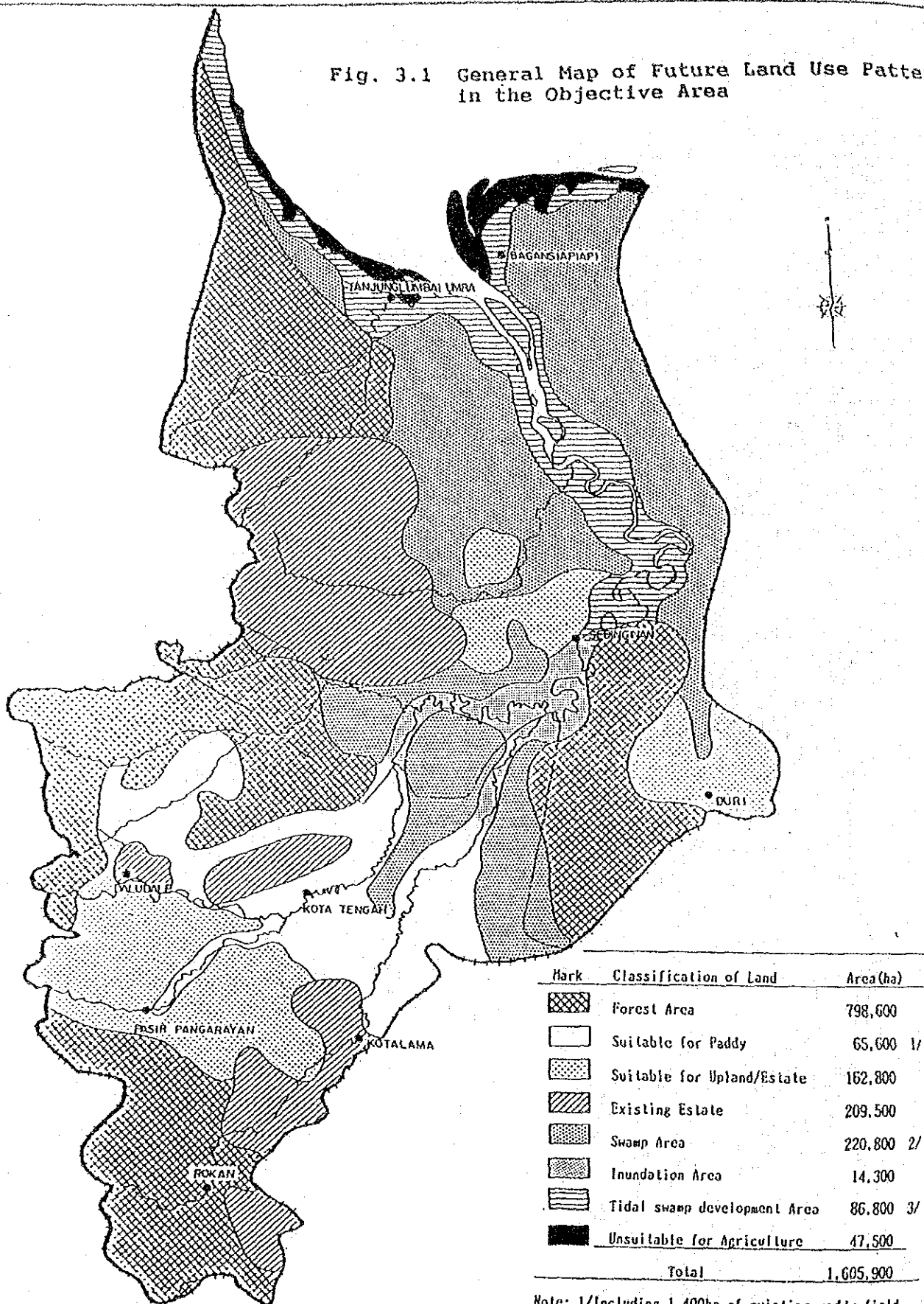


Fig. 3.1 General Map of Future Land Use Pattern in the Objective Area



Note: 1/Including 1,400ha of existing paddy field
 2/Including 39,900ha of land with potential for Agricultural development
 3/Including existing Tidal swamp development area of 39,800ha

0 10 20 30 KM
 SCALE

ANNEX D

FARM PRACTICES

ANNEX D FARM PRACTICES

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ANNEX D FARM PRACTICES

1. INTRODUCTION

This Annex presents the result of farming practices study conducted so far through the Phase I Field Study, the Phase I Dry Season Field Study and the Phase I Home Office Work. The major aims of the study on farming practices are:

- to clarify the present conditions of agriculture in the Study Area
- to identify the main constraints for agricultural development in the Objective Area in respect of agriculture
- to select the highest priority area for irrigation development following REPELITA V, regional agricultural development policy and the development criteria of Ministry of Public Works

The data and information have been obtained from variety of the government agencies concerned in collaboration with the counterparts of PU. On the basis of these data and information the study so far have been successfully conducted. The technical details are presented in the following chapters.

2. PRESENT AGRICULTURAL CONDITION

2.1 National and Regional Policy for Agriculture

Since the year of 1968 the Indonesian government has implemented four 5-year development plans in which the main emphasis was put on agricultural development to achieve food security and social stability, considering the food production industry as a major employment absorbing industry.

In the fourth 5-year development plan, the prime target was food self-sufficiency through production increase, and this was achieved, although only temporarily, in rice, maize and cassava.

The Fifth 5-year Development Plan (REPELITA V) is principally on the same line of the former plans. The goals of agricultural sector are as follows:

- 1) quality improvement and strengthening self-sufficiency in food,
- 2) agricultural production increase to meet the demand of export, feed, and raw materials for domestic manufacturing industry,
- 3) increase of agricultural productivity and value added of agricultural goods,
- 4) increase of farmers income, and
- 5) rural area development and natural resource conservation.

Following the REPELITA V, Riau province has formulated the agricultural development plan for the period of 1989-1993. The main goals are as follows:

- 1) Production increase of food crops through cropping area increase and productivity rise, especially in rice production which has a serious shortage of approx. 130,000 tons, and
- 2) Production increase of plantation crops through cropping area increase for export and domestic manufacturing industry.

2.2 Geographic Conditions

The Objective Area is roughly divided into three parts, namely upper stream, intermediate and downstream in respect of agroclimate and geography. The upper stream area in Riau Province is mainly hills and thus palawija and plantation crops (mainly oil palm and rubber) are widely planted. The intermediate area is relatively flat and fertile. Since the agricultural potential here is high, the area can be utilized in various ways such as shifting cultivation, transmigration, large scale plantation development, irrigation, etc. The downstream area is mostly covered by swamp and forest and thus the land use is relatively low.

The Objective Area extends over two Kabupatens, namely Kab. Bengkalis which is the downstream of the Objective Area and Kab. Kampar which occupies the upper stream and intermediate of the Objective Area. Therefore, Kab. Bengkalis is mostly covered by swamp and forest and Kab. Kampar is relatively developed as food crop fields, large plantation, shifting cultivation and residential area. From the geographic condition for agriculture the major farming in Kab. Bengkalis is wet land rice and in Kab. Kampar upland rice and various palawija crops, such as maize, soybean, groundnut, etc.

2.3 Crop Production

2.3.1 Food Crops

In Riau Province the most important food crop is rice, which occupies approximately three quarters of the cultivated area. There is, however, a severe shortage of rice supply in Riau Province as shown in Table 2.1 and thus more than a quarter of the demand, namely 130,000 ton of milled rice on the average during the REPELITA IV period, is bought from West Sumatra, North Sumatra and other regions. Rice self-sufficiency has been, therefore, a very important goal in the former REPELITAS and the current REPELITA V in the Province.

Besides rice, principle food crops in Riau Province are maize, cassava, soybean, peanut, and green gram in descending order of planted area in the year of 1988 as shown in Table 2.2. If the planted areas are compared between 1984 and 1988, the maize doubled, that of peanut increased two and half times and that of soybean almost three times. Rice has shown little change. On the other hand, the relative importance of cassava and sweet potatoes has dropped.

Major vegetables produced in Riau Province are chili, vegetable beans, cucumber, egg plant and kangkong which can grow under hot and dry climate. There is no distinctive productivity increase in spite of the intensification programme, although the planted area of all crops greatly increased over four years. Leafy vegetables are brought mainly from West and North Sumatra Regions where climate is cooler.

Fruits are produced mainly in small scale like home gardens rather than in large scale plantation. The main fruits are banana, orange, pineapple, durian, and rambutan.

Food crop production of Objective Area, that is, Rokan River Basin in Riau Province, is shown in Table 2.3 and the summary in the table of the next page.

In Kabupaten Kampar rice is planted mainly in upland. On the other hand, rice is planted in wetland in Kab. Bengkalis. In the Objective Area the productivity of wetland paddy, 3.57 ton/ha,

SUMMARY OF CROP PRODUCTION OF THE OBJECTIVE AREA 1989

		OBJECTIVE		AREA	WHOLE	WHOLE	WHOLE
		KAB. KAMPAR	KAB. BENGKALI	Rokan River Basin	KAB. KAMPAR	KAB. BENGKALIS	WHOLE PROVINCE IN 1988
Wet Land Rice	Harvested Area (Ha)	1,596	13,386	14,982	14,031	32,379	99038
	Production (ton)	5,983	47,564	53,547	62,071	110,736	295677
	Yield (t/Ha)	3.75	3.55	3.57	4.42	3.42	2.99
Upland Rice	Harvested Area (Ha)	11,549	1,663	13,213	31,345	6,489	53419
	Production (ton)	29,473	3,213	32,685	69,053	12,371	97676
	Yield (t/Ha)	2.55	1.93	2.47	2.20	1.91	1.83
Maize	Harvested Area (Ha)	2,786	458	3,244	4,657	980	13321
	Production (ton)	8,511	638	9,149	13,349	1,557	24293
	Yield (t/Ha)	3.05	1.39	2.82	2.87	1.59	1.82
Soybeans	Harvested Area (Ha)	2,373	224	2,597	3,023	574	6524
	Production (ton)	3,052	201	3,253	3,803	585	5252
	Yield (t/Ha)	1.29	0.90	1.25	1.26	1.02	0.81
Cassava	Harvested Area (Ha)	1,178	750	1,928	2,819	3,000	8529
	Production (ton)	17,254	12,009	29,263	41,589	45,625	92893
	Yield (t/Ha)	14.65	16.01	15.18	14.75	15.21	10.89
Sweet Potato	Harvested Area (Ha)	244	247	491	414	602	2037
	Production (ton)	1,795	1,267	3,061	2,947	3,839	17887
	Yield (t/Ha)	7.36	5.14	6.24	7.12	6.38	8.78
Ground Nuts	Harvested Area (Ha)	1,548	182	1,730	2,453	361	4479
	Production (ton)	2,906	185	3,092	3,997	334	4233
	Yield (t/Ha)	1.88	1.02	1.79	1.63	0.93	0.95
Green Gram	Harvested Area (Ha)	758	143	901	1,159	236	3508
	Production (ton)	907	134	1,040	1,331	215	5653
	Yield (t/Ha)	1.20	0.93	1.15	1.15	0.91	1.61

is higher than the average of the whole Province at 2.99 ton/ha. This yield is, however, lower than the national average of approx. 4 ton/ha. The reason for this low productivity is a lack of good irrigation, namely irrigation facility which can supply enough water throughout the year. With irrigation, high productivity can be expected as in Kec. Rokan IV Koto in Kab. Kampar which shows productivity of 5.66 ton/ha under the same agroclimatic conditions.

As for upland paddy the yields of Kab. Bengkalis are almost the same as that of the Province average. On the other hand the yield of Kab. Kampar is slightly higher than the Province average.

The rice production share of the Rokan River is approximately 22 % of that for the whole province. The production shares of palawija crops in the Objective Area are 13 % for maize, 58 % for soybean, 32 % for cassava, 17 % for sweet potato, 73 % for peanut and 18 % for vegetable beans. The soybean and peanut, for which the shares are higher, also show higher productivity than the average of the Province. Especially the yield of both crops is high in Kab. Kampar.

Other distinctive points are:

- a. the yield of cassava in Kab. Kampar is very high,
- b. the yield of cassava in Kab. Kampar and Bengkalis is higher than the province average, and
- c. the yield of sweet potato and vegetable beans of both Kabupatens is low.

2.3.2 Plantation Crops

The main plantation crops are rubber, coconut and oil palm. The production of plantation crops in the last six years is shown in Table 2.4 and that in 1989 is as follows:

Production and Planted Area of Plantation Crops in Riau Province

Crop	Planted		Area (ha)		Prod'tn (ton)	No of Farmers
	NYP*	P**	OS***	Total		
Rubber	116,542	190,388	70,665	377,595	104,297	117,957
Coconut	92,111	176,672	48,962	317,745	194,321	182,064
Oil palm	108,442	86,533	-	194,975	263,938	17,555
Coffee	2,733	5,472	1,633	9,838	1,675	-
Clove	3,645	5,573	3,501	12,719	755	6,918
Cacao	512	45	51	608	11	-

* : Not yet producing

** : Producing at present

***: Old stage

Source : Laporan Tahunan, Dinas Perkebunan Propinsi
Daerah Tingkat I Riau, 1989.

The production increase of these crops is one important policy in both the National and Regional REPELITA V in order to meet the demand of raw materials for domestic manufacturers and of the international market. From a monetary aspect, two important aims of plantation crops are to increase small farmers' income up to US\$ 1,500 per family and to increase foreign exchange earning.

The total production in 1989 is 565,517 tons which is 33% higher than the production of 1988. Especially the production of oil palm becomes more than double. The production of rubber and coffee also increased by 7.65% and 8.55% respectively. The production increase is expected to continue for a decade by new plantation development.

There are three principle approaches for plantation development, namely (i) small holder plantation, (ii) state owned large plantation and (iii) private large estate.

The first small holder plantation occupies the largest area, 754,659 ha and 82.7 % of the total plantation area in Riau Province. This consists of 613,717 ha(81 %) of self-supporting farmers, 60,366 ha(8 %) of UPP and 80,586 ha(11 %) of Plasma FIR. Major crops are rubber (47.8 %), coconut (40.2 %) and hybrid coconut (8.5 %).

The second one is state owned large plantation. These are PTPs, namely II, IV, V and VI. This plantation is divided into two types by the government programme, namely pure PTP of 38,557 ha and the nucleus PIR PTP of 30,586 ha. The main crops are oil palm and rubber.

The last plantation type is private large estate. This type occupies 9.8 %, 89,168 ha and most of this area is pure private plantation, namely 86,642 ha. The rest of this plantation, 6,524 ha, is nucleus of PIR. The highest priority crop is oil palm and the second is cocopalms.

As of December 1989, 40 private large estates are operational out of 89 estates which have acquired the right of the land use for plantation development.

In the Study Area plantation crop area is expanding for all the three types explained above, especially for private large estate.

2.3.3 Agronomic Land Use Pattern

Looking at the agronomic land use at farmers level, three types are identified as follows:

a. Intensively cultivated area:

The areas where population pressure is high and there are transmigrants are intensively used for farming. Since monthly rainfall is more than 100 mm throughout

the year, farming can be practiced anytime, although productivity is neither stable nor high. Even under shifting cultivation area, when the land is used, this land is cultivated twice a year. Another example of intensively cultivated area is irrigated area. The cropping intensity of this area is presumed at about 200%.

b. Tree crop area:

This area consists of two types, fruit trees and plantation crops. The latter is dominant and is increasing because of good profitability and Government programmes for better land use.

c. Fallow Land

Since shifting cultivation has been widely practiced in this area because of low population density and very low level of farm mechanization, fallow land is very large.

2.4 Livestock and Fowls

The number of livestock and fowls in Riau Province is increasing as a whole. Especially cattle numbers have expanded by 150% from 31,748 to 80,337 in the recent five years (Table 2.6). Kab. Kampar is the main area of livestock production and one third of cattle and more than half of water buffalo of the province are raised in 1988. On the other hand, the livestock and fowl sector is not active in Kab. Bengkalis except for boar which is mainly consumed by population of Chinese origin .

The livestock population in the Objective Area is shown in Table 2.7. Three distinctive points can be drawn from this table as follows:

- a. population of cattle and goat in Kab. Kampar in the Objective Area is comparatively higher than that of all Kab. Kampar,
- b. population of other livestock in the Objective Area is comparatively lower than outside the Objective Area, and
- c. in Kab. Bengkalis pig and layer/broiler are raised.

The government programme for cattle production increase is now being extensively implemented in transmigration areas under the assistance of the World Bank and IFAD. The objective of this programme is to provide transmigrants with animal power. This is a kind of loan programme and the repayment is made by two born calves for one adult cow supplied within three years and three born calves for a pair of cattle within four years. The distribution of oxen is limited to 10 % of cow in number. The implement for plowing is distributed free of charge to the farmers by IFAD. Since the origin of the most transmigrants is Java, they know how to train and operate cow for land

preparation.

This programme will end in 1992 and the achievement as of December 1990 is shown in Table 2.8.

2.5 Farming Practices

Current farming methods practiced in the Rokan River Basin area have been studied through interviewing farmers and BPP staff. Typical farming methods, cropping calendars and problems are explained in the following sections.

Since the Study Area is very large and the agronomic factors show wide variety such as, agroclimate, soil type, farming technique, production facilities, etc, farming practices also exhibit quite wide variation.

2.5.1 Wet Land Paddy

Wet land paddy is divided into rainfed and irrigated. In the Objective Area only 10 % of wet land paddy is in Kab. Kampar and 90 % in Kab. Bengkalis. Some wet land paddy in Kab. Kampar is irrigated and enjoyed high yield of 3.75 ton/ha in 1989. On the other hand, wet land paddy in Kab. Bengkalis is rainfed except for tidal swamp development area and the yield is slightly lower, namely 3.55 ton/ha.

(1) Tidal Swamp Development Area

The tidal swamp development area in Kab. Bengkalis is 3,650 ha near the river mouth of the Rokan River (Table 2.9). Out of this 3,650 ha, 3,473 ha is used for rice and 779 ha for other crops with a cropping intensity of 116 % in the cropping season of 1989.

The cropping pattern is sowing in September, transplanting in October at the seedling age of approx. 30 days and harvesting in January for rainy season planting and from March to July for dry season planting. The most popular rice variety is PB 42 and most of the other varieties are also HYVs.

The average seed amount used is 43 kg/ha and fertilizer is used in some advanced areas. The fertilizer quantities used in 1988 are urea of 53 kg/ha and 90 kg/ha. The majority of farmers, however, do not use fertilizers. The yield is low at 2.33 ton/ha due to poor drainage and unfavourable soil conditions. The productivity of other crops are also low.

One distinctive point in Table 2.9 is that the remaining farm households are few, in other words the high failure

ratio of transmigrants due to poor social infrastructure.

(2) Existing Irrigation Schemes

There are ten ordinary irrigation schemes, but they are not fully operational because of the various technical reasons explained in the chapter on irrigation.

Besides the reasons above there are some agronomic reasons, namely not very fertile soil, non-optimal fertilizer application in quantity, timing and type, selection of rice varieties and improper farming practices. Consequently the productivity here is not very high.

(3) General Rice Cultivation

There is not a very clear cropping season, since it rains throughout year.

The general cropping season is, however, from September/October to January/February in the rainy season and from April/May to July/August in the dry season as shown in Fig. 2.1. Nursery period is approximately 30 days. In wet land paddy area only transplanting by hand, and not the direct seeding method, is practiced despite relatively scarce labour force.

In irrigated paddy field only high yielding varieties (HYV) are planted and in non-irrigated paddy area both HYV and local varieties are used.

Major varieties for about 46,000 ha out of 150,000 ha of the Province paddy field, are shown in Table 2.10. The three most popular HYVs are PB 42, Sentani and Tondano and the most popular local variety is Kalpatal. Most of these varieties are the cere type which is photoperiodic sensitive. The potential yield with good care is 4.5-5.5 t/ha.

Mechanization level is primitive for land preparation. Manual plowing and oxen plowing are practiced, but not plowing by tractor. Harvesting is carried out by sickle and Ani-Ani. The harvested rice is immediately threshed mainly manually or pedal thresher, and then rice is dried at the farmer's yard or paddy field.

Fertilizer use is quite different by area and farmer. In irrigated paddy field fertilizers are generally used more than that in rainfed. The average amounts of fertilizer used in irrigated paddy field of Rambah Baru in Kec. Rambah are 75 kg/ha of urea and 156 kg/ha of triple super phosphate, according to the agro-economic farm survey.

2.5.2 Dry Land Paddy

Dry land paddy is cultivated mainly in the intermediate area of the Rokan River Basin. This rice is sown by direct seeding from August/September/October to January/February. The varieties used are both local varieties and HYVs. The yield is relatively very high at 2.46 ton/ha as one of dry land paddy according to the Government statistics. On the other hand, the result of our agro-economic farm survey showed that yield rarely exceeds 2 t/ha even with some fertilizer application. Under shifting cultivation land preparation is minimal, namely slashing and burning grass and not plowing, and seeds are sown in holes made by stick. Mixed cropping with palawija crops is often practiced.

Fertilizer is intensively used in newly transmigrated areas without irrigation, because farm inputs are supplied in a package. After the free supply in the first two years fertilizer use decreases, except for some areas like Rambah Baru and SKP E & F where the access to fertilizer market is easy or credit for fertilizer is available. The yield, however, is not so good.

2.5.3 Palawija Crops

Maize is the most important palawija crop, followed by soybeans, cassava, groundnut, vegetable beans and sweet potato in descending order.

The cropping seasons are both wet and dry season and detail are shown in Fig.2.1 and explained below.

The cultivation method of palawija crops here are divided into two, that is shifting cultivation and transmigration area. The former is least intensive and often mixed cropping. Land preparation is done by hand like that of rice cultivation and often slash and burn grass and direct seeding is practiced. Varieties used are mostly local and fertilizer usage is at a minimum level. The yield is, however, relatively high, especially that of beans. The reasons for this high yield are presumably preferable soil condition and relatively reliable rainfall.

In transmigration area the cropping season of palawija crops is the same as that for shifting cultivation as shown in Fig.2.1. The distinctive difference between the two areas is the quantities of farm inputs, especially fertilizer. In transmigration areas fertilizer is used in relatively large amount but the yield is not distinctively high. The reasons of this low yield are:

- (i) soil fertility is low due to continuous cultivation and soil erosion,
- (ii) run-off of applied fertilizer by rain, and
- (iii) other unstable factors such as flood, rain, and pests.

Major varieties of maize are shown in Table 2.11. The most common variety is Willis, followed by Arjuna and Kalingga. These varieties occupy only 5,233 ha out of 13,000 ha in the whole Province. Therefore, it is presumed that local varieties are dominantly used.

2.5.4 Intensification Programme

The INMUM program for palawija crops is in progress under the Department of Food Crops and thus the modern varieties and more intensive cultivation method are gradually being extended.

2.5.5 Mechanization

Farm mechanization level is generally low. Especially on-farm machinery is at a very initial level. Most items in Table 2.12 are simple tools except for hand sprayer and mist blower. As for post-harvest machines, the rice mill is very popular and is available at most villages.

Farm mechanization plan under REPELITA V is shown in Table 2.13. The distinctive point in this table is the increase of on-farm machines. If this plan is materialized, rapid increase of farming area can be expected.

2.5.6 Pests

In Riau Province there is no specific center for integrated pest forecasting and management and this function is executed by sub-Dinas office in Pekanbaru. The principle approach to pest management is an integrated one including pest forecasting, chemical control, control by farming practices (resistant variety, crop rotation, cropping season, fertilizer use, more manure use, etc), and biological control.

Major pests are shown in Table 2.14 and the ratios of pest damage are shown in Table 2.15. The most serious damage is presumably caused by rat and wild boar rather than insects and diseases. Boar hunting is often conducted in collaboration with police and local people.

Table 2.15 suggests that when crops are once damaged by pest, the ratio of damage is as high as 20-30 %. This damage is, however, less than 5 % for most crops in respect of the whole production.

2.6 Existing Problems

It is assumed there are variety of problems for farming practices. The existing major problems for farming which were encountered during the field interview are as follows:

- 1) lack of proper irrigation facilities, namely irrigation which can supply enough water in both dry and wet seasons,
- 2) crop damage caused by wide range of pests, especially rice blast, rats, elephant and wild boar,
- 3) labour shortage, especially experienced and skilled labour,
- 4) low soil fertility, low pH and Fe toxicity,
- 5) high transportation cost and poor access to market to sell farm products,
- 6) untimely supply of farm inputs, and difficult access to their market,
- 7) cooperative is not functioning well and thus agricultural supporting system is minimal,
- 8) farm mechanization level is low,
- 9) low availability of farmer's credit.
- 10) transmigrants go to private large plantation estates for employment because they can not get enough cash income to support their lives from their farms, and in some places more than 50 % of transmigrants work in private large estates,
- 11) irrigated fields are often far from farmers' residence and thus not properly managed,
- 12) previous HYVs have been replaced by less productive HYVs which have more pest resistance and better taste, and
- 13) low price of farm products at harvesting period is a disincentive to farmers.

3. AGRICULTURAL DEVELOPMENT

3.1 Agricultural Development Strategy in Riau Province

In REPELITA V for Riau, the agricultural development strategy states that the most important target of agricultural development is rice production increase to meet the supply deficit of more than 130,000 ton per year.

Since the year of 1984, "Operashi Khusus Riau Mukmur" (OPSUS) which is the Riau version of INSUS decreased the shortage of rice by 7000 ton per year. It is, however, far from solving the rice shortage in the Province by 1993 with this slow pace of rice production increase. A new version of OPSUS, therefor, has been planned for quicker production increase, namely integrated intensification by involving farm management improvement, plantation crops, livestock and fishery in addition to rice production. This is the principle policy of Riau agriculture development.

The targets of OPSUS are summarized as follows:

- a. achieving self-sufficiency of rice within the Province by 1993,
- b. improvement of agricultural supporting system, i.e. farmers' credit, post-harvest facilities, farm products' market, supply system of farm inputs, and thus improvement of farming profitability and farmers' living standard, and
- c. improvement of agricultural technology level and thus efficient use of regional resources and potentiality through diversification, intensification, rehabilitation, and extensification.

The detail targets of OPSUS are as follows:

- i. productivity increase of paddy to 4.62 kg/ha,
- ii. production increase by 180 % for soybean and 40 % for maize,
- iii. diversification of crops,
- iv. income increase to \$ 1,500/farm by plantation crops such as Small Holder Rubber Development Project (SRDP),
- v. production increase of animal power and livestock and thus increase of income and nutrient supply,
- vi. extension of fishery production from 12.6 ton per year to 64.6 ton per year, and
- vii. enrichment of KUD and implementation of farmers' training.

The four principle development strategies for both national and Riau Province are explained below:

Diversification:

Horizontal and vertical diversification. Supply side crop diversification and increase of cropping intensity shall be conducted. Demand side diversification, namely meal variety, especially non-rice meals, shall be implemented and thus excessive dependence should be avoided.

Intensification:

Technical packages consisting of fertilizers and pesticides are introduced and intensification of rice production is promoted. For palawija crops and vegetables the intensification program is changed from INMUM to INSUS.

Extensification:

Cultivated area will be expanded mainly by new area development and rehabilitation of fallow land. Target crop is rice and the target areas are alluvial area and tidal swamp area by weir and canal construction. Transmigration program is included.

Rehabilitation:

Existing irrigation facilities and cropped areas shall be rehabilitated. This rehabilitation shall be conducted carefully considering soil conservation.

In advanced areas of Indonesia SUPRA INSUS commenced in 1987. On the other hand SUPRA INSUS has not been started in Riau Province, because existing irrigation facilities are small scale and not fully operated, as well as the fact that farming is only at semi-technical level and thus there is not enough background to introduce SUPRA INSUS.

SUPRA INSUS is a more intensive program for rice production than INMUM and INSUS which are also extended nationwide. Regional self-sufficiency of rice, therefore, can be effectively improved, if large scale irrigation projects are materialized in alluvial low land. Furthermore farm income would be increased and living standard upgraded.

3.2 Constraints on Agricultural Development and Countermeasures in the Objective Area

The constraints of agricultural development in the Objective Area are explained in detail in the section of 2.6 and they can be summarized as follows:

- Uncertain factors such as unreliable rainfall, incomplete existing irrigation and drainage facilities prevent farming from being intensified, and
- Poor access to farm product market, to farm inputs (geographically to farm input trader and institutionally to agricultural supporting system) and to farm field from farmers' residence discourage farmers from good farm management.

The most effective countermeasures for these constraints are construction of agricultural production infrastructure, mainly irrigation and drainage, and of social infrastructure. In addition enrichment of the agricultural supporting system, which is one of the most important factors of OPSUS, is essential.

3.3 Crop Selection and Cropping Intensity

Crop selection on condition that irrigation and social infrastructure will be constructed should be conducted taking into account of the following factors:

- both national and regional development strategy.
- regional specific factors for farming, such as agricultural climate, soil, geography, water availability, pest, farming technical level and manpower,
- profitability,
- marketability and
- farmers' will

It can be, therefore, concluded that appropriate crops selected are rice as a main crop and soybean, peanut and maize as palawija crops following SUPRA INSUS which is the national super intensification program in irrigated area.

From point of view of profit, vegetables of solanaceae and cucurbitaceae families are promising but it may not be possible to produce these on a large scale due to available labor force and market limitation.

The final recommendation of crops and cropping pattern will be determined through the detailed study of projected yield, profitability, labor requirement, water availability, soil, etc, and the comparison of alternative plans. At the masterplan stage, however, it is reasonable to use the draft plan of cropping intensity of 200 % for rice as a standard plan in order to select priority area.

3.4 Agricultural Supporting System

Present farmers are divided into two types, namely native farmers who are practicing shifting cultivation and transmigrants mainly from Java Island. The farming areas are clearly divided into transmigrant areas and others. The farming technology level of both are not high enough to conduct farming under fully irrigated condition. Therefore, in addition to ten technical packages of SUPRA INSUS (explained in 4.2 Proposed Farming Practices) the following agricultural supporting services must be facilitated in order to upgrade farmer's technology and to fully utilize the facilities of agricultural production infrastructure under new irrigation projects:

- Improvement of BPPs' manpower, technology level and mobility,
- Implementation of more transmigration programs so as to fully utilize natural resources and solve labor shortage,
- Mechanization for land preparation and post-harvesting and production of animal power,
- Enrichment of KUD,
- Farm credit by BRI and so on,
- Appropriate supply of fertilizer, agrochemicals and seeds,
- Advice and supervision for farm product marketing,
- Stabilization of farm product market,
- Establishment of integrated pest management system,
- Farmers' training and vocational education for absorbing new farming technology, and
- Establishment of O/M system for irrigation and drainage.

4. FARMING DEVELOPMENT PLAN

The farming development plan should be formulated taking into account OPSUS's methodology and targets and local agricultural factors on the basis of SUPRA INSUS.

4.1 Cropping Pattern

As discussed in the part on Agricultural Development in the chapter 3, selected crops for the irrigation development in the Objective Area are mainly rice and soybean, peanut and maize as palawija crops.

The cropping pattern shown in Fig. 4.1 has been proposed as the most appropriate pattern on the basis of the study of the present cropping pattern and the recommendation by the Dinas Pertanian Riau and the cropping pattern of similar projects. Wet season cropping starts with sowing in October/November and is harvested in February/March. Dry season cropping is from March/April to July/August.

As the selected crop for the rainy season, rice at 100 % seems to be the most appropriate one. On the other hand there are three possibilities for dry season, namely rice at 100 %, rice and palawija at 50 % each or palawija at 100 %.

The possibility of rice is high in viewpoint of farmer's desire, profitability, production stability and etc. The demand of soybean is recently increasing and in respect of both nutrition and profitability, soybean is a very advantageous crop. In addition soybean production has been positively promoted in SUPRA INSUS. Peanut production has been increasing rapidly and the future potential is very high. Maize is easy to produce and the production is stable. It is difficult to determine the most appropriate crop at this stage of the master plan. After the detailed study of various production factors in the feasibility study stage the best crop will be selected.

In SUPRA INSUS a cropping intensity of more than 200 % is proposed as the technical package. In respect of cropping period, 300 % cropping intensity is theoretically possible by using an early maturing variety and modern mechanization. However, the present mechanization level is still initial and population pressure is low, thus the practical cropping intensity seems to be 200 %. In Java, however, mechanization is advanced and population pressure is high and thus a cropping intensity of more than 200 % has been practiced. It is, therefore, assumed that when the required conditions are satisfied, a cropping intensity of more than 200 % will be able to be practiced.

4.2 Proposed Farming Practices

Agricultural production infrastructure is not enough to maximize productivity. In addition to the construction of reasonable facilities, appropriate farming practices are essential in order to exploit the potential productivity full of crops and natural resources.

Proposed farming practices should be suitable to each area's specific condition, following the recommendation by SUPRA INSUS.

The summary of SUPRA INSUS is as follows:

a. Items determined within the unit of extension worker:

- suitable cropping pattern for each area,
- rotation of rice variety (For pest management, different rice varieties should be used by season and area. However, recommended rice varieties are determined by BPP Kabpaten office.), and
- For pest management, harvesting period is limited to one week and non-cultivation period should be more than one month.

b. Items to be determined by each BPP office:

- integrated pest management system,
- water control, and
- seed supply system.

c. Ten technical packages recommended:

- use of certified HYV seeds,
- appropriate fertilizer application rotation of variety and use of same variety within farmers group,
- cropping intensity of more than 200 %, high density planting (more than 200,000 hills per ha) and unification of cropping season,
- integrated pest management,
- appropriate land preparation (plowing twice with more than 15-20 cm depth, and puddling once),
- effective water control,
- appropriate field management, i.e. transplanting, weeding, water control, etc,
- use of growth hormone at appropriate time and with appropriate amount, and
- post-harvest improvement (possession of 20 sickles and a drying facility within a farmers' group).

The proposed farming practices by item and activity are explained in the following sections.

4.2.1 Paddy

(i) Variety

HYVs should be essentially adopted and appropriate resistant varieties should be chosen taking pest occurrence into consideration. Present recommended varieties are PB46, PB56, Kelera, Bahbutong etc. On the other hand, commonly planted rice varieties are PB42 and Sentani. These varieties are compared as follows:

Variety	Yield(t/ha)	Growth Period(Days)	Taste
PB46	4.0--5.0	125--130	poor
PB56	4.0--4.5	110--115	poor
Kelara	4.0--5.0	90--110	poor
Bahbutong	4.0--5.0	115--125	good
PB42	4.5--5.5	135--145	poor
Sentani	3.0	107--114	good

As a tendency of farmer's preference, varieties are divided into two extremes, namely high yield but poor taste, or low yield but good taste. It is, therefore, important to consider pest resistance, farmers' preference, productivity, etc, in order to determine the recommendation of rice varieties.

(ii) Seed

Recommended seed amount is 30 kg/ha. Selection by specific gravity of 1.13 should be practiced. Seed disinfection should be done and sowing to nursery should be done at appropriate time. It is recommended to use certified seed every time. However, if this is very costly, seed should be renewed at least once every four plantings.

Fertilizer at nursery stage is 5 kg of urea for one hectare of main field and the nursery period is 20 days. The size of nursery is approximately one thirtieth of planted area in the field.

(iii) Land Preparation

Plowing at least twice with 15 - 25 cm depth and puddling one time ten days before transplanting should be practiced. It is recommended to do these works by oxen.

(iv) Transplanting

Transplanting is done by hand. High density planting of more than 200,000 hills per ha can be materialized with the spacing of 30 cm x 15 cm. Number of plants per hill should be two to three with depth of two to three centimeter.

(v) Fertilizer

Fertilizer application should be planned on the basis of soil type. The standard plan is summarized as follows:

type	amount(kg/ha)	basal	1st top*	2nd top**
Urea	200	1/3	1/3	1/3
TSP	100	1/1		
KCl	50	1/3	1/3	1/3

* : 20 days after transplanting

** : Panicle formation stage

Manure use is recommended as much as possible.

(vi) Weeding

Weeding should be manually done at least three times. It is recommended to introduce rotary weeder.

(vii) Pest Control

As well as herbicide, agrochemical use should be minimized as little as possible with respect to financial and environmental impact. This can be made possible by the introduction of an integrated pest control system. Rat and wild boar should be controlled by regional coordinated work.

(viii) Harvesting and Post-Harvest

It is recommendable to use sickle for harvesting but not Ani-ani. There is no serious problem for post-

harvest of dry season rice, since the harvesting time is relatively dry. On the other hand the post-harvest of rainy season rice is troublesome and thus the threshing and drying should be completed within a short period. It is, therefore, desired to introduce at least the pedal thresher. As for drying, it is essential to construct communal paved drying yards.

4.2.2 Palawija Crops

It is important to cultivate palawija crops from various aspects, namely pedology, integrated pest management, profitability, marketability and so on.

Since there are a wide variety of palawija crops, by variety and characteristics, the farming practices will be identified for the first priority area after the feasibility study.

4.3 Anticipated Crop yield

According to the Provincial Statistics the yields of major crops are summarized below:

crop	Objective Area(t/ha)	RiauProvince(t/ha)
Wetland Paddy	3.57	2.99
Upland Paddy	2.47	1.83
Maize	2.82	1.82
Soybean	1.18	0.81
Peanut	1.79	0.95

It is important to remember that the productivity widely varies due to different production infrastructure and technical level by area. Therefore, the present yield in the priority area will be finalized after the feasibility study when the detailed agro-economic survey is conducted and analyzed.

At this stage, however, the present yields of the table above are assumed to be reasonable to use for priority area selection in the Objective Area.

The anticipated crop yields have been determined on the basis of the study of the present yields in the Objective Area, the yields

of similar projects, potentials of crop variety and so on under the condition that agricultural production infrastructure will be largely improved, the upgrading of farming technology and the enrichment of agricultural supporting system will be materialized. The anticipated crop yields are as follows:

crop	anticipated yield(t/ha)
Wet season paddy	5.0
Dry season paddy	5.5
Maize	3.5
Soybean	2.0
Peanut	2.0

The crop yields will reach the anticipated level five years after the completion of project construction accompanied by upgrading of farming technology. The crop production increase is assumed to be linear over five years.

5. CONCLUSION AND RECOMMENDATION

It is important to improve or construct irrigation and drainage facilities in order to increase agricultural production and farming profitability. Even so it is also clear that the production and profitability can not be increased without reasonable farming technology and agricultural supporting system. It is, therefore, essential to enrich the supporting system and to upgrade farming technology. On top of these improvements, it is desirable to facilitate the stable supply system of farming inputs and to stabilize the prices of farming products through regulating the agricultural market.

Furthermore, there have been a few cases of delayed project completion even after the construction of irrigation system due to the delay of paddy field reclamation by Ministry of Transmigration and UPPS of Ministry of Agriculture. Therefore, the interministry coordination should be properly done and the project effect should be appropriately realized as soon as possible.

Table 2.1 Rice Balance in Riau Province

	A. Population	B. Demand (ton) Consumption (kg/capita)	C. Production (ton) (C*95%)	D. Rice consumed as Food (ton)	E. Balance (ton)
1 Bginning of Pelita I 1969	1.490.181	178.822 120	128.919	122.473	-56349
2 End of Pelita I 1973	1.736.157	208.339 120	131.360	124.792	-83547
3 End of Pelita II 1978	1.997.097	281.592 141	169.465	160.992	-120600
4 End of Pelita III 1983	2.381.313	334.574 141	192.655	183.022	-151552
5 1st year of Pelita IV 1984	2.456.324	345.114 141	209.757	199.269	-145845
6 2nd year of Pelita IV 1985	2.533.698	355.985 141	227.724	216.338	-139647
7 3rd year of Pelita IV 1986	2.613.509	367.198 141	266.905	253.560	-113638
8 4th year of Pelita IV 1987	2.699.232	379.242 141	257.431	244.560	-134682
9 5th year of Pelita IV 1988	2.787.767	391.681 141	289.735	275.248	-116433

Source: PEMBANGUNAN PERTANIAN TANAMAN PANGAN PROPINSI DAERAH TINGKAT I RIAU
PELITA V

Table 2.2 Crop Production Statistics of Riau Province

	1984			1985			1986			1987			1988		
	Harvested Area (Ha)	Production (ton)	Yield (t/Ha)	Harvested Area (Ha)	Production (ton)	Yield (t/Ha)	Harvested Area (Ha)	Production (ton)	Yield (t/Ha)	Harvested Area (Ha)	Production (ton)	Yield (t/Ha)	Harvested Area (Ha)	Production (ton)	Yield (t/Ha)
Wet Paddy	89165	258148	2.8952	90171	264971	2.9385	98943	282319	2.8544	103339	296273	2.8678	99038	285677	2.8855
Dry Paddy	52683	70648	1.3410	50531	71956	1.4240	48998	73738	1.5080	42574	78518	1.7033	53415	97676	1.8285
Maize	6471	9791	1.5131	10687	17441	1.6320	12916	20782	1.6090	11093	20813	1.8684	13321	24293	1.8237
Cassava	6942	73683	11.5000	6177	69182	11.1999	5855	68594	11.7001	6814	84161	12.3512	8529	92893	10.8914
Peanut	1775	1933	1.0890	2388	2396	1.0034	4190	4240	1.0119	3976	4127	1.0380	4479	4233	0.9451
Sweet Potatoes	2148	15036	7.0000	2218	15635	7.5000	2106	16216	7.6999	2548	19759	7.7587	2037	17887	8.7811
Soybeans	2316	1709	0.7379	5036	3968	0.7879	11983	9850	0.8220	9115	7553	0.8286	6524	5282	0.8050
Green gram	1686	2095	1.2426	3721	5831	1.5133	3372	4441	1.3170	3025	3031	1.0079	2867	3539	1.2270
Chili	2106	4420	2.0988	5522	5790	1.0485	5870	5358	0.9128	6323	6373	1.0079	4078	5794	1.3987
Cucumber	1139	7292	6.4021	2447	11677	4.7720	2756	11663	4.2319	4068	15065	3.7033	3441	12151	3.5312
Egg Plant	1873	2822	2.7232	3376	8427	1.9037	3556	5641	1.6863	3885	5867	1.5102	2739	4712	1.7203
Vegetable beans	*	*	*	4605	5179	1.1246	5450	5749	1.0549	5560	6457	1.1613	3508	5653	1.6115
Spinach	745	2696	3.6188	1388	4799	3.4575	1608	4880	3.0348	1788	8127	3.4267	1722	5338	3.1347
Kangkung	410	2186	5.3317	2870	8678	3.0937	3320	10364	3.1036	4256	13245	3.1121	2938	9916	3.0682
Fruit															
Banana		69069			77970			82001		68295			58876		
Durian		3626			12576			11542		7782			8048		
Orange		49848			71389			66197		74785			12688		
Rambotan		3082			6524			7283		16085			4862		
Pineapple		44043			23413			38795		24502			29624		

*: Data not available

Source: RIAU IN FIGURES 1988/1989

Table 2.3 Crop Production of the Objective Area 1989

	Kab. Kampar			Kab. Bengkalis		
	Rokan IV Koto	Rambah Tambusai	Kepenuhan Darussalam	Bangka Kubu	Tanah Putih	Mandau Total
Harvested Area (Ha)	73	1,152	270	65	1,536	9,572
Production (ton)	415	4,218	1,001	243	5,983	36,948
Yield (t/Ha)	5.66	3.66	3.71	3.74	3.75	3.86
Harvested Area (Ha)	755	4,413	3,504	1,083	11,549	315
Production (ton)	1,291	12,919	8,577	2,961	29,473	643
Yield (t/Ha)	1.71	2.93	2.45	2.73	2.55	2.04
Harvested Area (Ha)	14	2,266	399	55	2,786	146
Production (ton)	27	7,285	957	116	8,511	149
Yield (t/Ha)	1.93	3.22	2.40	2.11	3.05	1.02
Harvested Area (Ha)	31	1,896	278	168	2,373	137
Production (ton)	39	2,526	282	205	3,052	138
Yield (t/Ha)	1.25	1.33	1.01	1.22	1.29	1.01
Harvested Area (Ha)	5	884	137	107	1,178	233
Production (ton)	91	13,253	1,856	1,317	17,254	1,554
Yield (t/Ha)	18.20	14.99	13.55	12.31	14.65	6.67
Harvested Area (Ha)	1	182	34	10	244	123
Production (ton)	7	1,475	178	52	1,795	522
Yield (t/Ha)	6.67	8.10	5.24	5.20	7.36	4.24
Harvested Area (Ha)	5	1,334	152	28	1,548	51
Production (ton)	5	2,685	159	28	2,906	52
Yield (t/Ha)	1.07	2.01	1.05	1.00	1.88	1.02
Harvested Area (Ha)	5	556	156	20	758	43
Production (ton)	5	698	162	20	907	31
Yield (t/Ha)	1.00	1.26	1.04	1.00	1.20	0.72

Source : LAPORAN TAHUNAN, DINAS PERTANIAN TANAMAN PANGAN
KABUPATEN DAERAH TINGKAT II BENGKALIS 1989
and
LAPORAN TAHUNAN, DINAS PERTANIAN TANAMAN PANGAN
KABUPATEN DAERAH TINGKAT II KAMPAR 1989

Table 2.4 Plantation Crop Production in Riau Province

(Unit: ton)

	1984	1985	1986	1987	1988	1989
Rubber	84,824	80,251	86,480	90,035	96,884	104,297
Coconut	126,394	144,308	154,702	158,478	194,320	194,321
Oil Palm	13,441	39,666	95,916	109,266	130,405	263,938
Coffee	3,005	1,934	1,439	1,365	1,543	1,675
Clove	1,776	484	890	743	1,779	755
Cacao	1	1	4	111	111	111

Source : RIAU IN FIGURES 1988/1989

Table 2.5 Small Holders Production of Plantation Crops

	Kab. Kampar			Kab. Bengkalis		
	Planted Area (Ha)	Production (ton)	Yield (t/Ha)	Planted Area (Ha)	Production (ton)	Yield (t/Ha)
Rubber	97074	19521	0.20	63594	31291	0.49
Oil Palm	74168	72786	0.98	73713	41437	0.56
Coffee	1496	490	0.33	3124	687	0.22
Clove	795	54	0.07	1571	358	0.23
Cacao	76	*	*	1107	98	0.09

* : No data available

Source : RIAU IN FIGURES 1988/1989

Table 2.6 Population of Livestock and Fowls in Riau Province and Kab. Kampar and Bengkalis

	Cow	Water Buffalo	Goat	Pig	Layer/Broiller	Domestic Chicken	Duck
Kampar	26.861	20.756	24.698	-	15.516.372	4.758.342	1.495.368
Bengkalis	3.976	3.549	54.885	16.760	3.613.184	3.245.298	2.357.813
Province Total							
1988	80.337	38.668	152.193	53.523	62.380.391	16.213.692	17.683.193
1987	68.527	36.909	143.665	50.360	52.869.746	14.372.646	16.697.563
1986	59.210	35.505	140.533	35.919	50.601.974	14.158.720	16.377.681
1985	47.910	36.735	128.732	33.471	48.780.867	12.413.226	15.986.981
1984	38.307	35.290	128.989	34.130	61.250.818	10.538.834	14.379.041
1983	31.748	34.456	117.538	29.584	-	-	-

Source : RIAU IN FIGURES 1988/1989

Table 2.7 Livestock Population in the Objective Area 1989/1990

	Cow	Water Buffalo	Goat	Pig	Layer/Broiller	Domestic Chicken	Duck
Kampar	26.861	20.756	24.698	-	15.516.372	4.758.342	1.495.368
Bengkalis	3.976	3.549	54.885	16.760	3.613.184	3.245.298	2.357.813
Objective Area							
Kab. Kampar	19.949	1.616	15.739	-	-	162.976	11.292
Rambah	13.785	691	3.740	-	-	110.921	5.875
Tambusai	4.221	245	1.308	-	-	23.600	988
Kepenuhan	1.297	91	1.354	-	-	8.508	1.018
Rokan VI	587	75	1.189	-	-	9.616	2.996
Kunto Darusalam	59	514	8.148	-	-	10.331	415
Kab. Bengkalis	1.053	712	8.579	7.619	11.967	150.487	20.264
Mandau	106	237	2.816	130	5.278	14.561	4.086
Bangko	619	34	2.035	1.832	6.096	76.461	8.030
Kubu	240	292	3.177	5.657	593	29.123	5.797
Tanah Putih	88	149	551	-	-	30.342	2.351

Source: Dinas Peternakan, Riau Province

Table 2.8 IFAD Programme for Livestock
Development, December 1990

Location	Start	End
Pasir Pangarayan A	821	117
Pasir Pangarayan B	264	343
Pasir Pangarayan B'	321	39
Pasir Pangarayan C	791	458
Pasir Pangarayan D1	704	581
Pasir Pangarayan D2	396	343
Pasir Pangarayan E1	550	409
Pasir Pangarayan E2	550	454
Pasir Pangarayan F	500	383
BKPG 1 Kota Tengah	468	468
KKPG 2 Kota Tengah	591	207
Rokan II	550	614
Bagan Sinembah I	550	513
Tebing Tinggi I	550	216
Tebing Tinggi II	429	224
Lubuk Dalam I	550	509
Total	8585	5878

Source: Dinas Peternakan, Riau Province

Table 2.9 Rokan River Tidal Swamp Development

	Kec. Bangko	Kec. Kubu	Total
Cleared Area	28,910 (Ha)	10,888 (Ha)	39,798 (Ha)
Farm Household original	3,119	184	3,303
Farm Household at 1988	2,472	92	2,564
Planted Area			
Wetland Paddy	3,356	118	3,474
Palawija	507	95	602
Tanaman Keras (Hard Fruit Crops)	171	6	177
Total planted area	4,034	219	4,253
Total land used	3,527	123	3,650
Cropping Intensity	1.14 (%)	1.78 (%)	1.17 (%)
Crop Yield (t/ha)	(ton/Ha)	(ton/Ha)	(ton/Ha)
Rice	2.36	1.50	2.33
Maize	1.74	1.12	
Cassava	2.40	2.00	
Soybean	0.50	0.70	
Peanut	0.90	0.60	
Coconut	1.17	0.50	
Coffee	0.35	-	

Cropping Pattern Paddy-palawija Paddy-Palawija

Source : P3S RIAU PROVINCE, MINISTRY OF PUBLIC WORKS

Table 2.10 Major Rice Varieties in Objective Area and Riau Province 1990

(Unit: Ha)

VARIETY	STUDY AREA				OTHER PROVINCE TOTAL	RATIO (%)
	TANDUN	ROKAN IV KOTO	TAMBAH RAMBAH	TAMBUSAI KEPENUHAN KUNTO DARUSSALAM		
HYV						
PB42	-	656	964	32	11608	28.9
IR46	-	215	674	56	821	4
IR48	-	40	41	-	133	0.5
BARITO	-	-	-	-	1150	2.5
SENTIANI	325	246	1206	714	3077	12.2
IONDANO	225	-	412	514	1586	5.9
DONKAN	250	204	200	-	52	4.8
OTHERS	0	0	189	0	1493	0.5
					12	
SUBTOTAL	800	1361	3686	1316	18484	59.3
LOCAL VARIETY						
KALPATAL	2617	1100	1943	800	786	16.2
OTHERS	557	489	1338	416	7358	24.5
SUBTOTAL	3174	1589	3281	1216	8144	40.7
GRAND TOTAL	3974	2950	6967	2532	26628	100

Source: Dinas Pertanian Tanaman Pangan, Riau

Table 2.11 Major Maize Varieties in the Objective Area and Riau Province

(Unit: Ha)

VARIETY	STUDY AREA				OTHER PROVINCE KEC. TOTAL	RATIO (%)
	TANDUN	ROKAN IV KOTO	RAMBAH	TAMBUSAI KEPENUHAN KUNTO DARUSSALAM		
LOKON	-	-	80	143	18	261
KERINCI	-	-	-	83	8	107
WILLIS	83	87	680	289	298	1732
SHAKTI	-	44	127	167	53	399
ORBA	-	20	43	215	40	324
HIBRIDA CI	-	-	100	16	50	166
METRO	-	-	40	37	25	102
HARAPAN	-	-	250	40	69	359
ARJUNA	17	13	242	229	375	933
KALINGGA	10	25	327	219	252	850
OTHERS	29	26	25	181	13	16
TOTAL	139	215	1914	1619	1188	5233

Source : Dinas Pertanian Tanaman Pangan, Riau

Table 2.12 Existing Agricultural Tools and Machines
1989

ITEM	Kab. Kampar	Kab. Bengkalis
On Farm		
Chopping Knife	3220	-
Cangkul (hieldike tool)	40318	-
Big hoe	11846	-
Hand Tractor	1	2
Mini tractor	2	2
Water Pump	3	12
Hand Sprayer	2565	935
Swing Fog	1	1
Mist Blower	100	100
Small Hoe	213	-
Porcupine	1073	44
Plow	230	79
Post-harvest		
Rice Mill	200	87
Pedal Thresher	15	31
Power Thresher	1	1
Cleaner	40	7
Dryer	1	11
Sickle	5929	3414
Corn Sheller	0	54

Source : PEMBANGUNAN PERTANIAN TANAMAN PANGAN
PROPINSI DAERAH TINGKAT I RIAU, REPELITA V

Table 2.13 Farm Mechanization Plan of REPELITA V
1989-1993, Riau Province

	1989	1990	1991	1992	1993
Oxen plow	563	640	820	905	994
Tractor	83	184	418	705	850
Hand sprayer	1726	1972	2282	2638	3018
Thresher (pedal & power)	385	401	416	431	446
Winower	14	30	41	42	70
Rice Mill Unit	38	40	40	41	42
Dryer	24	25	26	29	34
Water pump	21	58	98	130	166
Porcupine	1650	2660	2791	2925	3064
Sickle	1410	1350	1650	1920	2340

Source : PEMBANGUNAN PERTANIAN TANAMAN PANGAN
PROPINSI DAERAH TINGKAT I RIAU, REPELITA V

Table 2.14 Major Pests

Crop	Pest (Scientific Name)	Pest (Common Name)
Wetland Rice	<i>Nilaparvata lugens</i> Stal	Planthopper
	<i>Leptocarisa oratouris</i> F	Grasshopper
	<i>Ratus argentiventer</i> Rob	Rat
	<i>Pyricularisa oryzae</i> Cav	Rice Blast
	<i>Susscrofa linnaeus</i>	Wild Boar
Tidal Swamp Rice	<i>Ratus argentiventer</i> Rob	Rat
	<i>Nilaparvata lugens</i> Stal	Brown Planthopper
	<i>Scatinophora vermiculata</i> voll	Land Bug
	<i>Nyiphula depunctalis</i> Guen	Rice Case Worm
	<i>Thyporyza incertulas</i>	Yellow Rice Borer
	<i>Susscrofa linnaeus</i>	Wild Boar
Upland Rice	<i>Susscrofa linnaeus</i>	Wild Boar
	<i>Ratus argentiventer</i> Rob	Rat
	<i>Spodoptera mauritia</i> Boisd	Rice Army Worm
Maize	<i>Sclerospora maydis</i> Rob Buil	Albino disease
	<i>Susscrofa linnaeus</i>	Wild Boar
Soybean	<i>Atherigona exigua</i> Stein	Seed Fly
	<i>spodoptera mauritia</i> Boisd	Rice Army Worm
	<i>Crocidolomia binotalis</i>	Worm
Peanut	<i>Puccinia arachidis</i> Spag	Rust disease

Source : Pembangunan Pertanian Tanaman Pangan Propinsi
Daerah tingkat I Riau, REPELITA V

Table 2.15 Pest Damage Situation 1989 & 1989/1990

Crop	Planted Area (Ha)	Damaged Area (Ha)	Area Loss (%)	Quantity Prod' tn (t)	Damaged Value (Rp)	Ratio of Total Damage (%)
1989						
Rice	40,422	3,635	25.2	2,387	549,090	2.29
Maize	6,311	363	30.0	255	36,946	1.72
soybean	2,312	379	24.8	105	40,033	1.88
Peanut	1,478	632	24.6	248	178,732	10.49
Grean Gram	760	263	24.3	102	33,237	3.31
Cassava	3,135	367	37.8	2,209	198,815	1.35
Sweet Patato	493	3	16.2	4	557	0.01
1989/1990						
Rice	45,857	2,087	26.6	1,425	327,669	1.20
Maize	5,278	815	29.2	557	80,696	4.50
soybean	2,860	428	26.3	126	47,792	3.93
Peanut	1,556	574	21.1	194	139,428	7.78
Grean Gram	892	78	18.8	24	7,640	1.64
Cassava	2,669	426	30.1	2,038	183,422	4.79
Sweet Patato	751	9	32.7	26	3,242	0.37
Basic Values:						
Rice (unhusked)	2.57 (t/Ha)		230 (Rp/kg)			
Maize	2.34		145			
Soybean	1.12		380			
Peanut	1.60		720			
Green Gram	1.60		325			
Cassava	15.92		90			
Sweet Potato	9.17		125			

Source: PEMANTAPAN PERGENDALIAN OPGANISME PENGGANGGU TANAMAN (OPT)
 PANGAN PROPINSI DAERAH TINGKAT I RIAU 1990
 SUB DINAS PERLINDUNGAN TANAMAN

Fig. 2.1 Present Cropping Pattern

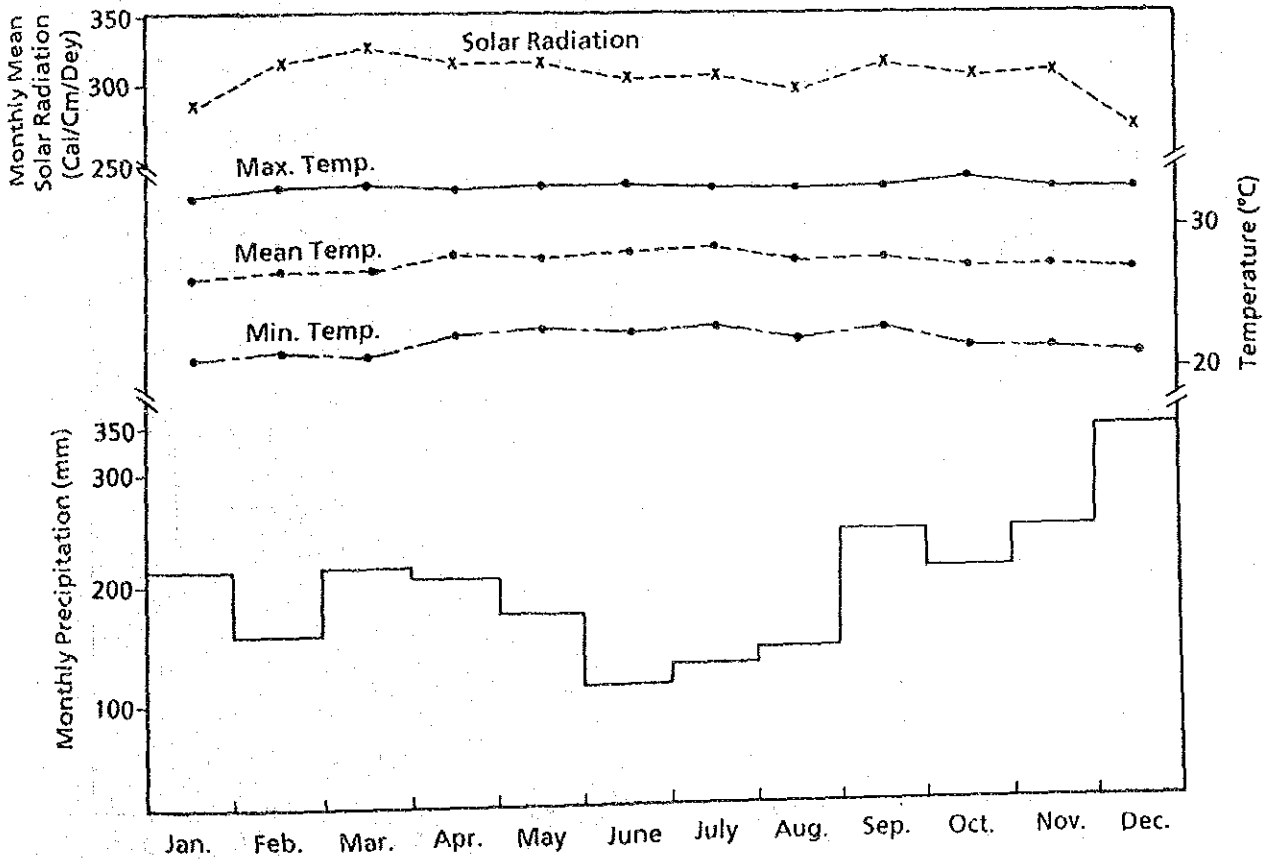
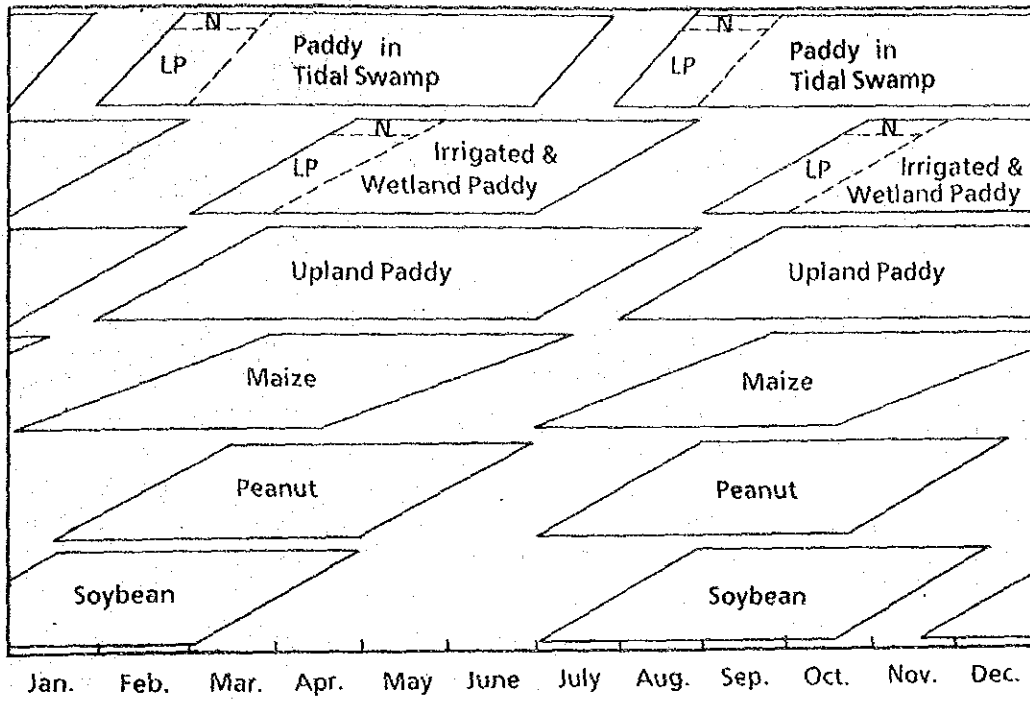
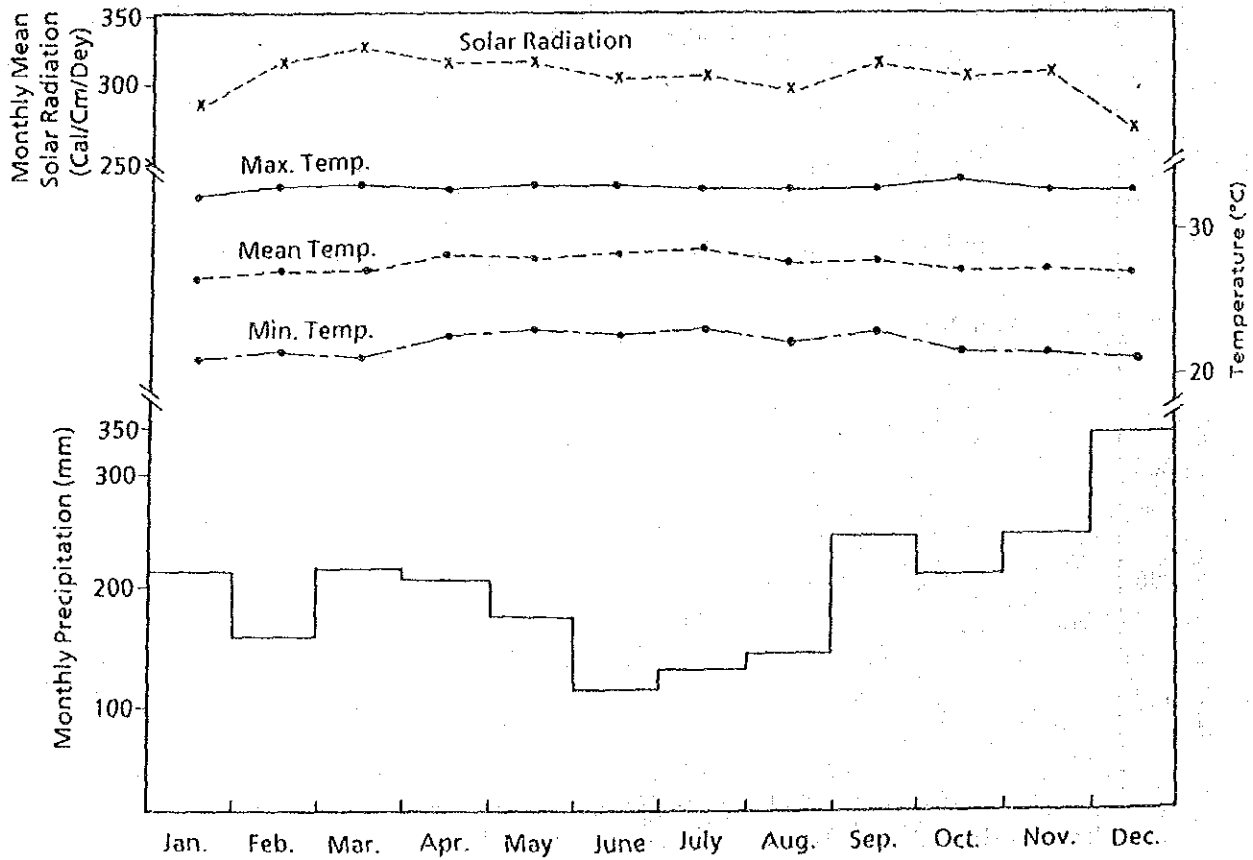
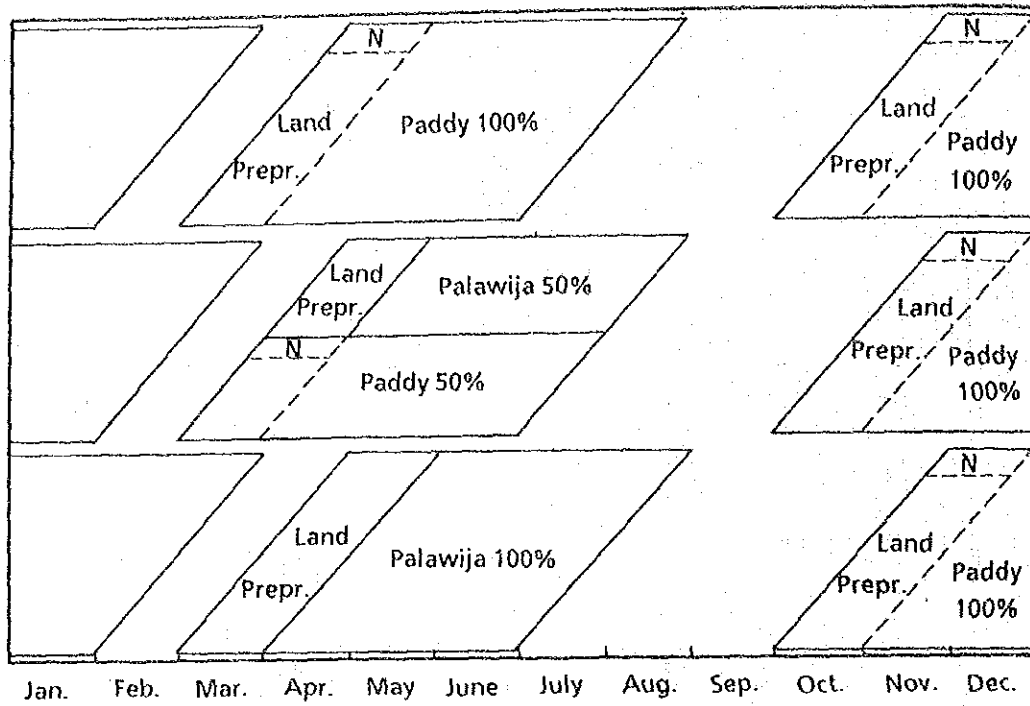


Fig. 4.1 Proposed Cropping Pattern



ANNEX E

AGROOECONOMY

ANNEX E AGROOECONOMY

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1. AGRICULTURE SECTOR

1.1 Role of Agriculture in National Economy

In spite of its gradual decline in the share of GDP, the agriculture sector is still the mainstay of the Indonesian economy. As presented in Table 1.1, agriculture sector accounts for 21.1% of GDP, more than 55% of the employment, and major part of non-oil export in 1988. Some two-thirds of rural households depend on agriculture for their livelihood. Of the some 57 million ha in the country suitable for agriculture, about 23.5 million ha is under cultivation, of which about 5.3 million ha is irrigated. With the exception of estate crops, nearly all agricultural production is undertaken by the country's 18 million smallholders.

Within the sector, the food crop subsector remains the largest, accounting for 61% of agriculture's contribution to GDP. Rice, the staple and dominant crop in Indonesia, accounts for 62% of the annually harvested area of all food crops; maize accounts for 17%, cassava for 8%, and soybean for 6%.

During REPELITA I and II (1969/70-1978/79), the main emphasis was on increasing rice production. More than half of the agriculture sector development expenditure was directed at the rehabilitation and expansion of irrigation facilities, with the aim of increasing rice production. Infrastructure development was supported by rice intensification programs aimed at increasing use of modern inputs and increasing productivity. During REPELITA III and IV (1979/80-1988/89), emphasis has been widened to include intensification programs for other crops, especially maize and soybeans. The overall focus of the current plan (REPELITA V, 1989/90-1993/94) is on improving sector efficiency, consolidating rice productivity gains, and promoting diversified cropping systems.

1.2 Role of Agriculture in Regional Economy

The agriculture sector in Riau province plays a key role in its economy, accounting for 26.2% of GRDP in 1988 excluding petroleum, and almost 60% of the employment in the province. GRDP share of agriculture and employment in agriculture are presented in Tables 2.2 and 2.3 of ANNEX A.

The importance of agriculture sector is also reflected in the provincial Fifth Five-year Development Plan (REPELITA V), in which priority for development has been placed on agriculture, industry and communication sectors. Development of these priority sectors is aimed at increasing income level of the people,

expanding employment opportunities, and achieving balanced economic structure of the province.

In agriculture sector, the first priority is placed on achievement of self-sufficiency in foodstuffs, especially rice, as the province is suffering from rice deficit for many years. Continued efforts to increase the production and to improve the quality of food crops are required. In addition, increase in the production of estate crops are also needed to increase exports as well as to meet the demand of domestic industries.

2. AGROECONOMIC SITUATIONS IN THE OBJECTIVE AREA

2.1 Agricultural Population

The 1983 Agricultural Census indicated that among the total households of 458,826 in the province, the agricultural households accounted for 283,922 or 62% of the total households in the province. Agricultural households accounted for 78.4% and 75.2% in Kabupaten Kampar and Bengkalis, respectively. Agricultural households had the share of 88.4% in the Objective Area (6 Kecamatan) of Kabupaten Kampar and 74.1% in the Objective Area (4 Kecamatan) of Bengkalis. Percentage of agricultural households in the Objective Area averaged 79.1% as presented in Table 2.1.

Based on the results of the 1983 Agricultural Census, the agricultural population of the Objective Area in 1990 has been estimated at 338,801 with an average family size of 4.83 persons per household (see Table 2.2). The highest percentage of farm household is registered in Kec. Kunto Darussalam (94.9%), followed by Kec. Rokan IV Koto (92%), and Kec. Tambusai.

The distribution of agricultural households by agricultural sub-sector is characterized by the fact that the majority of farm households are food crops households and most of them are also engaged in tree crops cultivation.

2.2 Land Tenure and Holding

The 1983 Agricultural Census reported that 709,200ha of land are utilized for agricultural purpose in Riau province, of which 683,800ha or 96.4% are owned by individual owners. Out of 683,800ha, 19,100ha of land are rented to others for agricultural activities, and the remaining 664,700ha are controlled by land owners. The balance between 709,200ha and 664,700, i.e. 44,500ha are classified as the tenant land. The average land holding size of the province was 2.55ha per farm household in 1973 and 2.65ha per farm household in 1983.

In the Objective Area, 92,395.3 ha of land were owned by 42,787 farm households, averaging 2.16 ha per farm household (1983 Agricultural Census). Of the 92,395.3 ha of land, 1,194.1 ha of land were rented to others, and the remaining 91,201.2 ha were controlled by land owners. The land under tenancy accounted for 1,779.7 ha or 1.9 % of the total land controlled by both owner and tenant farm households. Land ownership and holding size in the Objective Area (1983) are presented in Table 2.3.

2.3 Food Balance

Based on the data on food crops production and estimated population in 1989, food balances for both Riau province and

the Objective Area have been prepared as shown in Table 2.4A and 2.4B. It is noteworthy that Riau province is not self-sufficient in most of major food crops including rice, maize, soybeans, and groundnut. Particular attention should be placed on the deficit of rice totaling to as much as 200,000 tons in 1989. Taking into account the projected population growth rate of 3 to 4% per annum in the future, the province needs to make further efforts to increase rice production.

In the Objective Area, the situation is better than the provincial average. It has surplus production in some palawija crops such as groundnuts, soybeans, maize and cassava. However, rice production is still not at the level of self-sufficiency in spite of the fact that more than 70% of the total households are engaged in agricultural activities. Although some palawija crops are now at the level of self-sufficiency, it is anticipated that some crops may not be able to meet the growing demand in the future due to its higher rate of population growth. In such a situation, continued efforts would be required to increase the production of food crops in this area.

2.4 Marketing and Processing

2.4.1 Marketing

National Logistics Agency (BULOG) has been playing an important role in the market of major foodstuffs such as rice, wheat, and sugar. Its main task is to watch the market situation and take some measures to stabilize the market when the market prices are considered to exceed the allowable level. Such market intervention is carried out for the benefits of both producers and consumers in accordance with price policy of the Government.

BULOG has its regional Logistics Depot (DOLOG) at provincial level. There is a DOLOG office at Pekanbaru and six Sub-DOLOGs at Tanjung Pinang, Bengkalis, Dumai, Pulau Batam, Tembilahan and Rengat. As Riau is rice deficit province, the DOLOG's main operation is to purchase 70 to 80 thousand tons of rice every year from other provinces and distribute them in the Riau Province. Quantity of rice handled by the DOLOG in Riau is presented in Table 2.5.

In order to stabilize the prices of rice and palawija, basic prices of unhusked rice, milled rice and palawija were fixed by the government in October 1990 as follows;

- (1) purchase price of unhusked rice by KUD from farmers at Rp 295 per kg;
- (2) purchase prices of unhusked rice by DOLOG from KUD at Rp 310 and from Non-KUD at Rp 305 per kg;
- (3) purchase prices of milled rice by DOLOG from KUD at Rp 480 and from Non-KUD at Rp 474 per kg;
- (4) purchase of soybeans by KUD from farmers at Rp 500 per kg;

(5) purchase of soybeans by DOLOG from KUD at Rp 520 per kg.

There are 18 units of storages in Riau Province with total capacity of 43,500 tons; 3 units at Pekanbaru with capacity of 10,500 tons; 5 units at Dumai with capacity of 14,500 tons; 3 units at Tg. Pinang with capacity of 9,000 tons; 1 unit at Batam with capacity of 3,500 tons; one each at Bengkalis, Tembilahan, Rengat, Tarempa, Sedanan and Ranai with each capacity of 1,000 tons. (See Table 2.6).

Crude palm oil produced in Kabupaten Kampar, Kabupaten Indragiri Hulu and Kabupaten Bengkalis are transported to Dumai port and shipped by P.T. Sawit Indo Utama to other provinces and also to foreign countries. In 1989, about 154,680 tons of crude palm oil were shipped to Jakarta, Medan and Surabaya, and about 28,500 tons were exported to Mombasa, Rotterdam and Genoa.

Most of rubbers in Riau are produced at small holders plantations and some others at state-owned as well as private-owned plantations. About 25,000 tons of rubbers were shipped to other provinces in 1989.

2.4.2 Processing

(1) Rice

Rice milling facilities in Riau increased from 540 units in 1988 to 569 units in 1989. The 569 units consist of 378 Rice Milling Units (RMUs), 63 small type milling units, and 128 Engelberg milling units (Penggilingan Padi Engelberg). The 569 units have the total capacity of milling 245,797 tons per year.

In the Objective Area, there are 75 RMUs (Rice Milling Units) with a combined capacity of 39,145 tons and 79 PPEs (Engelberg Milling Units) with a combined capacity of 6,636 tons. As shown in Table 2.7, there are no PPEs in the 4 Kecamatan of Bengkalis, while 79 units of PPEs are utilized in the 6 Kecamatan of Kampar. It is recommended by the provincial and Kabupaten Agriculture Services that old type of PPEs should be replaced with the new type of RMUs to improve the processing quality of rice.

(2) Oil Palm

There are 13 oil palm processing facilities in Riau, of which 7 are located in Kampar and 4 are located in Bengkalis. Three (3) mills in Kampar have the processing capacity of 30 tons/hour of fresh fruit bunches per each mill, and other mills with the capacity of 60 tons/hour per each mill (see Table 2.8). Processed crude oil is shipped from Dumai either for domestic markets or for foreign markets.

(3) Coconut

There are 71 coconut processing facilities in Riau, of which 14

are reportedly inactive. Out of 57 units which are active, 33 units (58%) are located in Indragiri Hilir. In the Objective Area, there are 3 units in Kampar and 16 units in Bengkalis with a total combined capacity of 3,546 tons per year.

Existing processing facilities for estate crops in Pekanbaru, Kampar and Bengkalis are listed in Table 2.8.

3. AGRICULTURAL SUPPORTING SERVICES

3.1 Institutions in the Sector

The government's development strategy places strong emphasis on rural and regional development and includes support for key areas of the agricultural sector. Support services to the agriculture sector are provided through a number of government agencies, the most important among them being the Ministry of Agriculture, the Directorate General of Water Resources Development (DGWRD), P.T. Pusri (the public sector fertilizer distribution agency), and BULOG (the national logistics agency). In addition, village cooperatives (KUDs) have been assigned a major role in the distribution of agricultural inputs and socioeconomic uplift of the farmers. Within the Ministry of Agriculture, the Directorate General of Food Crops Agriculture oversees the provision of support services which are provided by the specialized agencies such as Agency for Agricultural Research and Development (AARD), the Agency for Agricultural Education, Training and Extension (AAETE), and the Agency for the Intensification Programs (BIMAS). These agencies and institutions are providing support services through their provincial as well as Kabupaten offices.

3.2 Agricultural Intensification Program

In order to achieve the self-sufficiency in food crops production, especially in rice production, a certain method of agricultural extension, known as BIMAS (Mass Guidance) was introduced in 1968. BIMAS program including its subsequent INSUS (Special Intensification) and SUPRA-INSUS (Super-special Intensification) program has resulted in achieving the level of self-sufficiency in rice production in 1985. Since 1986, the agricultural intensification program started to extend its activities to secondary food crops although rice production has been still the top priority in agricultural production policy. Recent intensification program is trying to expand its activities to integrated development approach including plantations, livestock and fisheries.

In Riau province, the agricultural intensification program, called Prosperous Riau Operation, is extensively promoted since the commencement of PELITA V. Characteristics of this operation is in its integrated development approach which involves combinations of such components as food crops cultivation, poultry farming, fish culture and plantations. This program aims not only to increase the production of food crops such as rice, soybeans and maize, but also to increase production of local chickens, freshwater fishes and cattles for farming.

3.3 Research

The national agricultural research system is coordinated and

administered by AARD. AARD has its research centers in the fields of agricultural statistics, soils, agroecology, estate crops, horticulture, livestock, and fisheries. The research program for food crops is carried out at six institutes supported by 15 research stations and 45 experimental farms. CRIFC (Central Research Institute for Foodcrops) in Bogor is extending research services through its 7 branch stations in the nation.

There is no agricultural research station in Riau Province. Agricultural research in this Province is covered by the West Sumatra Branch Station in Sukaramai. Main activities of this station are to execute experimental work under the instruction and supervision of the Central Station at Bogor and to collect information from extension services on the technical problems associated with the farming practices of local farmers.

3.4 Extension

Extension services are organized by the various departments of the Ministry of Agriculture, coordinated by AAETE. There are 28 agricultural information centers where extension materials are prepared and sent to the 1,650 agricultural extension centers (BPPs) in the country, which are the basic extension units.

There are several institutions involved in agricultural extension services in Riau Province which include, among others, Dinas Pertanian Tanaman Pangan (Provincial Food Crops Services), Dinas Perkebunan (Provincial Plantation Services), Dinas Kehutanan (Provincial Forestry Services), Dinas Peternakan (Provincial Livestock Services), Dinas Perikanan (Provincial Fishery Services), Provincial BIMAS Secretariat, Agricultural Information Center and Agricultural Training Center. At Kabupaten level, there are also several agencies and institutions involved in agricultural extension services such as extension services sections of various Cabang Dinas Offices in agriculture sector, Kabupaten office of Bimas Secretariat, some UPPs (Unit Penyuluhan Pertanian or Agricultural Extension Unit), seed farms, etc.

At Kecamatan level, each BPP (Balai Penyuluhan Pertanian or Agricultural Extension Center) acts as a base camp for the extension services. BPP is responsible for agricultural extension services at field level and each BPP covers one to three Kecamatan.

Riau Province consists of 68 WKBPPs (BPP Extension Working Areas), which are divided into 804 WKPPs (Working Area of Extension Workers). WKPPs are further sub-divided into 6,476 WILKELs (Area of Farmers' Group). Against 68 WKBPPs, 57 heads of BPP have been appointed, of which only 38 BPP buildings have been prepared for their activities. The number of staff and personnel of BPPs in the province is summarized in Table 3.1.

In the Objective Area, there are 10 BPPs in 8 Kecamatan to provide agricultural extension services in foodcrops, livestock,

estate crops and fisheries. Outline of BPPs in the Objective Area is presented in Table 3.2.

3.5 Agricultural Credit

The credit schemes in Indonesia have been only partly successful in reaching the vast majority of food crop farmers. The share of agricultural credit provided by banks to total credit is about 9 %, well below the shares of the industry and trade sectors that are in the range of 35 %. This low ratio of formal credit reflects the high level of self-reliance and credit from informal sources in the agriculture sector.

In Riau province, institutional credit services for farming are mainly provided by BRI (Bank Rakyat Indonesia), the state owned commercial bank with special task of serving agricultural credit needs of agricultural cooperatives. Although ordinary credit services are available to anybody who can pay the interest rate of around 25 % and who can provide sufficient collaterals, most of farmers are unable to pay such a high interest rate for their farming. A concessional credit facility, called KUT (Kredit Usaha Tani or Farming Credit) has been introduced in Riau in 1990 to promote the intensification of rice and palawija crops production in relation to the agricultural intensification program of the Prosperous Riau Operation.

Under this credit system, a short-term farming loan covering required working capital and provision of farming inputs are provided by BRI through KUDs to farmers. BRI provides short-term loans for a term of up to 12 months to KUDs, and KUDs provide loans for a term of up to 7 months to farmers. The interest rate of BRI of 16 % is levied on the loan provided to KUDs. Against the amount of repayment made within the specified term, a commission of 7 % is paid to KUDs. BRI's services are usually provided through its BRI Unit Desa. Within the Objective, BRI has 4 Unit Desa at Duri, Bagan Batu, Pasir Panggarayan and Ujung Batu. Location of BRI Unit Desa in Riau province is presented in Table 3.3.

3.6 Farm Input Supply

Supply of fertilizers and agrochemicals in Riau province is mainly handled by the government enterprises of P.T. Pupuk Sriwidjaja (Pusri) and P.T. Pertani. Fertilizers coming from other provinces (Line I) are stored in the godown of P.T. Pertani at Pekanbaru (Line II) and then distributed to retailers at Kabupaten level (Line III). Fertilizers are distributed to KUDs (Line IV) from Kabupaten level at subsidized prices. P.T. Pusri only handles fertilizers at government subsidized prices. Non-subsidized fertilizers are handled by some other traders.

P.T. Pertani is a main supplier of agrochemicals and also a supplier of fertilizers at Line III level. Some private traders

also handle fertilizers and agrochemicals although their trading share is not so big as P.T. Pertani. The quantities of fertilizers, agrochemicals and seeds handled by P.T. Pertani, Riau in 1990 are shown in Table 3.4. The table indicates that 95 % of fertilizers are utilized for the production of estate crops and the remaining 5% are for the production of food crops, and 80 % of agrochemicals for estate crops and 20 % for food crops.

3.7 Farmer Organizations

3.7.1 Farmer Groups

There are several forms of farmers' groups in the agricultural sector for the purpose of agricultural extension services, agricultural cooperatives, pest control, water management, etc. Basic unit is called farmers' group (Kelompok Tani) consisting of between 100 and 150 farm households. A group leader (Kontak Tani) is selected among the members. The number of farmers' groups per WKBPP in the Objective Area is shown in Table 3.5.

3.7.2 Extension Services

BPPs are the basic extension units to extend extension services to the level of farmers. Working area of a BPP is divided into WKPPs (Working Area for Extension Workers) which are further subdivided into WILKELs (Area of Farmers' Group). Under Training and Visit System, a PPL (field extension worker) visits 16 WILKEL in every 2 weeks to transfer the new agricultural information and farming technology and also to solve the problems faced by the farmers. It is expected that information obtained from a PPL will be transferred by a group leader to the farmers who are not members of the Village Unit Cooperatives (KUDs). In some occasions, meetings are held between government staff and farmers on the implementation of the agricultural intensification program in the province.

3.7.3 Agricultural Cooperatives

The Village Unit Cooperative (KUD) was firstly established in accordance with the Presidential Decree No. 4 in 1973. Since then some revisions have been made for the strengthening of the KUD. Establishment of the KUD aimed at regional development and improvement of living standard of rural population through direct participation of farmers at each village unit.

Major operations undertaken by the KUD include; (1) purchase and sale of agricultural products; (2) promotion of livestock; (3) rice milling and logistics; (4) purchase and sale of agricultural inputs; (5) deposit and credit; (6) provision of small scale credit; and (7) transport services.

In order to support development needs in Riau of increasing foodcrops, especially rice and palawija, provision of working capital for farming activities has been felt urgent. Under the Farming Credit (KUT) system, working capital for farming activities is provided by BRI through KUD under certain conditions for the needs of farmers who are members of KUD. Supply of agricultural input like fertilizers, agrochemicals and seeds is also conducted through KUDs. The performance of KUDs in the Objective Area has generally been unsatisfactory due partly to lack of experience in management and partly to small amount of transaction caused by low production level.

4. INLAND FISHERY

4.1 Fishery Production in Riau

Fish and fishery products are one of the main food items of the people in Riau. The 1987 Family Expenditure Survey reported that percentage of average per capita monthly expenditure for cereals accounted for 27.5 %, fishes accounted for 17.2 % and vegetables for 10.6 % in rural areas of Riau (see Table 4.1). This results reflect the imporatance of fishes in the diet of rural areas in the province.

Fishery production in Riau totaled 172,198 tons in 1988, of which marine fishery accounted for 92.6 %. Inland fishery including aquaculture accounted only for 7.4%. In terms of the value, however, inland fishery accounted for 15.4 % due to higher unit prices. As presented in Table 4.2, fishery production in Riau increased from 156,099 tons in 1984 to 172,198 tons in 1988 at an annual average of 2.48 %. Marine fishery grew at an annual average of 2.35 %, while inland fishery's production grew at an annual growth of 4.25 %. It is noteworthy that freshwater and brackish water aquaculture production had the higher annual growth rates of 22.8% and 12.5 %, respectively (see Table 4.2). Brackish water aquaculture is conducted in several Kecamatan of Dumai, Rupert, Bengkalis, Bukit Batu, etc. However, no brackish water aquaculture is conducted in the Objective Area.

4.2 Inland Fishery

In Kabupaten Kampar, most of fishery production comes from inland fishery including inland open water (rivers and swamp areas), and fresh water aquaculture. Out of total production of 4,942 tons in 1989, 4,342 tons (87.9%) comes from inland open water, 363 tons (7.3%) from fresh water aquaculture, 222 tons (4.5%) from marine water and 13 tons (0.3%) from paddy field. Taking into account the population of Kabupaten Kampar in 1989 (534,642), per capita supply of fish is estimated as 9.24 kg per person per year which is below the national average of 11.5 kg.

The inland open water fishery is commonly carried out at rivers and swamp areas by local fishermen and farmers for either daily income earnings or their own consumption. The area for inland open water is estimated to be around 20,000 ha. Species composition of inland open water fishery in Kampar is summarized below.

Species Group	Production (1989)	Composition (%)
Catfishes	778	17.9
Snake Heads	638	14.7
Kissing Gouramy	347	8.0
Sepat Siam	217	5.0
Other fishes	2,357	54.3
Shrimp (fresh water)	5	0.1
Total	4,342	100.0

Source: Laporan Tahunan Dinas Perikanan, Kampar

As for inland fishery in 6 Kecamatan of the Objective Area within Kabupaten Kampar, the total production in 1989 was 1,289.5 tons, of which 1,162.6 tons (90%) comes from inland open water, 120.9 tons (9%) from freshwater aquaculture and 5 tons from paddy field. Traditional small scale fishing gears are utilized in the Objective Area. These fishing gears include gill net (jaring tetap), portable net (bubu), long line (rawai), hook and line (pancing), portable lift net (anco), scoop net (serok), etc. Table 4.3 tabulates the number of fishing gears utilized in the Objective Area.

In Kabupaten Bengkalis, the total production of fish was 87,634 tons in 1989, of which 84,460 tons (96.4%) was from marine fishery and 3,174 tons (3.6%) from inland water fishery. Out of 3,174 tons of inland water fishes, 3,127 tons (98.5%) are produced in Kecamatan Mandau and Kecamatan Tanah Putih. Species composition and kind of fishing gears are almost the same as in the case of Kabupaten Kampar.

4.3 Aquaculture

4.3.1 Fish Pond Culture

Fresh water aquaculture has been developing rapidly in recent years in Riau province. However, its production is still at very low level, accounting for only about 4% of total inland fishery production. Fresh water aquaculture production in Riau province increased by 10%, from 483 tons in 1988 to 536 tons in 1989. Production averaged 0.75 tons per ha.

Kabupaten Kampar had the share of 66.6% in total production of fresh water aquaculture of the province in 1989. Its production increased by 23.2%, from 289.6 tons in 1988 to 356.7 tons in 1989. Fresh pond area also increased from 179.8 ha in 1988 to 233.7 ha in 1989. Average production accounted for 1.53 tons per ha in 1989.

Fresh water aquaculture production in the Objective Area (6 Kecamatan) in Kampar totaled 120.9 tons in 1989, of which Kecamatan Rambah accounted for 87.1 tons or 72% of the total production in Kampar. Pond area totaled 78.33 ha including 54.47 ha (69.5%) in Kecamatan Rambah. The number of households who are engaged in fresh water aquaculture totaled 1,182 in 6 Kecamatan, of which households in Rambah and Rokan IV Koto accounted for 396 (33.5%) and 295 (25.0%), respectively. The number of households, production, and pond area for fresh water aquaculture are presented in Table 4.4.

The fish species that are cultured at present are common carp (ikan mas; Cyprinus Carpio), tilapia (ikan nila; Tilapia Nilotica), giant gouramy (ikan gurami; Osphronemus gouramy), puntius (ikan tawes; Puntius Javanicus), kissing gouramy (tambakan; Helostoma teminchi), nilem carp (nilem; Osteochilus hasselti), etc.

Kabupaten Bengkalis had the share of only 8.7% in total production of fresh water aquaculture of the province in 1989. Its production increased slightly from 45.6 tons in 1988 to 46.6 tons in 1989. Fresh pond area increased from 108.8 ha in 1988 to 112.5 ha in 1989. Average production accounted for 0.41 tons per ha in 1989.

Fresh water aquaculture in the Objective Area (4 Kecamatan) in Bengkalis accounted for 24.1 tons in 1989, of which Kecamatan Mandau and Tanah Putih accounted for 23.1 tons. Pond area totaled 58.2 ha including 55.7 ha Kecamatan Mandau/Tanah Putih. The number of households who are engaged in fresh water aquaculture totaled 481 in 3 Kecamatan, of which households in Mandau/Tanah Putih accounted for 431 (90%). No household is registered in Kecamatan Kubu in this category. The number of households, production, and pond area for fresh water aquaculture are presented in Table 4.4.

4.3.2 Paddy Field Culture

Paddy field culture has recently been developed in the context of diversification of food crops. Paddy fish farming (usaha mina padi) is the mixture of paddy cultivation with fish culture in the paddy field. Palawija system (sistim palawija) is conducted using paddy field for fish culture after harvesting of paddy. In Kabupaten Kampar, 6.5 ha of paddy field were utilized for paddy fish farming, producing 13 tons of fish in 1989. In the Objective Area, 2.5 ha of paddy field were utilized to produce 5 tons of fish in Kecamatan Rambah. Paddy field culture is only reported in Kecamatan Rambah and no data are available for other Kecamatan.

4.4 Fish Marketing and Processing

4.4.1 Fish Marketing and Processing

Inland fishery catch in the Study Area is either consumed by fishermen and fish farmers or marketed to several market places in the Study Area. Approximately 50% of the total catch are consumed fresh, and the remaining are preserved as dried, salted and smoked fishes. In the objective Area in Kabupaten Kampar, out of the total fish catch (1,405.8 tons), 50.5 % are consumed fresh, 38.5% are preserved as dried/salted fishes, and 11% are preserved as smoked fishes (see Table 4.5).

Fresh fishes are mostly marketed for local fish markets in the Objective Area. Since no ice is used for transportation as well as handling of fishes, the freshness of fishes are not well maintained.

4.4.2 Price of Fish

Table 4.6 shows the average prices of fishes from inland open water and fresh pond culture in Kabupaten Kampar and Bengkalis in 1989, in which prices of fishes in Kabupaten Kampar are considerably higher than those in Kabupaten Bengkalis. It is estimated that higher fish prices in Kampar is caused mainly by its location where few marine fishes are available. Due to lack of marine fishes in Kabupaten Kampar, considerable amount of marine fishes are transported from the neighbouring provinces of North and West Sumatra, which involve the higher cost for transportation.

4.5 Inland Fishery Development Plan

4.5.1 Development Needs

(1) Provincial Development Policy

The provincial government has accorded high priority to the development of fisheries within the agricultural sector under the provincial Repelita-V (The Fifth Five-year Development Plan). The major objectives of fisheries development are: (i) to increase fish production to meet domestic demand and for export markets; (ii) to improve the standard of living of fishermen and fish farmers by increasing their incomes; and (iii) to promote the activities of fisheries cooperatives and private sector. The production target under the Repelita-V is 192,368 tons by 1993, of which 176,365 tons (92%) will be from marine fisheries, 13,885 tons (7%) from inland capture fisheries and 2,118 tons (1%) from aquaculture.

The objectives under the Repelita-V are to be achieved through modernization of fishing techniques and intensification of aquaculture, a more balanced distribution of fisheries development and equitable distribution of resultant benefits, and

creation of a favorable climate for artisanal fisheries and for private sector participation in fisheries development.

(2) Additional Income for Farmers

Inland fishery in the Objective Area is extensively conducted as a means of obtaining source of protein for consumption of farmers and part-time income source for farm families. The fish production from small scale fish pond provides agriculture farmers with additional incomes.

(3) Development Needs in the Objective Area

The production of fish in the 4 Kecamatan of Kabupaten Bengkalis totaled 72,730 tons in 1989, averaging 213 kg per person, which well exceeded the per capita consumption of the area. The production of fish in the 6 Kecamatan of Kabupaten Kampar, however, totaled 1289.5 tons in 1989, averaging only 7.2 kg per person. It is estimated that the 6 Kecamatan in Kabupaten Kampar is lacking 1,900 to 3,900 tons of fishes every year. The shortage of the fish is reflected on the higher average prices of fishes as presented in Table 4.3

In the circumstances as mentioned above, it is felt urgent to promote the development of inland open water fishery as well as fish pond culture in this area.

4.5.2 Inland Fishery Development Plan

(1) Education and Organization of Fish Farmers

Education and training program undertaken by Dinas Perikanan is required to be strengthened through provision of increased number of extension services personnel and improved facilities for education and training of fish farmers. At the same time, promotion of suitable fish farmers' organizations is needed to streamline the sale and purchase of production input and output related to fisheries activities.

(2) Fish Cage Culture (Keramba) in Open Waters

It is reported that a farmers' group at Menaming village is using a fish cage in the Menaming river producing about 100 kg of fish in 1988. However, cage culture is still at its initial stage in the Objective Area. In order to increase the production of fish culture, Dinas Perikanan is recommending the utilization of the rectangular floating cage made of bamboo or wood with size of two by three meters and one meter in depth. Carp culture is recommended for cage culture. One unit of cage with a capacity of 6 m³ can rear about 600 carp fries. The net cage culture would increase the rearing density to 150kg/m² that is higher than in the case of fish pond. The location of the net cage culture should be carefully selected taking into consideration the water depth, water current condition, and fewer possibility of damage

by floating materials.

(3) Hatchery Improvement and Extension

It is reported that out of the total requirement of 7.15 million tons fish fries in Kabupaten Kampar, only 1.75 million tons or 24% are provided by the hatchery of Dinas Perikanan at Bangkinang and by some fish fries ponds in Kampar and some other areas. In order to meet the increasing requirement of fish fries, the facilities the existing hatchery at Bangkinang should be upgraded. The upgrading will involve the provision of vehicles for transporting fish fries as well as equipment such as generators, pumps and laboratory equipment. The existing pond area will be upgraded and an additional pond will be constructed.

(4) Fish Pond Culture (Kolam)

The establishment of new fish ponds must depend on the marketability of the fish as well as availability of fish fries and water source. In consideration of increasing supply of irrigation water and fish fries in the future, there is great possibility of establishing new fish ponds in the Objective Area. Surplus water extracting from any of irrigation projects could be utilized for fish pond culture in consultation with Dinas PU. As freshwater aquaculture will require substantial extension effort, increase in the number of extension workers as well as provision of improved extension facilities would be indispensable.

5. ECONOMIC COMPARISON OF THE PROJECTS

5.1 Methodology for Economic Analysis

Economic analysis is made to assess the viability of a project from the view point of national economy. Direct tangible benefits are quantified and compared with direct project costs. Benefits and costs identified are converted into present value and expressed in terms of Economic Internal Rate of Return (EIRR). Valuation of costs and benefits for the traded goods is generally made on the basis of international prices. In this study, however, financial project cost is regarded as being equivalent to the economic project cost. Benefit calculation is based on the incremental net value of production of paddy accruing from each project. Economic price of paddy is based on the estimated future farmgate prices of rice projected by the World Bank (see detail in Table 5.1).

5.2 Basic Assumptions

The economic analysis has been undertaken on the basis of the following assumptions:

- 1) Price level : The current prices as of June 1991 are used in the cost estimate as well as benefit calculation.
- 2) Exchange rate : The exchange rate is set at US\$1.00 = Rp.1,945 which is an official rate as of June 1991.
- 3) Costs : Project cost includes all direct construction costs. It does not include such indirect costs as administration, physical contingency, taxes and duties for imported goods, and interest during construction works.
- 4) Project life : Economic useful life of the project facilities is assumed as 25 years and therefore, no replacement cost of the facilities is considered.
- 5) Benefits : Only direct tangible benefits are quantified for the calculation of the EIRR.
- 6) Price of paddy : The economic price of paddy is estimated as Rp.310 per kg based on the estimated future farmgate prices of paddy projected by the World Bank.
- 7) Construction period : Construction period of each project is assumed to be 5 years for the project size of more than 1,000 ha. Construction period of 4 years is assumed for the project size of less than 1,000 ha.

5.3 Project Cost

5.3.1 Investment Cost

Investment cost comprises the costs for construction of project facilities, land acquisition, and land reclamation. It does not include such indirect costs as administration, physical and price contingency, taxes and duties for the imported goods, and engineering services.

5.3.2 Annual Operation and Maintenance Cost

The annual operation and maintenance costs of Rp.60,000 per ha is assumed on the basis of experience gained from projects of similar type and magnitude.

5.3.3 Replacement Cost

No replacement cost for the project facilities is considered in the calculation of EIRR as the project life is assumed as 25 years.

5.4 Project Benefit

The direct project benefit is derived from the net incremental income from the future "without project" condition to the future "with project" condition, i.e. net value of production. The net value of production of paddy per ha is presented in Table 5.2. Production costs for paddy are presented in Table 5.3(1) and 5.3(2). The benefit will come out immediately after the completion of the project and will increase at the rate of 20%, reaching its full development stage (100%) at 5th year after the completion of construction works. Benefit calculation of each project is presented in Table 5.4.

5.5 Economic Internal Rate of Return

The cost and benefit stream of each project is presented on the basis of annual cost and benefit as estimated in the preceding section. The cost and benefit stream and result of EIRR calculation of each project is presented in Table 5.5(1) to 5.5(18).

Table 1.1

Economic Indicators of Indonesia

Item	Unit	1985	1986	1987	1988
Population	Million	162.5	165.7	169.0	172.3
Gross Domestic Product					
GDP (Current) 1/	Billion Rp	96,850	102,546	124,539	139,452
GDP (Constant) 2/	Billion Rp	84,959	90,014	94,302	99,697
GDP Growth Rate	%	2.5	5.9	4.8	5.7
GDP Share by Sector					
Agriculture 3/	Share (%)	22.6	21.9	21.4	21.1
Mining & Mfg. 4/	Share (%)	34.0	34.4	34.6	34.4
Others	Share (%)	43.4	43.7	44.0	44.5
Exports (FOB)					
Petroleum & Products	Share (%)	66.7	50.9	48.9	38.4
Wood & Wood Products	Share (%)	6.6	11.6	13.2	14.5
Textiles & Garments	Share (%)	3.1	4.6	5.4	6.9
Rubber	Share (%)	3.3	5.5	5.7	6.2
Coffee	Share (%)	3.6	5.5	2.7	2.9
Tin	Share (%)	1.3	1.1	0.8	0.8
Imports (CIF)					
Petroleum & Products	Share (%)	12.4	7.0	10.3	8.3
Machines	Share (%)	26.3	26.8	30.0	29.1
Rice	Share (%)	0.1	0.1	0.1	-
Fertilizer	Share (%)	0.6	0.3	0.3	0.8
Trade Balance	Million US\$	5,822	2,458	4,674	5,726
Labor Force					
Employed	Thousand	63,826	70,193	72,245	74,500
Agriculture	Thousand	34,142	37,644	38,772	40,475
Mining & Mfg.	Thousand	6,211	5,606	5,818	6,260
Others	Thousand	22,104	25,088	25,812	25,804
Unemployed	Thousand	1,368	1,855	1,843	1,961
Unemployment Rate	%	2.1	2.6	2.6	2.6
Price Indexes 5/	(Jakarta)	233.2	252.8	276.5	288.9
Price Indexes 5/	(Indonesia)	252.2	275.3	300.8	317.6
Exchange Rate 6/	Rp/US\$	1,131	1,655	1,651	1,729

Source: (1) Statistik Indonesia 1989
(2) Population Census 1990

Note: 1/ GDP (Current) = GDP at current prices
2/ GDP (Constant) = GDP at constant 1983 prices
3/ Agriculture = Agriculture, forestry and fishery
4/ Mfg. = Manufacturing
5/ Price Indexes = end-year consumer price indexes
(April 1977-March 1978 = 100)
6/ Exchange Rate = average exchange rate in December of each year

Table 2.1 Percentage of Farm Households in the Objective Area, 1983

Kabupaten Kecamatan	Total Households	Farm Households	Percentage of Farm H.H. (%)
Kampar (Objective Area)			
Tambusai	5,061	4,451	87.9
Kepenuhan	1,662	1,422	85.6
Kunto Darussalam	2,370	2,250	94.9
Rambah	12,833	11,388	88.7
Rokan IV Koto	2,417	2,223	92.0
Tandun *	2,053	1,601	78.0
Sub-total	26,396	23,335	88.4
(Other Areas)	61,075	45,245	74.1
Kampar Total	87,471	68,580	78.4
Bengkalis (Objective Area)			
Bangko	12,065	9,102	75.4
Kubu	5,891	4,784	81.2
Tanahputih	5,132	3,780	73.7
Mandau *	4,642	1,786	38.5
Sub-total	27,730	19,452	70.1
(Other Areas)	50,177	39,126	78.0
Bengkalis Total	77,907	58,578	75.2
Objective Area Total	54,126	42,787	79.1

Source: Sensus Pertanian 1983 Seri:A1

Note: * All the households in Kec. Tandun and Kec. Mandau are counted in the calculation although actually only 20% are included within the Objective Area.

Table 2.2 Farm Population in the Objective Area(1990)

Kecamatan	Populat- ion 1990	Total H.H.	Family Size	Share of Farm HH	No. of Farm HH	Farm Population
Bangko	97,491	18,620	5.24	75.40	14,039	73,508
Kubu	97,090	18,228	5.33	81.20	14,801	78,837
Tanahputih	43,326	9,144	4.74	73.70	6,739	31,931
Mandau	25,623	5,204	4.92	38.50	2,004	9,865
Sub-total	263,530	51,196	5.15	63.32	37,583	193,459
Tambusai	30,660	6,892	4.45	87.90	6,058	26,950
Kepenuhan	14,627	3,342	4.38	85.60	2,861	12,521
Kunto Darus.	17,943	4,364	4.11	94.90	4,141	17,028
Rambah	72,711	16,087	4.52	88.70	14,269	64,495
Rokan IV K.	20,094	4,848	4.14	92.00	4,460	18,486
Tandun	7,334	1,617	4.53	78.00	1,262	5,721
Sub-total	163,369	37,150	4.40	87.34	33,051	145,343
Total	426,899	88,347	4.83	72.38	70,635	338,801

Source: 1. 1990 Population Census, Riau
2. 1983 Agricultural Census, Riau

Note: Share of farm households is based on the 1983
Agricultural Census Data.

Table 2.3 Land Ownership and Land Holding Size
in the Objective Area, 1983

Unit: ha (except household)

Kecamatan	Farm House- hold (A)	Land Owned (B)	Land Rented (C)	Control- led Land (D=B-C)	Tenancy Land (E)	Total Land Contrld. (F=D+E)	Average Land Holding (G=F/A)
Tambusai	4,451	14,099	54	14,046	65	14,111	3.17
Kepenuhan	1,422	3,214	482	2,733	215	2,948	2.07
Kunto Darus.	2,250	7,022	50	6,972	123	7,095	3.15
Rambah	11,388	22,563	7	22,556	76	22,632	1.99
Rokan IV Kt.	2,223	7,105	150	6,954	114	7,068	3.18
Tandun	1,601	4,872	0	4,872	0	4,872	3.04
Sub-total	23,335	58,875	743	58,133	595	58,727	2.52
Bangko	9,102	10,697	212	10,485	689	11,173	1.23
Kubu	4,784	10,677	226	10,451	270	10,721	2.24
Tanahputih	3,780	8,897	0	8,897	0	8,897	2.35
Mandau	1,786	3,250	13	3,236	226	3,463	1.94
Sub-total	19,452	33,520	451	33,069	1,185	34,254	1.76
Total	42,787	92,395	1,194	91,201	1,780	92,981	2.17

Source: Sensus Pertanian 1983, Seri: A1, Riau

Note: Controlled Land = Land controlled by land owners

Table 2.4A Food Balance for Riau Province, 1989

	Product- ion (ton)	Feed, Waste & Seed	Total Supply (ton)	Populat- ion	Total Demand (ton)	Surplus (Deficit) (ton)
Rice 1/	393,353	35,206	243,540	3,147,286	443,767	(200,228)
Maize 2/	24,293	2,985	21,308	3,147,286	56,651	(35,343)
Soybeans 3/	5,252	661	4,591	3,147,286	15,736	(11,145)
Cassava 4/	92,893	12,076	80,817	3,147,286	157,364	(76,547)
Sweet Potato 5/	17,887	2,146	15,741	3,147,286	25,178	(9,438)
Ground Nuts 6/	4,233	485	3,748	3,147,286	11,016	(7,267)
Veg. Beans 7/	5,653	388	5,265	3,147,286	3,777	1,488

Source: 1. Pedoman Penyusunan Neraca Bahan Makanan, 1989
 2. Laporan Tahunan Dinas Pertanian Tanaman Pangan, Kampar, '89
 3. Laporan Tahunan Dinas Pertanian Tan. Pangan, Bengkalis, '89

Note: 1. Feed = 0.02 x total paddy production;
 Waste = 0.054 x total paddy production;
 Seed = Area planted x 40 kg;
 Per capita consumption = 141 kg;
 Per capita available rice in 1989 = 77 kg
 2. Feed = 0.06 x total maize production;
 Waste = 0.05 x total maize production;
 Seed = Area planted x 23.5 kg;
 Per capita consumption = 18 kg
 3. Waste = 0.05 x total soybeans production;
 Seed = Area planted x 61 kg;
 Per capita consumption = 5 kg
 4. Waste = 0.13 x total cassava production;
 Per capita consumption = 60 kg
 5. Waste = 0.13 x total sweet potato production;
 Seed = Area planted x 61 kg;
 Per capita consumption = 8 kg
 6. Waste = 0.05 x total ground nuts production;
 Seed = Area planted x 61 kg;
 Per capita consumption = 3.5 kg
 7. Waste = 0.05 x total veg. beans production;
 Seed = Area planted x 30 kg;
 Per capita consumption = 1.2 kg

Table 2.4B Food Balance for Objective Area, 1989

	Production	Feed, Waste & Seed	Total Supply	Population	Total Demand	Surplus (Deficit)
Rice 1/	86,232	12,479	50,152	398,971	56,255	(6,103)
Maize 2/	9,149	1,319	7,830	398,971	7,181	648
Soybeans 3/	3,068	551	2,517	398,971	1,995	522
Cassava 4/	29,263	3,804	25,459	398,971	19,949	5,510
Sweet Potato 5/	3,061	367	2,694	398,971	3,192	(498)
Ground Nuts 6/	3,092	428	2,664	398,971	1,396	1,268

Source: 1. Pedoman Penyusunan Neraca Bahan Makanan, 1989
 2. Laporan Tahunan Dinas Pertanian Tanaman Pangan, Kampar, '89
 3. Laporan Tahunan Dinas Pertanian Tan. Pangan, Bengkalis, '89

- Note: 1. Feed = 0.02 x total paddy production;
 Waste = 0.054 x total paddy production;
 Seed = Area planted x 40 kg;
 Per capita consumption = 141 kg;
2. Feed = 0.06 x total maize production;
 Waste = 0.05 x total maize production;
 Seed = Area planted x 23.5 kg;
 Per capita consumption = 18 kg
3. Waste = 0.05 x total soybeans production;
 Seed = Area planted x 61 kg;
 Per capita consumption = 5 kg
4. Waste = 0.13 x total cassava production;
 Per capita consumption = 60 kg
5. Waste = 0.13 x total sweet potato production;
 Seed = Area planted x 61 kg;
 Per capita consumption = 8 kg
6. Waste = 0.05 x total ground nuts production;
 Seed = Area planted x 61 kg;
 Per capita consumption = 3.5 kg
7. Population in 1989 = Population in 1990 divided by 1.07

Table 2.5 Quantity of Rice Handled by Dolog, Riau
(1985/86 - 1989/90)

Unit: ton

	1985/86	1986/87	1987/88	1988/89	1989/90
Beginning Stock	21,408	16,388	22,850	18,842	22,392
Procurement					
Procurement in Riau	2,560	2,502	284	63	117
From other provinces	35,536	68,013	57,533	63,043	41,034
Others	4	45	9	12	0
Sub-total	38,100	70,560	57,826	63,118	41,151
Total Availability	59,508	86,948	80,676	81,960	63,543
Distribution					
Government	22,737	23,954	26,163	26,100	31,901
State enterprises	2,191	4,284	4,400	5,440	5,814
Market Operations	8,668	16,276	17,556	20,744	1,697
Others	9,524	19,584	14,715	7,284	1,329
Sub-total	43,120	64,098	62,834	59,568	40,741
End-year Stock	16,388	22,850	17,842	22,392	22,802

Source: DOLOG Office, Riau

Table 2.6 Storage Capacity of Dolog, Riau(1991)

Unit: ton

Location	Unit	Capacity per Unit	Total Capacity
Pekanbaru	3	3,500	10,500
Dumai	3	3,500	10,500
	2	2,000	4,000
Tanjung Pinang	2	3,500	7,000
	1	2,000	2,000
Batam	1	3,500	3,500
Bengkalis	1	1,000	1,000
Tembilahan	1	1,000	1,000
Rengat	1	1,000	1,000
Tarempa	1	1,000	1,000
Sedanau	1	1,000	1,000
Ranai	1	1,000	1,000
Total	18	2,417	43,500

Source: DOLOG Office, Riau

Table 2.7 Rice Milling Capacity in
the Objective Area, 1989

Unit: ton per year

District	Location	RMU 1/		PPE 2/		Total	
		Unit	Capacity	Unit	Capacity	Unit	Capacity
Kampar	Tampusai	1	280	31	2,604	32	2,884
	Kunto Darusalam	4	1,080	4	336	8	1,416
	Rokan IV Koto	2	560	6	504	8	1,064
	Rambah	10	2,800	32	2,688	42	5,488
	Kepenuhan	0	0	5	420	5	420
	Tandun	5	1,400	1	84	6	1,484
Bengkalis	Mandau	9	6,645	0	0	9	6,645
	Tanah Putih	3	2,100	0	0	3	2,100
	Kubu	12	7,200	0	0	12	7,200
	Bangko	29	16,080	0	0	29	16,080
			1,000	0	0	0	1,000
Total		75	39,145	79	6,636	154	45,781

Source: Dinas Pertanian Tanaman Pangan, Riau

Note: 1. RMU = Rice Milling Unit
2. PPE = Penggilingan Padi Engelberg
(Engelberg Milling Unit)

Table 2.8 Existing Processing Facilities for Estate Crops in Pekanbaru, Kampar and Bengkalis

			Unit: ton
Crops/ Name of Firm	Location	Product	Processing Capacity
RUBBER			(ton/year)
PT Bangkinang	Pekanbaru	SIR-20	15,000
PT Ricry	Pekanbaru	SIR-20	17,000
PT Union Siak	Pekanbaru	SIR-20	12,000
PT Remco	Bengkalis	SIR-20	4,800
OIL PALM			(ton/hour)
PTP II	Kampar	CPO	60
PTP V	Kampar	CPO	60
PIR PTP V	Kampar	CPO	60
PTP V	Kampar	CPO	60
PIR PTP II	Bengkalis	CPO	60
PIR PTP IV	Bengkalis	CPO	60
Ivo Mas Tunngal IB	Bengkalis	CPO	60
Ivo Mas Tunngal IIA	Bengkalis	CPO	60
Inti Indosawit Subur	Kampar	CPO	30
Sari Lembah Subur	Kampar	CPO	30
PTP V Sei. Intan	Kampar	CPO	30
COCONUT			(ton/year)
Bandung	Kampar	Coconut Oil	250
Union	Kampar	Coconut Oil	180
Bandung Jaya	Kampar	Coconut Oil	600
Adil	Bengkalis	Coconut Oil	120
Tunas Baru	Bengkalis	Coconut Oil	360
Surya	Bengkalis	Coconut Oil	60
Sunaryo	Bengkalis	Coconut Oil	258
Tiga Serawan	Bengkalis	Coconut Oil	150
Sudah Jadi	Bengkalis	Coconut Oil	72
Sehat	Bengkalis	Coconut Oil	36
Delta	Bengkalis	Coconut Oil	480
Basri Rahman	Bengkalis	Coconut Oil	200
Berkat	Bengkalis	Coconut Oil	24
Karya	Bengkalis	Coconut Oil	360
Sepakat	Bengkalis	Coconut Oil	60
Harapan	Bengkalis	Coconut Oil	60
Halpindo	Bengkalis	Coconut Oil	90
Setia Kawan	Bengkalis	Coconut Oil	36
Kud Sukajaya	Bengkalis	Coconut Oil	150

Source: Dinas Perkebunan, Riau

- Note: 1. SIR = Standard Indonesian Rubber
 2. CPO = Crude Palm Oil
 3. Facilities in Indragiri Hulu, Indragiri Hilir and Kepulauan Riau are not included in the table.