation Scheme	Alternative Development Case						
	1	2	3	4	5	6	7
Pitap	o	o	o	-	-	o	-
Batang Alai	o	o	o	o	-	o	-
Barabai	o	o	-	-	-	-	-
Amandit	o	-	o	o	o	-	o
Tapin	o	o	o	o	o	o	o

The definition of each Case is also described in Section 5.1.1(3). Case 7 is given as reference data showing the declining tendency of the economic viability due to dam construction in Case 4.

The ranking made for the respective alternative development cases shown in Tables 38 and 39 indicates that all alternative plans have lower values of EIRR and (B-C)/ha compared with Case 1 with the only exception which is a combination development plan of Barabai irrigation scheme and Tg. Jaranih drainage scheme.

Another alternative plan is made in order to assess the effect of step-wise development of six new/planned drainage schemes from economic viewpoints. The economic comparison is made for package and step-wise development drainage plans as follows:

Drainage Scheme	Target Level of Drainage System	
	Package	Step-wise
R. Pinang Kara	Type D	Type A / Type D
S. Hadangan	Type D	Type A / Type D
S. Batang Alai	Type D	Type A / Type D
Tinjau Langit	Type D	Type A / Type D
R. Muning extension	Type E	Type D / Type E
R. Muning IIIJ 2nd extension	Type E	Type D / Type E

The results of economic comparison reveal that there is no worthwhile merit to promote step-wise development of the respective new/planned drainage scheme as shown in Table 40.

5.5 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 are shown in Table 41.

5.6 Possible Public Investment

5.6.1 Possible public investment for agricultural development in South Kalimantan

The projection of future public investments in agricultural development in South Kalimantan is carried out throughout the period of 30 years up to the end of Repelita X (2018/19). This projection is made through the following steps:

- Total development expenditures at current prices in South Kalimantan during the period from 1980/81 to 1987/88 are converted to those at 1988 constant prices by applying the Indonesia's implicit deflators for gross domestic investment. The annual average of the said period at 1988 constant prices is, then, calculated at about Rp.105.0 billion,

- This amount is assumed to be the total public investment available in South Kalimantan in 1987/88. To this total public investment amount, the estimated rates of past development expenditures in the agricultural sector to those for South Kalimantan are applied, and then the public investment allocated to DPUP, Sub-Dinas Water Resources Development and Agriculture in 1987/88 is estimated as shown below:

	Rate of Allocation (%)	Public Investment in 1987/88 (Rp. Billion)
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

- The projection of public investment available to DPUP, Sub-Dinas Water Resources Development and Agriculture in South Kalimantan is, then, projected to 2018/19 by applying the growth rate of fixed public investment to the above estimated 1987/88 public investment. The projection is made for the following four cases with respective growth rates during the period from 1987/88 to 2018/19:

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

Total public investments in terms of 1988 financial prices for the next 30 years to be available to 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

5.6.2 Possible public investment for agricultural development in the Study Area

Based on the above results, projection of the public investment in agriculture development in the Study Area is carried out. In the projection, the ratio of population in the Study Area to the whole South Kalimantan (38.5% in 1985) is applied to DPUP, and the ratio of farm households in the Study Area to the whole South Kalimantan (47.5% in 1985) is applied to Sub-Dinas Water Resources Development and Agriculture in all the cases. As a result, total public investments for the next 30 years to be available in agriculture development in the Study Area is projected. (Details are presented in Annex J.) Investments to 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. 98.7 billion

6. PROPOSED PROJECTS AND INVESTMENT PLAN

6.1 Proposed Projects

6.1.1 Negara Pilot Project

(1) Necessity of Pilot Project

To date, development potentials of land and water resources in the Study Area have been practically used to a certain extent. As clarified under the present Study, however those performance is still inadequate. To make full use of existing potentials, their development should be realized through the implementation of on-going development programs. To improve the substance of these programs, special attention should be paid to correct the current capabilities of the agencies staff concerned as well as farmers' way of thinking and behavior. At present, both of these constitute an insuperable barrier to the smooth conduct of development programs in desirable and effective manners.

In due consideration of such background and weakpoints, it is a prerequisite to involve capable staff and well-trained farmers in development activities to promote large investments to the Study Area. One of the indispensable measures for this purpose is to create opportunities and places to the agencies' staff concerned on how to upgrade and strengthen their capabilities and responsibilities as well as to train farmers on how to improve and increase their practices and productivity through the establishment of pilot project.

(2) Negara Pilot Project

Based on the above consideration, the following five schemes shall be selected as training fields for the respective five Kabupatens in the Study Area by taking into account technical and topographic features of the 76 prior schemes. These schemes are needed to be undertaken immediately in a package form as the Negara Pilot Project prior to the realization of the remaining 71 prior schemes.

- The Jaro Bawah scheme of 200 ha in Kabupaten Tabalong is located along the Jaro river. As the gabions type headworks collapsed in 1981, the whole access area of 200 ha is grown with paddy under rainfed condition at present. This scheme will function as a training field for DPUP's staff to learn adequate methodology of planning and design works as well as in-depth analysis of

hydrological data and also proper O&M techniques of the upgraded irrigation facilities. For extension workers and leading farmers, this scheme will also function as a training field to teach and learn how to conduct improved farming practices under irrigated double cropping of paddy,

- The Alabio polder scheme of 4,500 ha in Kabupaten Hulu Sungai Utara is located along the Negara river and equipped with two pumping stations and 45 km long dykes. Presently, a total of 4,500 ha is cultivated once a year. This scheme has bigger crop and inland freshwater fish production potentials compared to other existing gravity polder schemes in the Study Area. Although the government policy to develop swamp areas throughout the country still rely on water control by the gravity method, it is worthwhile to fully realizing and utilizing production potentials of the Alabio polder by taking into account limitation of swamp development by cheaper measures in the Negara sub-basin. With such background, this scheme will function as a training field for all the agencies staff concerned with regard to how to rehabilitate and operate existing mechanical polder facilities and for farmers in respect to how to practice irrigated double cropping of paddy,

- The Rawa Taras drainage scheme of 300 ha in Kabupaten Hulu Sungai Tengah is located in the East Amuntai Swamp and its drainage system is to be upgraded from Type A to Type D. Due to its location inside the swamp areas, special attention is needed to drainage control in conjunction with hydrological conditions in the surrounding swamp areas. In this regard, this scheme will function as a training field for the DPUP's staff in terms of how to establish and practice technically and economically reasonable drainage improvement methods under the above-mentioned swamp condition,

- The Rawa Negara drainage scheme of 5,200 ha in Kabupaten Hulu Sungai Selatan is located in the East Negara Swamp and its drainage system is to be upgraded from Type A to Type D. Currently planted area is 1,550 ha out of the whole scheme area of 5,200 ha and suffered from heavy sedimentation in canals. Although inflow of sediments into the swamp areas is needed to be tackled by means of long-term and area-wise watershed management in the Study Area, this scheme will function as a training field for the DPUP's staff with regard to practicing of sedimentation preventing methods by utilizing an upgraded drainage system comprising drainage canals and gates, and

- The Sungai Tapin Gadung drainage scheme of 1,000 ha in Kabupaten Tapin is located in the Tapin Swamp and its drainage system is to be upgraded from Type A to Type D. The planted area at present is 400 ha out of the whole scheme area of 1,000 ha. As its location is quite near to the alluvial plains, drainage control is needed to be carried out paying attention to discharge condition of adjacent rivers. This scheme will function as a training field for the DPUP's staff in terms of how to set up and practice technically and economically reasonable drainage improvement methods under such hydrological conditions.

The required investment for implementation of the proposed Negara Pilot Project is estimated to be Rp.17,639 million.

6.1.2 Projects following to 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.

(1) Negara Irrigation and Drainage Upgrading Project

The Negara Irrigation and Drainage Upgrading Project is to be composed of existing prior schemes classified into first and second priority groups other than the component schemes of Negara Pilot Project. In addition, the experimental aquaculture scheme is to be included in this project in the light of higher potential of fishery development in the Study Area. This project aims to spread to effect of the Negara Pilot Project throughout the Negara sub-basin. A total of 24 prior schemes are proposed to be involved in this project under proper investment program. The required investment is estimated to be Rp.40,363 million for all the component schemes of this project.

(2) Upper Negara Agricultural Development Project

The Upper Negara Agricultural Development Project is to be composed of the remaining all the prior schemes identified in Kabupaten Tabalong, Hulu Sungai Utara and Hulu Sungai Tengah. This project is to be promoted with the object of implementing new or planned schemes and lower priority existing schemes in these three Kabupatens based on the experience to be obtained from the execution of the precedent two projects. A total of 28 prior schemes are proposed to be included in this project. The required investment is estimated to be Rp.140,938 million in total.

(3) Lower Negara Agricultural Development Project

The Lower Negara Agricultural Development Project will be composed of the remaining all the prior schemes identified in Kabupaten Hulu Sungai Selatan and Tapin with the same object as presented in the Upper Negara Agricultural Development Project. The component schemes of this project include the 19 prior schemes and require an investment of Rp.357,629 million.

The prior schemes to be included as component schemes in the above-mentioned three proposed projects are listed in Table 42 together with the proposed Negara Pilot Project. To what extent these component schemes are to be covered by the respective proposed projects depend on the investment scale projected in Section 5.6 for water resources development in the next 30 years.

6.2 Investment Plan

In the investment planning for water resources development in the Study Area, the first consideration is given to the proposed Negara Pilot Project in the light of its importance. The investment for this project with a total construction cost of Rp.17,639 million is assumed to be done during the period of Repelita V in all the four cases presented in Section 5.6.2.

In addition to the said investment, the estimated investment of Rp.2,194.5 million in the base year of 1987/88 is assumed to be available every year during the period of Repelita V in all the four cases. Accordingly, the total investment would be Rp.28,612 million during the Repelita V for all the cases.

The investment to be available for the remaining 25 years from Repelita VI to Repelita X is, then, calculated based on the assumption that the investment would increase in an arithmetic progression to the extent of the limits of possible investment in the four cases.

As a result, public investment to be available in water resources development in the Study Area for the respective Repelita periods would be as follows:

(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

The investment to be available in each Kabupaten is estimated based on the ratio of the total construction cost of prior development schemes in each Kabupaten to that in the Study Area. Such ratio is estimated as follows:

	Tabalong	H.S.U.	H.S.T.	H.S.S.	Tapin	Total
Construction Cost (Rp. 10^6)	15,496	73,609	72,798	87,448	108,283	357,629
Ratio of investment (total = 100)	4.3	20.6	20.4	24.4	30.3	100.0

By applying the above estimated ratio to the total investment to be available in each Repelita period, possible investment for each Kabupaten is estimated for all the four cases as shown in Table 43.

Based on Table 43, investment plans for Case 1, Case 2, Case 3 and Case 4 are prepared as summarized in Tables 44 to 47. (Details are presented in Annex J).

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

6.3 Implementation Program

For the Negara Pilot Project, undertaking of feasibility study is proposed as the first step to introduce modified and improved procedures for the realization of agriculture development potentials in the Study Area. The year to start the proposed feasibility study is expected to be 1990/91 in order to implement project works in 1991/92 and 1992/93. After completion of civil works in the pilot project area, intensive training programs for operation and maintenance works of this project will be provided to officials concerned and leading farmers through foreign technical cooperation from 1992/93 onward.

For the Negara Irrigation and Drainage Upgrading Project, an immediate action program is necessary in order to spread the effect of the proposed Negara Pilot Project to the Study Area. In this connection, an overall feasibility study for this Project is proposed to be undertaken in 1991/92. Project works will have to commence from Repelita V and completed between Repelita V and Repelita VIII.

The Upper Negara Agricultural Development Project is proposed to be implemented during the Repelita VI and X periods. In this regard, the feasibility study will have to be done by 1994/85.

The Lower Negara Agricultural Development Project is proposed to be implemented during the period from Repelita VI to Repelita X. The overall feasibility study will have to be carried out in 1995/96.

The implementation program of the proposed four projects is as shown on Figure 26.

6.4 Effect Accrued from the Investment and Social and Environmental Impact

6.4.1 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 anticipated paddy yield and cropped area. The following shows the expected amount of paddy production, its increment and annual growth rate from the proposed projects.

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 in the Study Area would increase with a rate of 2.05% p.a. during the period from 1985 to 2018 and will attain 815,600 tons in 2018, while paddy demand in the Study Area would be 261,900 tons in 2018, and the surplus in that year would be 553,700 tons. The result of food balance projection also shows that such paddy surplus in the Study Area would cover local demands in neighboring provinces of South Kalimantan, i.e. East and Central Kalimantan. Accordingly, paddy production from the proposed projects would almost correspond with

the demand in Kalimantan as a whole under Case 1 Investment Plan and a small excess of 64,470 tons would supplement demands of the 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	Foreign
Paddy (1000 tons)	Rice * (1000 tons)	Price (US$/ton)	Exchange Savings (US$ million)
462.6	314.5	243	76.4

*: Milling rate of 0.68 is applied.

In addition, shrimps to be produced in the proposed agriculture schemes would bring about US$39.0 million in export earnings under Case 1 Investment Plan.

6.4.2 Preventive effect for population outflow

The implementation of proposed projects would create an additional demand of farm labor requirement to be accrued from the introduction of intensive farming practices coupled with expansion of double and two cropping areas.

The incremental farm labor requirement in 2018 is estimated at 24.0 million man-days under Case 1 Investment Plan as presented in detail in Section 5.2, Annex J .

The said incremental farm labour requirement would provide incremental employment opportunity for about 82,800 persons on the assumption that one labor would work 290 man-days per annum. By applying the ratio (0.4) of working population to total population in the Study Area projected for 2018 directly to the said number of population, the population which contains such incremental employment is calculated to be 207,000. By adding this population to the projected population of about 1,102,000 in 2018 under without project condition, the population in 2018 will be 1,309,000. Accordingly, the population increase rate during the period from 1985 to 2018 is calculated to be 1.18% p.a., while that under without project condition is projected at 0.65% p.a. (from 890,000 in 1985 to 1,102,000 in 2018 as presented in Chapter 4, Annex A).

As a result, it can be said that the implementation of the proposed projects would prevent the population outflow from the Study Area.

6.4.3 Improvement of farmers' economy

Farmers' income would be expected to improve considerably as a direct result of the increase of crop production under with project condition. In order to assess the degree of such improvement, a farm budget analysis is made for the typical farmers both under the future with and without project conditions. The analysis is made of two typical farmers; a farmer in the Rawa Negara Drainage Scheme with 1.0 ha of farm land and a farmer in the Jaro Bawah 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 Bawah Irrigation Scheme. The net income of a typical farmer under with project condition would also increase about 1.4 times of that under without project condition in both schemes. The expected increase in the net reserve is then estimated to be from subsistence level to about Rp.500,000 in both schemes. (Details are presented in Annex J).

6.4.4 Environmental impact assessment

Possible impact of the proposed projects on the environment in the Negara sub-basin is assessed at preliminary level. In the assessment, possible effects are classified into three ranks just to indicate if they would be beneficial, neutral or harmful to natural surroundings. Assessment results are summarized in Table 48.

As seen in the table, negative effects are predicted on swamps, water quality and fauna/flora from the proposed drainage and intensive agricultural development. However, the predicted negative effects from the former development would be minimum, because new and planned schemes are relatively small at 24,300 ha in total or only 6% of the total swamp areas in the Study Area due to the introduction of gravity drainage system in development. Moreover, the gravity drainage system itself would also render negative effects predictable particularly on inland fishery resources.

It would be needed to pay particular attention to the negative effects predicted on water quality and fauna/flora from the latter development which requires agro-chemicals.

Accordingly, strategic guidance to farmers about proper use of agro-chemicals is required from the extension services.

7. CONCLUSION AND RECOMMENDATION

7.1 Conclusion

Through this overall study, it is concluded that the intensive and integrated agricultural development in the Study Area should to be carried out in as early stage and proper manner as possible. It is because development potentials of land and water resources in the Study Area have been practically used to a certain extent but those performance is still inadequate. Maximum development of existing potentials should be realized through the original development programs. The development matrix in respect to the overall development of the Study Area is presented in Table 49.

To realize full development of existing potentials of the Study area, it would be necessary to provide additional investment to the amount of Rp.358 billion during the next 30 years. Assuming that such huge investment could be realized as planned, it is necessary, a priori, to establish as a first step, pilot projects in representative areas. The aim of establishing projects is to solve problems and constraints in agriculture development of respective areas as to serve as a guideline in the implementation of agricultural development projects of the Study Area. In this context, it is necessary to realize the proposed Negara Pilot Project as early as possible.

Subsequent to the Negara Pilot Project, the following three projects should be promoted to make full use of the results of the pilot project throughout the Negara sub-basin:

- Negara Irrigation and Drainage Upgrading Project
- Upper Negara Agricultural Development Project
- Lower Negara Agricultural Development Project

If it is possible to increase public investments in water resources development in the Study Area at an annual growth rate of 10% (at National level this is 7.0% p.a. in IBRD's projection) up to 2018, the total investment to be available in the next 30 years is expected to be Rp. 397 billion in terms of 1988 financial prices. This scale of investment would cover the said investment of Rp.358 billion required for the proposed four projects.

The completion of the proposed four projects would enable to produce 880,000 tons of paddy annually, and this amount would satisfy the projected production (815,600 tons in 2018) required in the Study Area for a well-balanced demand and supply in Kalimantan

island. Additionally the completion of the four 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$76 million and export earnings of US$39 million (1988 constant prices).

Therefore, it is comprehended that the proposed four projects formulated in the present Study is worthy of implementation. Since the present Study is on the master plan study level, it is necessary to undertake a feasibility study of each proposed Project.

7.2 Recommendation

(1) Recommendation on action programs

To realize the proposed development plans, the following actions should be taken in the existing Government's services:

- In respect to irrigation, drainage and polder schemes, urgent undertaking of feasibility study for the Negara Pilot Project, completion of the Pilot Project within two years, establishment of a model operation and maintenance system of the Pilot Project in DPUP, conducting full feasibility study of the proposed Negara Irrigation and Drainage Upgrading Project as well as both Upper and Lower Negara Agricultural Development Projects, and carrying out of uniform operation and maintenance of irrigation and drainage facilities by DPUP,
- Regarding inland fishery schemes, formulation of systematic extension service network, construction of fishery centers including development of aquaculture ponds and promotion of basic research,
- With regard to forestry schemes, creation of job opportunities to shifters and acceleration of forest conservation and reforestation.
- Concerning paddy cultivation, further improvement of research works, credit, input supply and marketing, and strengthening of extension service,

- In regard to other crop cultivation, further improvement of research works, extension services, input supply and marketing, and strengthening of credits, and

- As for estate crop planting, further improvement of extension services, credits, input supply and marketing, and strengthening of research works.

To encourage farmers' participation in the proposed projects, the following actions are required:

- For paddy farmers, uniform operation and maintenance by organizing water users' associations, active contribution for operation and maintenance expenditures, activation of KUD, clear understanding to increase income through intensive farming and active use of animal power, and

- About fishermen, establishment of fishermen organization.

(2) Necessary future studies and actions

Taking into consideration the importance and urgency of attaining development targets and realizing investment effectiveness, expeditions undertaking of feasibility study on the Negara Pilot Project is proposed as a further subsequent step. The timing to commence the proposed feasibility study is expected to be 1990/91 in order to implement project works in 1991/92 and 1992/93. After completion of civil works, intensive training programs for operation and maintenance works will be provided to officials concerned and leading farmers through foreign technical cooperation from 1992/93 onward.

In order to spread the effect of the proposed Negara Pilot Project to the Study Area, it is proposed to conduct an overall feasibility study of the Negara Irrigation and Drainage Upgrading Project in 1991/92. It is also proposed to implement project works within the Repelita V period. Then, it is proposed to carry out the feasibility study of the Upper Negara Agricultural Development in 1994/95 and of the Lower Negara Agricultural Development in 1995/96.

(3) Recommendation for lower priority schemes

As a result of screening of the candidate development schemes from the economic viewpoint, 28 schemes are dropped out due to their low economic viability. They include

15 irrigation schemes, seven drainage schemes and six polder schemes as listed up in Table 50.

Although their priority is very low from the economic point of view, some further action programs can be considered as reference information. Those action programs are outlined in respective Annexes of Annex F and Annex G.

TABLES

Table 1 Personnel Assigned for the Study

Speciality	Expert	Counterpart Personnel
Team Leader	Dr. Y. Kunihiro	Ir. H.A. Tamdjid
Co-team Leader	Mr. Y. Matsumoto	Ir. Rachmat Norlias
Pedologist	- do -	Ir. Gedon Nohoi
Hydrologist	Mr. A. Kojima	Drs. T. Eko Haryanto
		Mr. Sutarno
Irrigation Engineer	Mr. H. Arai	Ir. Adzroi
Drainage Engineer	Mr. M. Watanabe	Ir. Kurjait Noor
Land Reclamation Engineer	Mr. S. Uesugi	Ir. Soeprapto
		Mr. Halawani
Infrastructure Engineer	Mr. T. Katayama	Ir. Masdar Bachtiar
		Mr. Rayu Dala
Agronomist	Mr. Y. Kameishi	Ir. Bambang Magie R.
		Ir. Hamudani
Agro-economist	Mr. M. Ishizuka	Ir. Hairin Fajeri
Fishery Expert	Mr. M. Doi	Ir. Yusa Anward
		Ir. Syaiful Anwar

Table 2 Population, Growth Rates, Distribution by Sex, Density and Households in the Study Area

Kabupaten	Area (km2)	Population 1971 ('000)	Population 1980 ('000)	Population 1985 ('000)	Average Growth Rate 1971-80 (% p.a.)	Average Growth Rate 1980-85 (% p.a.)	Average Growth Rate 1971-85 (% p.a.)	Distribution by Sex, 1985 Males (%)	Distribution by Sex, 1985 Females (%)	Distribution by Sex, 1985 Total (%)
Study Area	12,655	781.7	848.6	890.2	0.92	0.96	0.93	48.0	52.0	100.0
Tapin	2,663	84.3	108.4	120.4	2.84	2.13	2.58	48.9	51.1	100.0
H.S. Selatan	1,803	165.5	175.7	182.7	0.66	0.78	0.71	48.0	52.0	100.0
H.S. Tengah	1,472	196.0	200.4	205.4	0.25	0.49	0.33	46.9	53.1	100.0
H.S. Utara	2,771	220.9	239.5	247.1	0.90	0.62	0.80	48.0	52.0	100.0
Tabalong	3,946	115.0	124.6	134.7	0.90	1.57	1.14	49.0	51.0	100.0
South Kalimantan	36,986	1,699	2,063	2,315	2.18	2.33	2.23	49.8	50.2	100.0
Total Indonesia	1,918,769	119,208	147,490	163,876	2.39	2.13	2.30	50.2	49.8	100.0

Kabupaten	Density in 1985 (prs/km2)	Total Households in 1985 (No.)	Average Family Size in 1985 (prs/family)	Farm Households in 1985 (No.)	Percent. of Farm H.Hold (%)
Study Area	70	209,690	4.25	158,700	75.7
Tapin	45	29,046	4.15	22,900	78.8
H.S. Selatan	101	46,506	3.93	30,520	65.6
H.S. Tengah	140	48,380	4.24	39,080	80.8
H.S. Utara	89	55,207	4.48	44,630	80.8
Tabalong	34	30,632	4.40	21,570	70.4
South Kalimantan	63	509,520	4.54	334,400	65.6
Total Indonesia	85	35,889,000	4.57	20,344,500	56.7

Source: Statistics Office, South Kalimantan, Banjarmasin and Statistical Yearbook of Indonesia 1986, CBS

Table 3 Present Land Use Pattern in Study Area

(Unit: ha)

Land Use Paddy Field	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

Table 4 Existing Irrigation Schemes in the Study Area

(Unit:ha)

Scheme	Data obtained from Kabupaten			Potential Area by Water Availability		Re-estimated Brrigable Area		Area not to be Irrigated by Available Water	
	D.P.U.P's Revised Plan	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season
Tabalong									
1. Jaro	625	625	436	642	220	625	220	0	405
2. Jaro Bawah	200	200	0	700	242	200	200	0	0
3. Gumba	254	0	0	1,247	388	254	254	0	0
Sub-Total	1,079	825	436	2,589	850	1,079	674	0	405
H.S.U									
1. Paran	188	0	-	1,106	377	188	188	0	0
2. Tundakan	268	182	71	233	79	233	79	35	189
3. Siapin	383	317	37	116	40	116	40	267	343
4. Lok Batu	407	105	25	116	40	116	40	291	367
Sub-Total	1,246	604	133	1,571	536	653	347	593	899
H.S.T									
1. Talang	165	42	2	288	137	165	137	0	28
2. Tapuk	186	78	25	460	219	186	186	0	0
3. Tamiyan	166	146	7	345	164	166	164	0	2
4. Baruh Hawang	160	89	17	403	191	160	160	0	0
5. Intangan	1,180	587	10	920	437	920	437	260	743
6. Kahakan	777	755	413	633	301	633	301	144	476
7. Mangunan	515	503	271	1,150	547	515	515	0	0
8. Haruyan Dayak	1,486	764	210	4,313	2,051	1,486	1,486	0	0
Sub-Total	4,635	2,964	955	8,512	4,047	4,231	3,386	404	1,249
H.S.S									
1. Telega Langsat	2,831	2,410	1,000	1,534	487	1,534	487	1,297	2,344
2. Tayub	200	200	0	178	57	178	57	22	143
3. Nunungin	165	105	0	36	11	36	11	129	154
4. Kuangan	235	185	0	143	45	143	45	92	190
5. Pamujaan	350	310	0	214	68	214	68	136	282
6. Hawatu	256	150	0	71	23	71	23	185	233
7. Taal	289	245	0	107	34	107	34	182	255
8. Jarau	294	233	50	143	45	143	45	151	249
Sub-Total	4,620	3,838	1,050	2,426	770	2,426	770	2,194	3,850
Tapin									
1. Lok Paikat	452	209	0	392	125	392	125	60	327
2. Pampain	882	300	65	392	25	392	125	490	757
3. Nupadang	253	50	0	285	91	253	91	0	162
4. Tatakan	99	85	20	107	34	99	34	0	65
5. Pulau Pinang	270	220	70	321	102	270	102	0	168
6. Rampanang	146	136	20	428	136	146	136	0	10
7. Binuang	1,408	420	-	1,106	351	1,106	351	302	1,057
Sub-Total	3,510	1,420	175	3,031	964	2,658	964	852	2,546
Total	15,090	9,651	2,749	18,129	7,167	11,047	6,141	4,043	8,949

Remarks:Data based on DPUP Kabupaten Offices

Table 5 Existing Drainage Schemes in the Study Area

(Unit: ha)

Kabupaten	Scheme	Swamp	Drainage System	Cultivated Paddy Field	Area not Cultivated	Total Scheme Area
Drainage Schemes						
Tabalong	1. S. Gampa	8	B	688	812	1,500
	2. S. Rampang	8	C	325	275	600
	3. S. Paliat	8	B	352	123	475
	4. S. Pimping	8	B	95	55	150
	5. S. Binitoro	8	B	87	13	100
	6. S. Nanti	8	B	93	107	200
	Sub-total			1,640	1,385	3,025
H.S.U	7. S. Pinang Habang	3	A	200	1,795	1,995
	8. R. Batu Mandi	3	A	650	710	1,360
	Sub-total			850	2,505	3,355
H.S.T	9. Tg. Jaranih	8	C	455	739	1,194
	10. Tg. Semanggi Kambat	8	C	755	1,885	2,640
	11. R. Taras	3	A	100	200	300
	12. R. Rangkau	3	A	0	900	900
	Sub-total			1,310	3,724	5,034
H.S.S	13. Tg. Lungau	8	C	1,550	455	2,005
	14. Tg. Pengambau	8	C	500	0	500
	15. S. Kajang	5	A	700	800	1,500
	16. S. Tirtaba Halayung	5	C	400	200	600
	17. S. Taniran	8	A	300	0	300
	18. R. Negara	5	A	1,550	3,650	5,200
	19. S. Balum	4	A	500	100	600
	Sub-total			5,500	5,205	10,705
Tapin	20. 5bh Pintu Air	8	C	400	0	400
	21. S. Udul	6	A	1,000	0	1,000
	22. S. Muning	7	D	3,600	4,400	8,000
	23. S. Garis Halat	6	A	300	700	1,000
	24. S. Tapin Gadung	6	A	400	600	1,000
	25. S. Pinang Babaris	6	D	250	50	300
	26. R. Beranti	8	D	1,594	1,156	2,750
	27. S. Damar	6	A	450	800	1,250
	28. S. Salai	4	A	200	200	400
	29. S. Marisa	5	A	150	0	150
	Sub-total			8,344	7,906	16,250
	Total			17,644	20,725	38,369
Polder Schemes						
Tabalong	1. Ampukung			365	53	418
	2. Tigaron			115	29	144
H.S.U.	3. Padang Gusti			468	0	468
	4. Bakar			2,050	294	2,344
	5. Pakacangan			1,444	250	1,694
	6. Kaludan			1,800	500	2,300
	7. Murung Bayur			1,687	50	1,737
	8. Simpang Empat			1,274	0	1,274
	9. Alabio			4,500	1,450	5,950
	Total			13,703	2,626	16,329

Remarks: Swamp
1 Tabalong
2 West Amuntai
3 East Amuntai
4 West Negara
5 East Negara
6 Tapin
7 North Muning
8 Others

Drainage System
A Drainage Canal
B Natural Water Course + Gate (Stop log)
C Dyke + Gate (Stop log)
D Drainage Canal + Gate (Stop log)
E Drainage Canal + Gate + Dyke

Table 6 Present Paddy Field Distribution by Type of Field Condition

(Unit: ha)

Type of Paddy Field	Kabupaten					Strip along the Barito	Study Area
	Tabalong	H.S.U.	H.S.T.	H.S.S.	Tapin		
1. Swamps							
- Poldered	480	13,320	-	-	-	-	13,700
- Drained	1,640	850	1,310	5,500	8,340	-	17,640
- Rainfed	2,530	12,130	9,670	18,980	16,520	300	60,130
Sub-total	4,650	26,200	10,980	24,480	24,860	300	91,470
2. Alluvial plains							
- Irrigated	820	600	2,970	3,840	1,420	-	9,650
- Rainfed	6,180	6,560	34,790	8,660	5,860	-	62,050
Sub-total	7,000	7,160	37,760	12,500	7,280	-	71,700
3. Alluvial valleys							
- Rainfed	-	2,330	-	-	-	-	2,330
Total	11,650	35,690	48,740	36,980	32,140	300	165,500

Source: Provincial Agricultural Office, South Kalimantan Province

Table 7 Seasonal Paddy Planted Area at Present by Type of Field Condition

(Unit: ha)

Type of Paddy Field	Kabupaten					Strip along the Barito	Study Area
	Tabalong	H.S.U.	H.S.T.	H.S.S.	Tapin		
1. Wet Season							
- Poldered	-	4,500	-	-	-	-	4,500
- Drained	950	650	1,310	5,000	7,990	-	15,900
- Irrigated	820	600	2,970	3,840	1,420	-	9,650
- Rainfed	6,180	8,890	34,890	8,660	5,860	-	64,480
- (Swamps)	(-)	(-)	(100)	(-)	(-)	(-)	(100)
- (Alluvial plains)	(6,180)	(6,560)	(34,790)	(8,660)	(5,860)	(-)	(62,050)
- (Alluvial valleys)	(-)	(2,330)	(-)	(-)	(-)	(-)	(2,330)
Sub-total	7,950	14,640	39,170	17,500	15,270	-	94,530
2. Dry Season							
- Poldered	480	8,720	-	-	-	-	9,200
- Drained	690	200	-	500	350	-	1,740
- Irrigated	440	130	950	1,050	180	-	2,750
- Rainfed	2,530	12,130	9,570	18,980	16,520	300	60,030
- (Swamps)	(2,530)	(12,130)	(9,570)	(18,980)	(16,520)	(300)	(60,030)
- (Alluvial plains)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
- (Alluvial valleys)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Sub-total	4,140	21,180	10,520	20,530	17,050	300	73,720
Total Planted Area	12,090	35,820	49,690	38,030	32,320	300	168,250
Total Paddy Field	11,650	35,690	48,740	36,980	32,140	300	165,500
Cropping Intensity (%)	104	100	102	103	101	100	102

Table 8 Harvest Areas, Productions and Yields of Major Crops in the Study Area, 1982-1986

	1982	1983	1984	1985	1986	5 Years Average	Growth Rate (1982-86)
a/ Area Harvested	('000 ha)						(% p.a.)
Paddy (wet land)	111.4	108.2	117.2	119.8	123.8	116.11	2.7
Paddy (dry land)	13.8	6.7	15.1	15.1	12.8	12.68	-1.9
Maize	1.9	3.3	3.2	1.9	2.2	2.53	3.5
Cassava	1.6	1.5	1.9	1.7	1.9	1.71	4.3
Sweet potato	1.3	0.7	0.7	1.1	1.4	1.06	3.0
Soybeans	0.2	0.5	0.5	0.9	1.3	0.68	59.4
Groundnuts	3.0	3.9	3.6	3.6	4.4	3.71	10.2
Mungbeans	0.2	0.4	0.3	0.4	0.7	0.40	33.7
Vegetables	2.1	3.7	2.5	2.4	2.8	2.71	8.1
Rubber	60.0	64.4	67.0	73.0	78.9	68.65	7.1
Coconut	20.5	20.7	20.2	22.5	22.5	21.28	2.3
Coffee	2.1	2.1	2.0	2.3	2.5	2.23	3.9
Cloves	3.3	3.2	3.3	3.8	3.8	3.50	3.9
Pepper	0.2	0.3	0.4	0.6	0.6	0.43	27.9
Banana	0.8	1.2	1.3	1.7	1.7	1.33	22.9
Rambutan	0.3	0.2	0.4	0.5	0.1	0.30	-18.0
Citrus	0.3	0.3	0.4	0.3	0.3	0.34	-2.0
Production	('000 tons)						(% p.a.)
Paddy (wet land)	326.4	378.1	418.3	433.1	421.9	395.57	6.6
Paddy (dry land)	23.5	12.3	23.8	26.4	23.6	21.93	0.1
Maize	1.7	2.5	2.3	1.5	2.0	1.99	4.3
Cassava	11.4	10.0	13.5	12.9	14.4	12.41	6.1
Sweet potato	6.3	3.8	3.6	5.6	7.2	5.28	3.3
Soybeans	0.1	0.3	0.3	0.9	1.2	0.57	76.9
Groundnuts	2.5	3.0	3.0	3.5	4.4	3.27	15.1
Mungbeans	0.1	0.2	0.2	0.3	0.4	0.22	36.0
Vegetables	2.2	6.2	4.2	4.5	6.4	4.69	31.1
Rubber	23.2	23.6	26.0	25.0	26.3	24.81	3.2
Coconut	14.1	14.1	14.1	14.9	15.4	14.51	2.2
Coffee	0.5	0.5	0.5	0.5	0.6	0.50	4.5
Cloves	0.1	0.2	0.2	0.1	0.1	0.15	3.6
Pepper	0.1	0.1	0.1	0.2	0.2	0.15	6.9
Banana	2.4	2.8	4.3	7.0	8.7	5.04	37.6
Rambutan	0.6	0.3	2.4	2.1	0.5	1.18	-2.1
Citrus	0.3	0.9	2.4	1.5	1.4	1.30	43.2
Yield	(kg/ha)						(% p.a.)
Paddy (wet land)	2,929	3,493	3,569	3,614	3,406	3,407	3.9
Paddy (dry land)	1,704	1,843	1,582	1,754	1,843	1,729	2.0
Maize	858	751	720	776	883	786	0.7
Cassava	7,143	6,737	7,139	7,432	7,624	7,236	1.6
Sweet potato	4,950	5,072	4,876	5,042	5,010	4,992	0.3
Soybeans	623	611	661	942	945	836	11.0
Groundnuts	827	778	828	961	985	881	4.5
Mungbeans	546	518	538	587	585	561	1.7
Vegetables	1,045	1,678	1,687	1,822	2,262	1,731	21.3
Rubber	387	366	387	342	334	361	-3.7
Coconut	685	682	696	663	685	682	0.0
Coffee	220	227	240	205	226	223	0.6
Cloves	38	48	54	34	38	42	-0.3
Pepper	598	411	372	258	292	347	-19.7
Banana	3,170	2,317	3,428	4,195	4,986	3,798	12.0
Rambutan	1,969	1,710	6,131	4,238	3,517	3,886	13.5
Citrus	944	2,839	5,968	4,451	4,298	3,793	31.5

a/: Area planted for estate crops
Source: Statistical Yearbook of South Kalimantan 1983...1987, Statistics Office, South Kalimantan

Table 9 Institutions for Agricultural Services at Province Level in South Kalimantan

Institution	Location
General Agricultural Services	
1. KANWIL Agriculture	Banjarbaru
2. DINAS Food Crops	Banjarbaru
3. DINAS Estate Crops	Banjarbaru
4. DINAS Livestock	Banjarbaru
5. DINAS Fishery	Banjarbaru
6. KANWIL Forestry	Banjarbaru
7. DINAS Forestry	Banjarbaru
Research and Breeding	
1. Banjarbaru Research Institute for Food Crops (BRIFC)	Banjarbaru
2. Veterinary Research Station	Banjarbaru
3. Livestock Breeding and Feed Center	Pelaihari
Extension Services	
1. Agricultural Information Center	Banjarbaru
2. Food crops Protection Center	Guntung Payung
3. Seed Control and Certification Center	Banjarbaru
4. Agricultural Training Center	Binuang
5. Livestock Disease Investigation Center	Banjarbaru
6. Provincial BIMAS Secretariat	Banjarbaru
Agricultural Education	
1. Senior Highschool for Agriculture	Banjarbaru
2. Senior Highschool for Livestock	Pelaihari
3. Lambung Mangkurat University (Faculty of Agriculture, Fishery and Forestry)	Banjarbaru
Marketing Services	
1. P.T. Pertani	Banjarmasin
2. P.T. Pusri	Banjarmasin
3. Regional Logistics Depot (DOLOG)	Banjarmasin
Credit Services	
1. Bank Indonesia	Banjarmasin
2. Bank Rayat Indonesia (BRI)	Banjarmasin
3. Pegional Development Bank (BPD)	Banjarmasin
4. Private Banks	
Irrigation, Drainage, Polder and O&M Services	
1. Sub-Dinas WRD, Provincial Public Works (DPU)	
Other Services	
1. KANWIL Transmigration	Banjarmasin
2. KANWIL Cooperative	Banjarmasin

Table 10 Location of Rural Extension Center (REC) in the Study Area in 1988

Kabupaten/ Location	Area Jurisdiction (Name of Kecamatan)		
Tapin			
1. Pulau Pinang	1. Binuang	2. Tapin Selatan	
2. Lok Paikat	1. Lok Paikat	2. Piani	
3. Pematang Kar.Hilir	1. Tapin Tengah	2. Bakarangan	
4. Banua Padang	1. Tapin Utara	2. Bungur	
5. Margasari	1. Candi Laras Utara	2. Candi Laras Selatan	
6. Soato	1. Salam Babaris	2. Tapin Selatan	
H.S.Selatan			
1. Negara	1. Daha Utara	2. Daha Selatan	
2. Sungai Raya	1. Sungai Raya		
3. Bamban	1. Angkinang	2. TelagaLangsat	
4. Padang Batung	1. Padang Batung	2. Kandangan	3. Lok Sado
5. Simpur	1. Simpur	2. Kelumpang	
H.S.Tengah			
1. Kapar	1. Batang Alai Utara	2. Batang Alai Selatan	
2. Pantai Hambawang	1. Labuan Amas Selatan	2. Haruyan	
3. Kasarangan	1. Labuan Amas Utara	2. Pandawan	
4. Pagat	1. Batu Benawa	2. Barabai	
H.S.Utara			
1. Alabio	1. Alabio	2. Amuntai Selatan	
2. Kaludan	1. Amuntai Utara	2. Amuntai Tengah	3. Lampihong
3. Paringin	1. Paringin	2. Batu Mandi	3. Awayan
4. Juai	1. Juai	2. Halong	
5. Danau Panggang	1. Babirik	2. Danau Panggang	
Tabalong			
1. Muara Uya	1. Muara Uya	2. Jaro	
2. Maburai	1. Tanta	2. Murung Pudak	
3. Kelua	1. Kelua	2. Banua Lawas	3. Pugaan
4. Tanjung	1. Tanjung	2.	
5. Wirang	1. Upau	2. Haruai	

Source: BIMAS Secretariat, South Kalimantan

Table 11 Food Balance Projection to 2018 in Indonesia

(Unit: 1000 tons)

	Base				1998			
	a/ Supply	b/ Demand	c/ Balance	S/D d/ Ratio	Supply	Demand	Balance	S/D Ratio
Rice	24,320	24,510	(190)	0.99	31,662	32,607	(946)	0.97
Maize	4,535	5,275	(740)	0.86	7,656	7,610	46	1.01
Cassava	13,326	11,854	1,472	1.12	16,172	14,910	1,262	1.08
Sweet potato	2,073	2,246	(173)	0.92	2,535	2,747	(212)	0.92
Soybeans	679	802	(123)	0.85	874	1,261	(387)	0.69
Groundnuts	490	541	(51)	0.91	631	850	(219)	0.74
Coconut	1,737	1,819	(82)	0.95	2,459	2,575	(116)	0.95
Vegetables	2,734	2,779	(45)	0.98	4,851	4,931	(80)	0.98
Fruits	4,439	4,086	353	1.09	7,683	7,071	612	1.09
Meat	685	658	27	1.04	1,461	1,611	(150)	0.91
Eggs	324	305	19	1.06	782	736	45	1.06
Milk	143	560	(417)	0.26	223	1,465	(1,242)	0.15
Fish	2,156	2,094	62	1.03	4,638	4,714	(76)	0.98

	2008				2018			
	Supply	Demand	Balance	S/D Ratio	Supply	Demand	Balance	S/D Ratio
Rice	38,785	40,376	(1,591)	0.96	47,511	49,996	(2,485)	0.95
Maize	11,453	10,458	995	1.10	17,133	14,372	2,761	1.19
Cassava	18,768	17,648	1,120	1.06	21,781	20,888	893	1.04
Sweet potato	2,960	3,207	(247)	0.92	3,455	3,743	(288)	0.92
Soybeans	1,061	1,819	(757)	0.58	1,288	2,623	(1,334)	0.49
Groundnuts	766	1,226	(460)	0.62	930	1,768	(838)	0.53
Coconut	3,213	3,365	(152)	0.95	4,198	4,396	(198)	0.95
Vegetables	7,541	7,666	(125)	0.98	11,722	11,916	(194)	0.98
Fruits	11,716	10,783	933	1.09	17,867	16,444	1,422	1.09
Meat	2,617	3,207	(591)	0.82	4,686	6,387	(1,701)	0.73
Eggs	1,539	1,450	89	1.06	3,031	2,855	176	1.06
Milk	314	3,067	(2,753)	0.10	442	6,421	(5,979)	0.07
Fish	8,361	8,799	(438)	0.95	15,073	16,424	(1,351)	0.92

a/: Average figures from 1981 to 1985
c/: Figures in parentheses indicate minus balance.
d/: Supply/demand ratio

Source: a/; Supplement to the President's Report to Parliament, August 15 1986, and Draft State Budget, 1986/87
b/; Food balance Sheet in Indonesia 1983, CBS

Table 12 Food Balance Projection to 2018 in South Kalimantan

(Unit: 1000 tons)

	Base				1998			
	a/ Supply	b/ Demand	c/ Balance	S/D d/ Ratio	Supply	Demand	Balance	S/D Ratio
Rice	586.2	346.2	240.0	1.69	870.7	464.7	406.0	1.87
Maize	6.5	74.5	(68.0)	0.09	10.5	108.5	(97.9)	0.10
Cassava	56.1	167.5	(111.4)	0.33	76.8	212.5	(135.7)	0.36
Sweet potato	10.5	31.7	(21.2)	0.33	22.0	39.1	(17.2)	0.56
Soybeans	2.0	11.3	(9.3)	0.18	3.0	18.0	(15.0)	0.16
Groundnuts	8.3	7.6	0.7	1.09	12.2	12.1	0.1	1.01
Coconut	30.7	25.7	5.0	1.19	49.2	36.7	12.5	1.34
Vegetables	10.7	39.3	(28.5)	0.27	19.0	70.3	(51.3)	0.27
Fruits	29.3	57.7	(28.4)	0.51	50.7	1000.8	(50.1)	0.50
Meat	8.6	9.3	(0.7)	0.93	18.4	23.0	(4.5)	0.80
Eggs	14.1	4.3	9.8	3.28	21.5	10.5	11.0	2.05
Milk	0.0	7.9	(7.9)	0.00	0.0	20.9	(20.8)	0.00
Fish	96.8	29.6	67.3	3.27	208.3	67.2	141.2	3.10

	2008				2018			
	Supply	Demand	Balance	S/D Ratio	Supply	Demand	Balance	S/D Ratio
Rice	1,066.6	578.3	488.2	1.84	1,306.5	719.4	587.2	1.82
Maize	15.2	149.8	(134.6)	0.10	22.0	206.8	(184.7)	0.11
Cassava	89.1	252.8	(163.7)	0.35	103.4	300.5	(197.1)	0.34
Sweet potato	25.6	45.9	(20.3)	0.56	29.9	53.9	(23.9)	0.56
Soybeans	3.6	26.0	(22.5)	0.14	4.4	37.7	(33.4)	0.12
Groundnuts	14.9	17.6	(2.7)	0.85	18.1	25.4	(7.4)	0.71
Coconut	64.2	48.2	16.0	1.33	83.9	63.3	20.7	1.33
Vegetables	29.6	109.8	(80.2)	0.27	46.0	171.5	(125.5)	0.27
Fruits	77.3	154.5	(77.1)	0.50	117.9	236.6	(118.7)	0.50
Meat	33.0	45.9	(13.0)	0.72	59.0	91.9	(32.9)	0.64
Eggs	29.7	20.8	9.0	1.43	41.1	41.1	0.0	1.00
Milk	0.1	43.9	(43.9)	0.00	0.1	92.4	(92.3)	0.00
Fish	375.6	126.0	249.5	2.98	677.0	236.3	440.7	2.86

a/: Average figures from 1981 to 1985
c/: Figures in parentheses indicate minus balance.
d/: Supply/demand ratio

Source: a/; Supplement to the President's Report to Parliament, August 15 1986, and Draft State Budget, 1986/87
b/; Food balance Sheet in Indonesia 1983, CBS

Table 13 Food Balance Projection to 2018 in the Study Area

(Unit: 1000 tons)

	Base				1998			
	a/ Supply	b/ Demand	c/ Balance	S/D d/ Ratio	Supply	Demand	Balande	S/D Ratio
Rice	283.9	133.1	150.8	2.13	369.6	150.5	219.1	2.46
Maize	2.0	28.7	(26.7)	0.07	3.2	35.1	(31.9)	0.09
Cassava	12.4	64.4	(52.0)	0.19	17.0	68.8	(51.8)	0.25
Sweet potato	5.3	12.2	(6.9)	0.43	8.1	12.7	(4.6)	0.63
Soybeans	0.6	4.4	(3.8)	0.13	0.8	5.8	(5.0)	0.14
Groundnuts	3.3	2.9	0.4	1.13	4.9	3.9	1.0	1.24
Coconut	14.5	9.9	4.6	1.47	19.3	11.9	7.4	1.62
Vegetables	4.7	15.1	(10.4)	0.31	8.3	22.8	(14.4)	0.37
Fruits	9.4	22.2	(12.8)	0.42	16.3	32.6	(16.4)	0.50
Meat	4.4	3.6	0.8	1.24	9.4	7.4	2.0	1.27
Eggs	8.1	1.7	6.4	4.88	12.3	3.4	8.9	3.62
Milk	0.0	3.0	(3.0)	0.00	0.0	6.8	(6.7)	0.00
Fish	39.8	11.4	28.4	3.50	85.6	21.8	63.8	3.93

	2008				2018			
	Supply	Demand	Balance	S/D Ratio	Supply	Demand	Balance	S/D Ratio
Rice	452.8	163.3	289.5	2.77	554.6	178.1	376.5	3.11
Maize	4.7	42.3	(37.6)	0.11	6.7	51.2	(44.5)	0.13
Cassava	19.7	71.4	(51.6)	0.28	22.9	74.4	(51.5)	0.31
Sweet potato	9.4	13.0	(3.6)	0.73	11.0	13.3	(2.4)	0.82
Soybeans	1.0	7.4	(6.3)	0.14	1.2	9.3	(8.1)	0.13
Groundnuts	5.9	5.0	1.0	1.20	7.2	6.3	0.9	1.14
Coconut	23.9	13.6	10.3	1.76	29.8	15.7	14.1	1.90
Vegetables	12.9	31.0	(18.1)	0.42	20.1	42.5	(22.3)	0.47
Fruits	24.8	43.6	(18.8)	0.57	37.9	58.6	(20.7)	0.65
Meat	16.9	13.0	3.9	1.30	30.2	22.8	7.5	1.33
Eggs	17.0	5.9	11.2	2.91	23.5	10.2	13.4	2.31
Milk	0.0	12.4	(12.4)	0.00	0.0	22.9	(22.8)	0.00
Fish	154.3	35.6	118.7	4.34	278.1	58.5	219.6	4.75

a/: Average figures from 1981 to 1985
c/: Figures in parentheses indicate minus balance.
d/: Supply/demand ratio

Source: a/; Supplement to the President's Report to Parliament, August 15 1986, and Draft State Budget, 1986/87
b/; Food balance Sheet in Indonesia 1983, CBS