

THE KINGDOM OF THAILAND
ROYAL IRRIGATION DEPARTMENT

MASTER PLAN STUDY
ON
THE WATER MANAGEMENT SYSTEM AND MONITORING PROGRAM
IN
THE CHAO PHRAYA RIVER BASIN

FINAL REPORT

ANNEX - 7 SOCIAL SYSTEM / ECONOMY

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CHAPTER 1 NATIONAL AND REGIONAL ECONOMY

1.1 National Economy

1.1.1 Production

(1) Agricultural production

In 1987, agricultural production increased by 0.2%, compared with a decline of 0.8% the year before. Crop production decreased further due to drought, for the second year in a row. At the same time, the below-normal level of water in the dams did not facilitate off-season plantings, and caused rice, maize and sugarcane production to fall. Furthermore, drought this year hurt the yields of fruit trees such as longan and durian. Low prices also discouraged expansion of mung beans, groundnuts, kenaf, and sorghum. However, tapioca, coffee and rubber output still rose due to increased plantings several years before and comparatively less vulnerability to the weather.

All other sectors of agricultural production increased from the previous year. Livestock production grew as a result of brisk export demand and high prices, especially frozen chicken, whose sharp increase in exports led to a substantial rise in poultry output. Swine production continued its growth which had started at the middle of 1986 due to high profitability. Fishery production expanded as reflected by increase in the amount of catches both in the central and in the provincial areas. This is because of generally high prices and buoyant exports of fishery products while the costs of production declined in line with the price of oils. As for forestry, the concession areas have been fully utilized this year, thus lumber production increased significantly.

(2) Non-agricultural production

In 1987, non-agricultural production grew by 8.4% as a result of growth in almost every sector. Sectors which showed steep rise were

manufacturing, construction, trade, services and banking.

Manufacturing production increased by 8,5% compared with a 6% rise in 1986. The authorities' consistent export and investment promotion policies provided the major impetus for the rebound of the economy, beginning with export and export-related industries, while domestic-demand industries followed suit. Export industries which expanded significantly were textiles, precious stones and jewellery products, canned pineapple, canned marine products, floor and wall tiles products, plastic products, artificial flowers and wood products. On the other hand, production of domestic consumption which rose significantly were beverages (liquor, beer, soda-water, soft drinks), construction materials (cement, galvanized iron sheet, iron rod) and motor vehicles (automobiles, motor-cycles, tyres).

Construction, which had remained sluggish for more than 2 years, grew by over 8%, particularly private dwellings and commercial buildings both in the Bangkok Metropolitan and rural areas. Stimulus was provided by financial institutions, enjoying high liquidity, which lowered their lending rates for housing, while fiscal incentives were also given by making tax deductible interest payments on housing loans.

Mining production increased, reflecting the rise in production of natural gas in the wake of the substantial increase in the price of oil in the world market. Stone quarrying and crushing grew following the trend in construction activities. However, production of tin, wolfram, and fluorite still slowed down because world price remained sluggish and competition from abroad intensified.

The trade sub-sector picked up in continuation from the previous year. Both international and domestic trade expanded at a faster pace, revealing the real recovery in response to the tourist promotion efforts and the appreciation of the yen and other European currencies. Tourism and related businesses such as hotels, restaurants, transportation and souvenir industries showed encouraging growth signs. Moreover, banking services also evidenced increased activity.

1.1.2 Employment and Wage Rates

At the end of 1987, the population of Thailand totalled 54 million, an increase of 2% from the previous year. Of this total, the labour force (over 11 years of age) numbered 28.9 million. Amongst them, about 27 million were employed, with 17.4 million in the agricultural sector, 2.5 million in the manufacturing sector and 7 million in other activities. Approximately 2 million were unemployed, of which 3% were openly unemployed and 4% comprised persons willing to work.

The Tripartite Committee decided to adjust upwards the minimum wage rates by 3.7% on average, effective as from April 1, 1987:

- from ฿ 70 to ฿ 73 per day for 9 provinces (Bangkok, Samut Prakan, Nonthaburi, Pathum Thani, Samut Sakhon, Nakhon Pathom, Ranong, Phangnga, and Phuket), an increase of 4.3%.
- from ฿ 65 to ฿ 67 per day for 4 provinces (Chon Buri, Saraburi, Nakhon Ratchasima, and Chiang Mai), an increase of 3.1%.
- from ฿ 59 to ฿ 61 per day for the remaining provinces, an increase of 3.4%.

1.1.3 Income Distribution

Nominal income in 1987 increased by 11%, substantially higher than the 6% growth of the previous year. In real terms, national income rose by approximately 8%, higher than the 4% rate in 1986.

In the agricultural sector, income of most farmers improved despite lower production of major crops resulting from droughts that occurred in two successive years while prices of several crops rose in line with buoyant export prices. Those crops that showed an increase in earnings were rubber, soybean, tapioca, rice, coconuts and sugarcane. Rising the most were incomes from rubber and soybean, by 23% and 20%, respectively, due both to production and price increases. Income from tapioca increased by 14%, mainly reflecting growth in production volume. On the

other hand, earnings were lower for coffee, mung beans, maize, kenaf, groundnuts, tobacco leaves and cotton owing to declines in both production and prices, following drastic falls in world prices. Altogether, income from crops representing 70% of total crop production, increased by 5.2% compared with a reduction of 0.8% in the previous year.

On a regional basis, farmer incomes rose in all regions, but most notably in the South and Northeast. The South enjoyed higher incomes from rubber and coconuts while the Northeast earnings from tapioca, rice, soybean and sugarcane were the major factors.

Nominal incomes of government and state enterprise employees rose between 5 - 6% due only to normal annual incremental increases, but, still above the 2.5% inflation rate. For workers in private business, income is estimated to have risen quite substantially in the wake of the economic upswing which triggered expansion in production and sales. Sectors which experienced large increases in income were export-oriented industries, tourism and tourism-related industries, construction, trade, and services. As for daily wage earners, the minimum wage levels were adjusted upward by 3.7% on average, effective as of 1 April 1987.

1.1.4 Expenditure and Savings

During 1987, real gross national expenditure expanded by 7.1% compared with merely 0.4% last year. The rapid growth in expenditure was due to the increase in private expenditures on both consumption and investment while public expenditures remained more or less the same as in 1986 with the investment component of public expenditures declining. However, with incomes of households and businesses rising faster than in the previous year, private savings moved steeply up.

Private consumption expanded by approximately 5.6% in real terms compared with 2.9% last year. The growth took place both within the Bangkok Metropolitan area and outside. Major items whose sales increased substantially were beverages, electrical appliances, motor cycles and automobiles. Imports of consumer goods also rose sharply as

a result of increases in domestic crop prices together with expectations of prospective upward adjustment in prices of imported consumer durables to reflect higher costs.

Private investment expenditures picked up by 20% in 1987 after two years of uncertain economic environment which had resulted in a temporary slowdown in private investment. Many industries were producing at or close to full capacity, e.g., spinning, weaving, and wall tile industries. In addition, the government provided substantial support for investment, and foreign investors, particularly from countries such as Japan and Taiwan, stepped up their investments in machinery and equipment to take advantage of the cheap but efficient labour in Thailand.

On stock accumulation, stocks of manufacturing raw materials increased substantially while stocks of rice and maize declined in line with their reduced production.

Overall public expenditures stood at virtually the same level as last year. Nominal expenditures on wages and salaries increased by 6% following an adjustment in the wage ceilings of public employees at all levels. Actual military expenditure and current expenditures, however, declined. The delay in government budget approval and the limits set on external borrowing resulted in reductions in investments of both central and local governments by 1.5 and 4%, respectively. Investment by state enterprises mainly on ongoing projects, e.g., for electricity, expressway construction, and airport improvements, continued to increase. Additionally, it is noteworthy that investments by state enterprises during the past two years have been increasingly financed by their own retained earnings instead of by foreign or domestic borrowings.

Gross national savings in 1987 rose by 15.3%, lower than the 23.1% increase of investments. Thus, partial reliance had to be made on foreign savings in order to finance the foregoing investments. Private savings grew at a higher rate than last year, as a result of the rises in incomes of both agricultural and non-agricultural sectors while

general price levels increased only marginally. Government savings also increased, though to a lesser extent, as tax collection exceeded target.

Reflecting a policy measure imposed to encourage more contributions to the budget from state enterprises, and also an increase in foreign debt servicing, savings of state enterprises declined.

1.1.5 Prices

During 1987, prices remained stable, with the consumer price index increasing by 2.5% compared with 1.9% last year. Both agricultural and industrial prices contributed proportionately to the increase. For various agricultural commodities, prices rose as a result of the decline in production due to sporadic droughts right from the beginning of the cropping season. For manufactured products, the manufacturers began to adjust their prices in line with the rising costs of raw materials and wages, increases in total domestic demand and rapid trade expansion.

The producer price index rose by a substantial 6.0% in 1987 after declining continuously over the past three years. Prices of agricultural goods especially paddy, cash crops, fresh vegetables and fruits, showed marked increases, resulting in rises in the prices of food and animal feed. As for industrial goods, prices increased in almost every category, in particular, beverages, transportation equipments, rubber, paper, textile products, chemical products and construction materials. Prices of petroleum products on the other hand, continued to decline reflecting the oil prices adjustments in 1986.

The export price index showed a notable increase as demand for exports remain high while supplies of major agricultural products, both domestic and abroad, fell. Major export items registering significant price increases included rice, maize, rubber, tin and raw sugar.

1.1.6 Foreign Trade and Balance of Payments

Despite being negatively affected by protectionist measures of countries, Thai exports maintained a remarkable performance during 1987.

This was achieved through considerable efforts on the part of the exporters, support given by the government in seeking new markets as well as in improving product form and quality, and improved export competitiveness which reflected international exchange rate developments. The total value of exports reached ¥ 291,000 million in 1987, or increase by 26% from last year. Export volume increased by 15%, a marked increase for the second consecutive year. This rate of growth was extremely high when compared with the 3.4% rate of growth of world trade. The prices of Thailand's eight principal exports increased by approximately 10% while corresponding volumes grew only slightly, except for textiles, rubber and fresh shrimp, the volumes of which increased significantly. As for "other exports", the volume increased by over 30%.

Imports value also increased - by 37% - owing to the sharp growth investment and the rapid economic recovery. In addition, the tariff rates on some imported raw materials were reduced, while some raw materials and goods were imported in order to replenish stocks which had been severely run down during 1986. As a result, import value amounted to ¥ 337,000 million: oil imports increased 34% reflecting a slight increase in oil price while all categories of non-oil imports grew by more than 30%. Those imports increasing the most were "other imports" which included automobile parts. Raw materials and other intermediate products also showed substantial growth. In addition, there were imports of 4 commercial aircrafts by Thai Airways International Limited which amounted to ¥ 8,800 million. As a result, the trade balance registered a large deficit of around ¥ 46,000 million in 1987 compared with ¥ 14,369 million deficit recorded in 1986.

However, the trade deficit was largely offset by the surplus in services and transfers account, which rose markedly in 1987 due, in particular, to increased income from tourism and reduced interest payments. The current account in 1987 thus registered a deficit of around ¥ 15,000 million, or approximately 1% of Gross Domestic Product.

Moreover, the capital account also registered a net surplus exceeding the previous year's level. Net capital inflows were observed

in both the public and private sectors, particularly a large increase in private capital inflows attributed to securities investment. The overall balance of payments position of Thailand consequently showed a large surplus of approximately ¥18,000 million in 1987.

International reserves amounted to US\$ 5,200 million, equivalent to 4.7 months of imports. Meanwhile, with a major reduction in the private sector external debt, the total debt services ratio fell to 17% of export earnings, compared with 20.1% in 1986.

1.2 Socio-Economic Condition

1.2.1 Social Infrastructure

(1) Road Networks

As shown in Figure 1-1, the main road networks connecting major municipalities with each other are well consolidated for more convenient and speedy communication than other communication systems. Particularly the national highway No. 1 (823 km) connecting Bangkok with Chiang Rai via Saraburi is completely paved and is the main road for transportation in the Study Area.

(2) Railway

The railway is less consolidated than the road networks, and operation length of the State Railway of Thailand (SRT) as of 1982 is 3,735 km and new line has not been constructed since 1970.

The railway networks of SRT are laid radially from Bangkok, as northern line, northeastern line, eastern line, and south line (Refer to Figure 1-1). As for Mae Klong line, running western part of Bangkok with 67 km length, is not connected with the aforesaid four main lines and cut off at Khwae Noi River.

In the Study Area, northern line runs between Bangkok and Chiang Mai and the railway networks are provided to connect major

municipalities. The northern line, main railway in the Study Area, is double lined between Bangkok and Ban Phachi for 90 km, but others are single-lines and electrification of the lines has not been realized yet.

(3) Airlines

In the Study Area, there are eight airports for regular flights, out of which Bangkok and Chiang Mai Airports are the international airports. Demand for the domestic transportation by airplanes has been also increased and become indispensable as communication system because of the more speedy transportation than any other means of transportation.

(4) Inland Water Transportation

The total length of canal in Thailand reaches about 3,000 km and particularly, the canal networks of the Chao Phraya River Basin are the largest in the Country. Those canal networks have been used for the transportation of gravels, cement, paddy, maize, and so on; however, the problems on water-borne transportation is that the year round navigation is impossible due to fluctuation in water depth and high cost canal dredging.

(5) Power Generation

In 1983, the total generating capacity in Thailand was 4,976 MW and the total generated power was 19,066 GWH. In the power generation, 21 percent is by hydropower and the remainder is by thermal power.

Out of 14 hydropower plants managed by Electricity Generating Authority of Thailand (EGAT), almost of the existing hydropower plants including Bhumibol Dam with 535 MW capacity and Sirikit Dam with 375 MW capacity are located in northern and central plain regions.

(6) Water Supply

"Population and Housing Census of 1980" shows that the housing rate equipped with water supply is 16 percent for whole Thailand and 70 percent in the Bangkok Metropolis. In the rural area, public and private wells are popularly used. In the Bangkok Metropolis, land subsidence caused from over-pumping of groundwater has become a social problem.

1.2.2 Socio-Economy

According to geographical division of Thailand, the Study Area covers the entire area of North Region and most of Central Plain Region, relating to six (6) RID Regional Offices of No. 1, 2, 3, 7, 8 and 9, and 33 changwats.

Table 1-1 shows general condition of regional economy within the Study Area as well as command area under the related RID Regional Office.

On the basis of 1980 census, total number of households and total population in the Study Area are estimated at 3,709 thousand households and 18,466 thousand capita, among which agricultural households and population are 1,687 thousand households and 8,605 thousand capita, respectively.

According to gross regional and provincial product in 1985, the Study Area produced about 655.9 billion bahts in current prices, occupying 63 percent of Gross Domestic Product, 1,047.3 billion bahts. Out of the gross regional product in the Study Area, 655.9 billion bahts, manufacturing sector produced 167.2 billion bahts occupying top position, and their commercial sector 106.9 billion bahts, service sector 79.6 billion bahts, and agricultural sector accounts for 64.9 billion bahts at 6th position, following banking and transportation sectors.

1.2.3 Human Resources

As of 1985, population in Thailand is 51,795,650 and annual growth rate since 1980 is accounted at 2.0 percent. According to the projection by NESDB, population is estimated to be 55,458,000 in 1989. Presently 82 percent of population is living in rural areas.

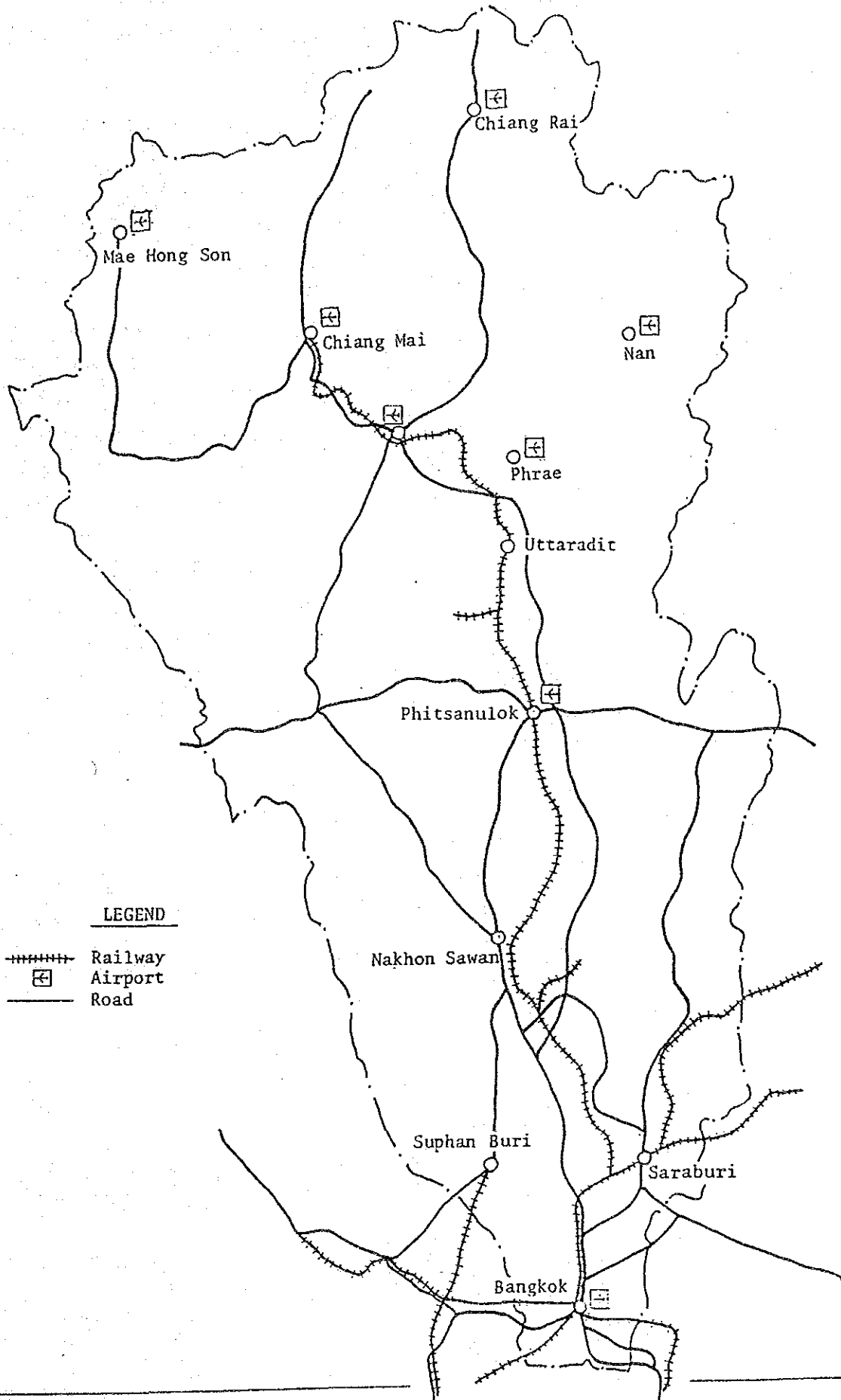
Population in the Study Area is about 21,281 thousand in 1985, corresponding to 41 percent of the total population in Thailand. Bangkok Metropolis has 5,363,000 population which corresponds to 25 percent of the Study Area, causing over- centralization phenomenon.

Workable population above 11 years of age in the Study Area is estimated at about 9.4 million (45%) and out of them 6.8 million people (72%) are engaged in agriculture.

Table 1-1 GENERAL CONDITION OF REGIONAL ECONOMY IN THE STUDY AREA

Item	Unit	RID Regional Office									Total
		1	2	3	7	8	9	9	9		
1. Total Land	km ²	37,300	48,550	67,730	19,910	15,900	120			190,590	
2. Population (1980)	thousand	1,622	2,752	4,026	4,370	5,418	276			18,466	
3. Population (1985)	"	1,831	3,091	4,689	5,049	6,274	347			21,281	
4. No. of Household	"	369	573	794	860	1,060	53			3,709	
5. Agr. Population (1980)	"	961	1,952	2,906	1,623	1,063	99			8,605	
6. Agr. Household (1980)	"	209	393	552	312	203	18			1,687	
7. Population Density (1985)	per km ²	49	64	69	254	395	2,892			112	
8. Population Growth (1980-85)	%/year	2.5	2.4	3.1	2.9	3.0	4.7			2.9	
9. Gross Provincial Product (1985)	₱ million										
- Agriculture		7,237	10,282	20,915	15,166	10,046	1,252			64,898	
- Manufacturing		702	1,288	3,802	47,871	107,772	5,749			167,184	
- Transportation		2,813	3,729	3,931	19,160	38,031	563			68,227	
- Commercial		5,544	8,409	11,951	29,318	50,246	1,425			106,893	
- Banking		1,980	1,830	2,943	20,186	43,157	467			70,563	
- Services		4,217	3,404	4,578	21,589	45,331	525			79,644	
- Other Sectors		5,134	7,372	12,733	24,130	47,184	1,956			98,509	
Total		<u>27,627</u>	<u>36,314</u>	<u>60,853</u>	<u>177,420</u>	<u>341,767</u>	<u>11,937</u>			<u>655,918</u>	

Figure 1-1 Traffic Network in the Study Area



CHAPTER 2 SIXTH NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT PLAN

2.1 Special Feature of the Plan

The national economic and social development plan has started since 1961, and the Sixth National Economic and Social Development Plan (6th NESDP) covers five years from October 1986 to September 1991.

In order to solve various problems which have been accumulated by implementation of the former five NESDPs, the current plan is characterized as an adjustment one, and it stresses strongly to change the development pattern from expansion in quantity to enrichment in quality. For the purpose of successfully implementing the 6th NESDP, the following basic policy is taken into consideration;

- To give higher priority to improvement of financial balance with foreign countries through careful management of entire economy during the first half of the plan period,
- To seek a growth pattern depending on expanding employment opportunity,
- To diversify production pattern, attaching more importance to marketing than expanding production of traditional primary commodity,
- To carry out industrialization by utilizing resources close to one such as plentiful labor force and agricultural products,
- To utilize vitality in private sector,
- To give priority to not a large scale project but small and medium scale projects.

2.2 Composition of the 6th NESDP

2.2.1 Performance of the Former NESDPs

While it has past almost a quarter of the century since the first plan was commenced, Thai economy had grown almost seven (7) percent per annum during the period. As a result, GDP increased from 58.9 billion bahts in 1961 to 1,047.5 billion bahts in 1985 in current prices, and GDP per capita also did from 2,150 bahts to 20,420 bahts.

As seen in Table 2-1, the economic growth rate decreased and could not attain the target, 6.6 percent per annum of the fifth plan, mainly due to low economic growth (2.5 percent) in the world resulted in rise of protectionism, stagnation of world market for primary commodities, unstability in foreign exchange market, intensification in international competition. These phenomena affected to Thai agriculture and export sectors and brought cause and effect as stagnation of farmers' purchase power brings stagnation of consumption expenditures and then inactivity of investment.

2.2.2 Objective and Targets

In view of the problems and limitations on the one hand and the development opportunities falling within Thailand's province in the near future on the other, the 6th NESDP defines its two major objectives as follows:

ECONOMIC

Maintain an average rate of growth at a level of 5% in order to absorb the minimum of 3.9 million persons who will be entering the labour market. Growth should be accomplished in such a way that economic stability is strengthened and the economic problems that arose during the 5th NESDP period are solved.

SOCIAL

Develop the quality of the population so that social development can progress, peace and justice be attained and development of the country as a whole supported. The national identity, culture and system of values will be maintained and the quality of life of the Thai people will be raised in both rural and urban areas.

Table 2-2 indicates macro economic targets of the 6th NESDP.

2.2.3 Development Guidelines and Programmes (Refer to Table 2-3)

In order to attain the principal economic and social objectives and targets cited above, clear guidelines for development need to be defined which can be used as the basis for formulating appropriate work plans and operational plans in the future. An important issue that all parties should be aware of is that despite the less critical conditions and the increased development opportunities, it will not be easy to exploit the full potential of these opportunities. The task must be approached with conviction and dedication; cooperation and coordinated hard work are necessary in compliance with the following key guidelines:

- (a) Increase the efficiency of national development in regard to human resources, science and technology, natural resources and the formation of integrated systems of administration and management. Especially important is the need to review the state's role to ensure that its duties consist only of those appropriate to the state and its monetary and fiscal capabilities. On the other hand the role of the private sector in national development should be enhanced both in production and in the provision of infrastructure services hitherto provided by the government.
- (b) Improve the production system and marketing and raise the quality of the basic economic factors to reduce the cost of goods, diversify into more types of goods together with market expansion. This will enable Thai goods to be far more competitive in the world market while simultaneously

emphasizing the development of the marketing system within the country.

- (c) Increase the distribution of income and prosperity into provincial regions and rural areas by focussing on the low income population in these areas as the main target group for receiving the benefits of national development efforts.

Based on the foregoing objectives and guidelines for development, the 6th NESDP specifies 10 programmes divided into three major categories as the operating framework for the government and private sector, as follows:

Improving the efficiency of development

- (1) Overall Economic Development
- (2) Population, Social and Cultural Development
- (3) Development of Natural Resources and the Environment
- (4) Development of Science and Technology
- (5) Improving the Administration and Reviewing the Role of the Government in National Development
- (6) Development of State Enterprises

Restructuring production and improving quality of infrastructure services

- (7) Development of the Production System, Marketing and Employment
- (8) Development of Infrastructure Services

Distributing prosperity and creating justice

- (9) Development of Urban and Specific Areas
- (10) Rural Development

2.3 Interrelation between Identified Projects/Study and 6th NESDP

The 6th NESDP has three development guidelines, under which 10 main programmes are prepared. Further, each programme is composed of several plans/components for smooth implementation of the 6th NESDP. Since the 6th NESDP set a basic economic and social development policy, an interrelation between the 6th NESDP and identified projects/study under the Master Plan Study is examined, as shown in Table 2-3.

Table 2-1 PERFORMANCE OF NATIONAL DEVELOPMENT PLAN

Particulars	Unit	1st Plan (1961-66)	2nd Plan (1967-71)	3rd Plan (1972-76)	4th Plan (1977-81)	5th Plan ^{1/} (1982-86)	6th Plan ^{2/} (1987-91)
1. Overall Economic Growth	%/annum	8.1	7.2	6.2	7.3	4.9	5.0
2. Growth in Agricultural Sector	- do -	4.6	4.1	3.9	3.5	2.9	2.9
3. Growth in Industrial Sector	- do -	10.2	9.7	8.6	8.7	5.6	6.6
4. Growth in Export of Goods (Nominal Figure)	- do -	8.7	4.1	14.0	20.0	7.6	10.7
5. Saving Ratio vs Nominal GDP	%	26.0 ^{3/}	20.4 ^{3/}	24.6	22.6	18.2	23.7
6. Investment Ratio vs Nominal GDP	- do -	25.4 ^{3/}	24.1 ^{3/}	23.6	26.7	22.7	24.9
7. Increase in Consumer Prices	%/annum	2.3	1.5	12.5	11.6	2.7	2.3
8. Current Account Deficit vs Nominal GDP	%	-	2.5 ^{3/}	1.7	6.3	4.7	0.9
9. Financial Deficit vs Nominal GDP	- do -	0.7	2.9	2.7	3.3	3.7	2.1

Note: 1/ ... Actual figures for 4 years (1982 - 85)

2/ ... Target figures

3/ ... Actual figures at the end of plan period

Source: NESDB.

Table 2-2 OVERALL ECONOMIC TARGETS IN THE SIXTH PLAN

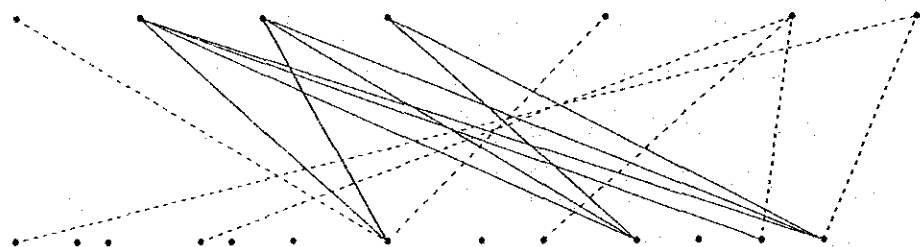
Category	Fifth Plan Targets (1982-1986)	Sixth Plan Targets (1987-1991)
1. <u>Trade Deficit</u> (current prices)		
1.1. Average value per year (million baht)	55,600	35,900
1.2. Trade deficit/GDP (%)	5.8	2.7
2. <u>Current Account Deficit</u> (current prices)		
2.1. Average value per year (million baht)	36,000	11,800
2.2. Current account deficit/GDP (%)	3.8	0.9
3. <u>Export of Goods and Services</u>		
3.1. Value growth rate (%)	9.8	9.9
3.2. Volume growth rate (%)	8.4	7.4
4. <u>Export of Goods</u>		
4.1. Value growth rate (%)	8.4	10.7
4.2. Volume growth rate (%)	8.3	8.1
4.3. Average value per year (million baht)	177,500	290,700
5. <u>Income from Tourism</u> (current prices)		
5.1. Value growth rate (%)	12.2	7.4
6. <u>Import of Goods and Services</u>		
6.1. Value growth rate (%)	3.7	9.3
6.2. Volume growth rate (%)	2.0	4.5
7. <u>Import of Goods</u>		
7.1. Value growth rate (%)	2.9	9.5
7.2. Volume growth rate (%)	2.9	4.6
7.3. Average value per year (million baht)	233,100	326,700
8. <u>Economic Growth</u> (%/yr a constant prices)		
8.1. Agriculture	2.1	2.9
8.2. Manufacturing	5.1	6.6
8.3. Mining	6.1	6.4
8.4. GDP	4.4	5.0
9. <u>Government Revenue/GDP</u> (%)	14.8	15.8
10. <u>Population Growth Rate</u> (%)	1.7 ^{*1}	1.3 ^{*2}
10.1. Municipal districts	(2.7)	(2.5)
10.2. Sanitary districts	(2.1)	(2.4)
10.3. Villages	(1.4)	(0.8)
11. <u>Inflation Rate</u> (%)	2.9	2.3
12. <u>Per Capita Income</u> (baht)	21,395 ^{*1}	27,783 ^{*2}

Note: *1 ... In 1986, *2 ... In 1991

Source: National Economic and Social Development Board

Table 2-3 INTER-RELATION BETWEEN 6TH NESDP AND IDENTIFIED PROJECT (DETAILED) (1)

6th N.E.S.D.P.	
Main Program	Component/Plan
(1) Overall Economic Development	01 Restoration of National Monetary & Fiscal Condition 02 Saving Mobilization & Role of Private Sector in Development 03 Public Finance
(2) Population, Social and Cultural Development	04 Development of Quality of Population and Labour Force 05 Promotion of Peace in Society 06 Improvement of Social Development Mechanisms
(3) Development of Natural Resources and the Environment	07 Efficient Use of Each Type of Natural Resources 08 Mitigation of Conflicting Use of Various Natural Resources 09 Mobilization of Organizations and Implementation Planning
(4) Development of Science and Technology	10 Develop Basic Structure and Administration System 11 Increase Efficiency in Scientific Technological Activity 12 Develop Human Resources & Manpower Science & Technology 13 Increase Efficiency in Production System thru Technology



Identified Project/Study under M/P	
Components	Project/Study
(1) Preparation of Guideline (2) Software Development (3) Data Management	Basic Frame of Improved Water Management System
(1) Monitoring/Commun. Facility (2) Data Management Facility (3) Water Use Facility	Implementation of Water Management Model Project
(1) Telemetering System (2) Communication Improvement (3) Data Base	Improvement of Tele-Communication/Monitoring System
(1) Prepare Criteria & Guideline (2) Basin System Level Facility (3) Main/Lateral System Level Faci. (4) On-farm Level Facility	Implementation of Irrigation and Drainage System Modernization Project
(1) Bang Pakong River Basin (2) Upper Pasak River Basin (3) Groundwater Development (4) Kwai Noi River Basin (5) Yom River Basin (6) Ing-Yom-Nan Transbasin (7) Salween River Basin (8) Lower Ping River Basin	Comprehensive River Basin Study
(1) Institutional Vitalization (2) Staff Training Program	Promotion of Humaware Development
(1) Research on Upland Irrigation (2) Land Inventory/Zoning (3) Cropping Plan Infor. Service (4) Agro-Marketing Infor. System	Crop Diversification Promotion Center

(Cont'd)

INTER-RELATION BETWEEN 6TH NBSDP AND IDENTIFIED PROJECT (DETAILED) (2)

6th N.E.S.D.P.	
Main Program	Component/Plan
(5) <i>Improving the Administration and the Role of the Government in National Development and the Environment</i>	14 Develop Programme System for Government Administration ...
	15 Improving Government Instruments for Supporting Administration of Development
	16 Improving Provision of Government Services
	17 Cooperation between Public and Private Sectors
	18 Investment
(6) <i>Development of State Enterprises</i>	19 Fund Mobilization
	20 Loan Guarantee
	21 Pricing of Goods and Services
	22 Personnel Management
	23 State Enterprises Management
	24 Privatization of State Enterprises
	25 Production for Sale
(7) <i>Development of the Production System, Marketing and Employment</i>	26 Diversification of Production and Services
	27 Marketing Development
	28 Restructuring Management System for Production and Marketing
	29 Role of Public Sector in Development of Production System, Marketing and Employment

Identified Project/Study under M/P	
Components	Project/Study
(1) Preparation of Guideline (2) Software Development (3) Data Management	<i>Basic Frame of Improved Water Management System</i>
(1) Monitoring/Commun. Facility (2) Data Management Facility (3) Water Use Facility	<i>Implementation of Water Management Model Project</i>
(1) Telemetering System (2) Communication Improvement (3) Data Base	<i>Improvement of Tele-Communication/Monitoring System</i>
(1) Prepare Criteria & Guideline (2) Basin System Level Facility (3) Main/Lateral System Level Faci. (4) On-farm Level Facility	<i>Implementation of Irrigation and Drainage System Modernization Project</i>
(1) Bang Pakong River Basin (2) Upper Pasak River Basin (3) Groundwater Development (4) Kwai Noi River Basin (5) Yom River Basin (6) Ing-Yom-Nan Transbasin (7) Salween River Basin (8) Lower Ping River Basin	<i>Comprehensive River Basin Study</i>
(1) Institutional Vitalization (2) Staff Training Program	<i>Promotion of Humaware Development</i>
(1) Research on Upland Irrigation (2) Land Inventory/Zoning (3) Cropping Plan Infor. Service (4) Agro-Marketing Infor. System	<i>Crop Diversification Promotion Center</i>

(Cont'd)

INTER-RELATION BETWEEN 6TH NESDP AND IDENTIFIED PROJECT (DETAILED) (3)

6th N.E.S.D.P.	Component/Plan
(8) <i>Development of Infrastructure Services</i>	30 Development Plan for Public Utility and Amenities
	31 Development Plan for Energy
	32 Development Plan for Transport
	33 Development Plan for Communication
(9) <i>Development of Urban and Specific Areas</i>	34 Development Plan for Bangkok Metropolitan Region
	35 Development Plan for Regional Urban Growth Center
	36 Development Plan for Eastern Seaboard Sub-Region
	37 Preparation for Development of Other New Economic Area ..
	38 Developing Basic Factors in Rural Production & Marketing ..
(10) <i>Rural Development</i>	39 Increasing Efficiency and Capability of Government in Solving Rural Problems
	40 Improving Administrative Mechanisms by Consolidating Efforts in Integrated Rural Development System
	41 Increasing Participation by People's Organization and Private Sector in Rural Development

Identified Project/Study under M/P	Project/Study
Components	
(1) Preparation of Guideline (2) Software Development (3) Data Management	<i>Basic Frame of Improved Water Management System</i>
(1) Monitoring/Commun. Facility (2) Data Management Facility (3) Water Use Facility	<i>Implementation of Water Management Model Project</i>
(1) Telemetering System (2) Communication Improvement (3) Data Base	<i>Improvement of Tele-Communication/Monitoring System</i>
(1) Prepare Criteria & Guideline (2) Basin System Level Facility (3) Main/Lateral System Level Faci. (4) On-farm Level Facility	<i>Implementation of Irrigation and Drainage System Modernization Project</i>
(1) Bang Pakong River Basin (2) Upper Pasak River Basin (3) Groundwater Development (4) Kwai Noi River Basin (5) Yom River Basin (6) Ing-Yom-Nan Transbasin (7) Salween River Basin (8) Lower Ping River Basin	<i>Comprehensive River Basin Study</i>
(1) Institutional Vitalization (2) Staff Training Program	<i>Promotion of Humaware Development</i>
(1) Research on Upland Irrigation (2) Land Inventory/Zoning (3) Cropping Plan Infor. Service (4) Agro-Marketing Infor. System	<i>Crop Diversification Promotion Center</i>

CHAPTER 3 THAI AGRICULTURAL POLICY

The sector of agriculture, forestry and fishery had kept the leading position in the gross domestic product (GDP) for long time, but the weight of the sector dropped down the third position in 1984, occupying 17 percent of GDP in 1985, because of rapid expansion in the sectors of manufacture and commerce.

The phenomena does not indicate the decrease in growth of the agricultural sector, but the stagnation in development of rural economy, which absorbs about 70 percent of the national population (Refer to Table 3-1).

While products of agriculture, forestry and fishery including their related ones, occupied about 60 percent of total export earnings in 1985, and have supported Thai economy by gaining foreign exchange, the share or weight has been decreasing in these three years. The reason is that export earnings by the other sector have been increasing and an international market for primary commodities, especially agricultural, forestry and fishery products have stagnated (Refer to Table 3-2).

Thai government has devoted to expand production of main agricultural products, such as rice, maize, cassava, sugarcane, etc., as well as to maintain paddy price received by farmers, in her agricultural policy. However, stagnation in farmers' receiving prices of main agricultural products have become more serious, because the relation between supply and demand for the main agricultural products is presently under slack situation in the world market. Therefore, Thai government started to control paddy production since 1984, and also is forced to control cassava production, because of EEC's import restriction on a tapioca.

Table 3-1 CHANGE OF PRODUCTION IN AGRICULTURAL SECTOR

(unit: billion bahts)

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
GDP (1)	786.2	846.1	924.3	991.6	1,047.8
Agricultural Sector(2)	187.9	188.7	204.4	193.4	182.3
Agriculture	138.9	139.9	150.0	141.7	132.6
Livestock	24.7	23.6	28.8	26.3	23.9
Fishery	13.2	14.2	14.5	13.1	12.7
Forestry	11.1	11.1	11.2	12.3	13.2
Share (2) / (1)	22%	22%	22%	19%	17%

Table 3-2 SHARE OF AGRICULTURAL SECTOR IN EXPORT

(unit: billion bahts)

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Total Export (1)	153.0	159.7	146.5	175.2	193.3
Agricultural Sector (2)	101.5	107.8	96.6	112.6	115.5
Share (2) / (1)	66.3%	67.5%	66.0%	64.2%	59.7%

Source: Ministry of Agriculture and Cooperatives

Under such circumstances, Thai government plans to raise the farmers' receiving prices of agricultural products through primarily promoting export of them, for which the following important objectives are taken into consideration;

- Crop diversification coping with exportable demand
- Quality improvement for strengthening export competitiveness
- Reduction of production cost
- Mitigation of obstacles for export promotion such as export tax, export premium, etc.
- Provision of credit to farmers, rice millers, exporters with low interest rate.

In the 6th NESDP, the following development objectives are adopted;

(1) Agricultural Development

- 1) Rural development for poverty alleviation
 - 2) Development in area which has much rainfall
 - 3) Development in advanced area where farmers own average management size ranging 20 to 25 rai.
 - Expanding cultivation of vegetables, fruits, and plants having shorter gestation period, for both domestic and international market.
 - Improving cultivation of main crops such as rice, maize, cassava, etc.
- (2) Annual growth rate in the agricultural sector: 2.9%
- (3) To place stress on from an expansion in quantity to an improvement in quality.

In compliance with the development policy on the agricultural sector, the Department of Agricultural Extension, Ministry of Agriculture and Cooperatives has prepared production target in the whole Kingdom as shown in Table 3-3. In this target, more attention is paid to fruits and such field crops as sesame, castor seed, and soybean, on the contrary dry season paddy, pineapple and cassava are expected to decrease, in terms of cropped area.

Table 3-3 PRODUCTION TARGET IN 6TH NESDP

	Production (1,000 tons)		Planted Area (1,000 ha)		Yield (ton/ha)	
	1987	1991	1987	1991	1987	1991
Paddy (Wet)	18,178	19,442	9,386	9,426	1.94	2.06
Paddy (Dry)	2,000	1,870	528	480	3.79	3.89
Paddy (Wet + Dry)	20,178	21,312	9,914	9,906	2.04	2.15
Maize	4,357	4,879	1,863	1,916	2.34	2.54
Sorghum	393	488	269	284	1.46	1.72
Cassava	18,060	18,391	1,266	1,228	14.27	14.97
Soybean	363	468	274	331	1.33	1.41
Groundnut	196	213	139	140	1.41	1.53
Mungbean**	315	355	420	424	0.75	0.84
Caster Seed	32	51	38	52	0.86	0.98
Sesame	30	48	52	73	0.58	0.65
Pineapple	1,778	2,147	81	78	21.88	27.50
Coconut	1,435	1,660	433	451	3.96	4.21
Other Fruits***	2,649	3,609	426	532	N.A	N.A

Note: * ... Increase/Decrease between 1987 and 1991

** ... Mungbean (fat + black)

*** ... Rambutan, Durian, Sugar Apple, Sour Tamarind, Mangosteen, Longan, Banana, Mango, Lichee, Pomelo, Grape

Source: Department of Agricultural Extension, MOAC

CHAPTER 4 FOREIGN TRADE AND WORLD MARKET FOR FARM PRODUCTS

Thai foreign trade has steadily and remarkably expanded, showing annual growth rate of about 13% over the last 10 years, in which the total exports have grown with a little higher rate of 14.4% per annum than the total imports, 12.7%.

As reflecting more importation of investment goods to be required by the export promotion of Thai light industry, the total imports had rapidly increased since 1979, and thus the annual trade deficit amounted to 30 to 90 billion bahts until 1985. However, the total exports had jumped from 193 billion bahts in 1985 to 233 billion bahts in 1986, resulted in remarkable improvement of the trade deficit, amounting to 8 billion bahts, due to the public and the private sectors' efforts for export promotion (See Table 4-1).

Although the weight of agricultural products has gradually dropped in the total export earnings because of the recent stagnation of the world market prices, they still occupy about 60% of the earnings (See Table 4-2), on which the Thai economy could depend. As shown in Table 4-2, rice occupies about 20% of agricultural exports, followed by fishery products' 14.5%, cassava products' 13% and rubber and its products' 12.8%, 1985. In addition, garden crops and fishery products have increased remarkably in the share.

Figure 4-1 shows the relation between paddy production and rice export in Thailand. Rice export was three million tons in 1981 and reached to 4.6 million tons in 1984. Since 1981, the farmgate price of paddy has continuously declined due to stagnation in the world market for milled rice, and further production restriction for paddy has been adopted starting from 1985.

It is, of course, forecasted that the both international and domestic prices of paddy would fluctuate due to the world market

situation. However, due attention should be paid for continuous effort to increase productivity of paddy, because the rice would keep its important position as a source of the Thai export earnings. In addition, it is also considered quite important to pay more attention to continuously make efforts to diversify Thai agricultural exports and to penetrate into world markets of various agricultural products.

Table 4-1 EXPORTS, IMPORTS AND BALANCE OF TRADE, 1966 - 1986

(Unit: Million Bahts)

Year	Exports			Imports	Balance of trade
	Domestic exports	Re- exports	Total exports	Total imports	
1966	13,796	512	14,310	25,347	-11,037
1967	13,796	368	14,166	22,188	-8,022
1968	12,967	692	13,679	24,103	-10,424
1969	14,101	621	14,722	26,891	-12,169
1970	14,250	522	14,772	27,009	-12,237
1971	16,683	496	17,281	26,794	-9,513
1972	21,616	875	22,491	30,875	-8,384
1973	31,146	1,080	32,226	42,184	-9,958
1974	49,164	1,161	50,325	64,043	-13,718
1975	47,504	933	48,437	66,835	-18,396
1976	60,189	608	60,797	72,877	-12,080
1977	70,396	800	71,196	94,177	-22,979
1978	81,252	1,813	83,065	108,899	-25,834
1979	106,337	1,842	108,179	146,161	-37,962
1980	130,406	2,791	133,197	193,618	-60,421
1981	148,962	4,039	153,001	219,026	-66,025
1982	156,039	3,689	159,728	196,616	-36,888
1983	144,322	2,150	146,472	236,609	-90,137
1984	172,075	3,162	175,237	245,155	-69,918
1985	191,613	1,753	193,366	251,169	-57,803
1986	232,095	1,288	233,383	241,358	-7,975

Source: Agricultural Statistics of Thailand

Table 4-2 EXPORT VALUE OF AGRICULTURAL PRODUCTS

(Unit: Million Baht)

	1978	1979	1980	1981	1982	1983	1984	1985	1985/1978
Total Amount of Export (A)	81,252	108,179	133,197	153,001	159,728	146,472	175,237	193,866	2.38
Agricultural Products (B)	56,341	72,058	81,463	101,475	107,820	96,669	112,620	114,976	2.04
1. Total of Rice	10,424	15,592	19,507	26,366	22,510	20,157	25,932	22,524	2.16
2. Rice Products	260	283	310	465	564	505	578	706	2.72
3. Food Crops	6,181	7,881	9,773	11,566	11,840	11,452	13,464	11,889	1.92
4. Cassava Products	10,892	9,891	14,887	16,447	19,752	15,387	16,600	14,967	1.37
5. Raw Sugar and Products	4,491	5,427	3,357	10,311	13,807	7,878	6,111	7,060	1.57
6. Oil Seeds	834	831	389	684	602	247	361	426	0.51
7. Vegetable Oils	30	13	214	229	293	263	400	571	19.03
8. Fiber Crops	3,038	3,687	3,783	3,218	3,969	3,256	4,969	5,129	1.69
9. Garden Crops and Products	176	211	205	314	507	667	720	953	5.41
10. Fruits and Products	1,727	1,752	2,123	2,975	3,120	3,032	4,206	5,114	2.96
11. Spices	75	50	32	512	206	169	322	293	3.91
12. Miscellaneous Crops	344	654	761	818	1,017	1,092	1,176	2,076	6.03
13. Other Food Products	140	232	262	441	662	783	1,031	1,003	7.16
14. Tobacco and Products	1,161	1,243	1,372	1,741	2,560	1,837	1,650	1,590	1.37
15. Rubber and Products	8,214	12,705	13,025	11,470	10,060	12,406	13,892	14,807	1.80
16. Live Animals	292	249	165	97	108	107	113	201	0.69
17. Animal Feed	1,021	1,388	1,618	1,847	1,584	1,862	1,832	1,971	1.93
18. Animal Products	1,027	1,536	1,391	2,239	2,361	2,016	3,005	3,354	3.27
19. Milk Products	110	145	161	150	207	166	122	101	0.92
20. Fertilizer and Pesticide	2	4	14	20	42	67	65	77	38.50
21. Fishery Products	4,326	6,380	6,185	7,635	10,033	11,192	13,423	16,720	3.87
22. Paper and Products	102	160	225	188	236	225	281	613	6.01
23. Wood and Products	1,474	1,738	1,703	1,499	1,424	1,484	1,733	2,031	1.92
24. Forestry Products)))	244	358	421	634	802)
(B) / (A) X 100 (%)	69.3	66.6	61.1	66.3	67.5	66.0	64.3	59.5	

Source: Agricultural Statistics of Thailand

Table 4-3 IMPORT VALUE OF AGRICULTURAL PRODUCTS

(Unit: Million Baht)

	1978	1979	1980	1981	1982	1983	1984	1985	1985/1978
Total Amount of Import (A)	108,899	146,161	193,618	219,026	196,616	236,609	245,155	251,169	2.31
Agricultural Products (B)	17,255	20,255	23,952	27,781	24,796	29,930	33,504	36,509	2.12
1. Food Crops	793	1,170	1,187	1,619	1,296	1,664	1,558	1,615	2.04
2. Sugar Products	9	6	1,436	9	10	11	14	16	1.78
3. Cocoa and Products	61	66	58	49	47	70	75	92	1.51
4. Tea and Coffee	56	55	49	62	52	71	60	67	1.20
5. Spirits and Beverage	3,818	365	421	653	589	581	605	736	0.19
6. Oil Seeds	92	2	309	288	180	2	3	4	0.04
7. Vegetable Oils	154	359	1,307	821	379	718	1,026	432	2.81
8. Fiber Crops	2,512	3,229	3,122	4,052	3,065	4,844	6,164	6,248	2.49
9. Garden Crops and Products	163	135	205	228	201	188	227	201	1.23
10. Fruits and Products	34	37	103	149	156	225	245	272	8.00
11. Spices	26	54	26	60	95	104	63	103	3.96
12. Miscellaneous Crops	13	17	24	16	12	16	23	15	1.15
13. Other Food Products	268	385	390	389	359	432	432	478	1.78
14. Tobacco	759	851	1,099	936	1,739	688	1,079	1,520	2.00
15. Rubber and Products	610	842	896	1,167	1,086	1,368	1,394	1,426	2.34
16. Live Animals	92	104	114	122	155	140	163	154	1.67
17. Animal Feed	614	557	1,306	1,368	1,540	1,512	2,224	1,247	2.03
18. Animal Products	247	351	413	497	434	362	424	741	3.00
19. Milk Products	955	1,204	1,315	2,175	1,650	2,140	2,085	2,193	2.30
20. Fishery Products	170	428	472	481	648	984	2,020	3,754	22.08
21. Paper and Products	1,711	2,759	2,851	3,668	2,805	3,325	2,848	3,752	2.19
22. Fertilizers	1,945	2,757	2,829	3,620	3,511	5,123	4,664	5,512	2.83
23. Pesticides	913	1,160	1,348	1,565	1,379	1,261	1,635	1,752	1.92
24. Agricultural Machineries	928	988	1,045	1,634	1,170	1,222	1,540	1,537	1.65
25. Forestry Products	242	380	442	412	458	516	547	419	1.73
26. Wood and Products	71	1,996	1,186	1,831	1,783	2,366	2,388	2,223	31.31
(B) / (A) X 100 (%)	15.8	13.9	12.4	12.7	12.6	12.6	13.7	14.5	

Source: Agricultural Statistics of Thailand

Table 4-4 RICE TRADING IN THE WORLD

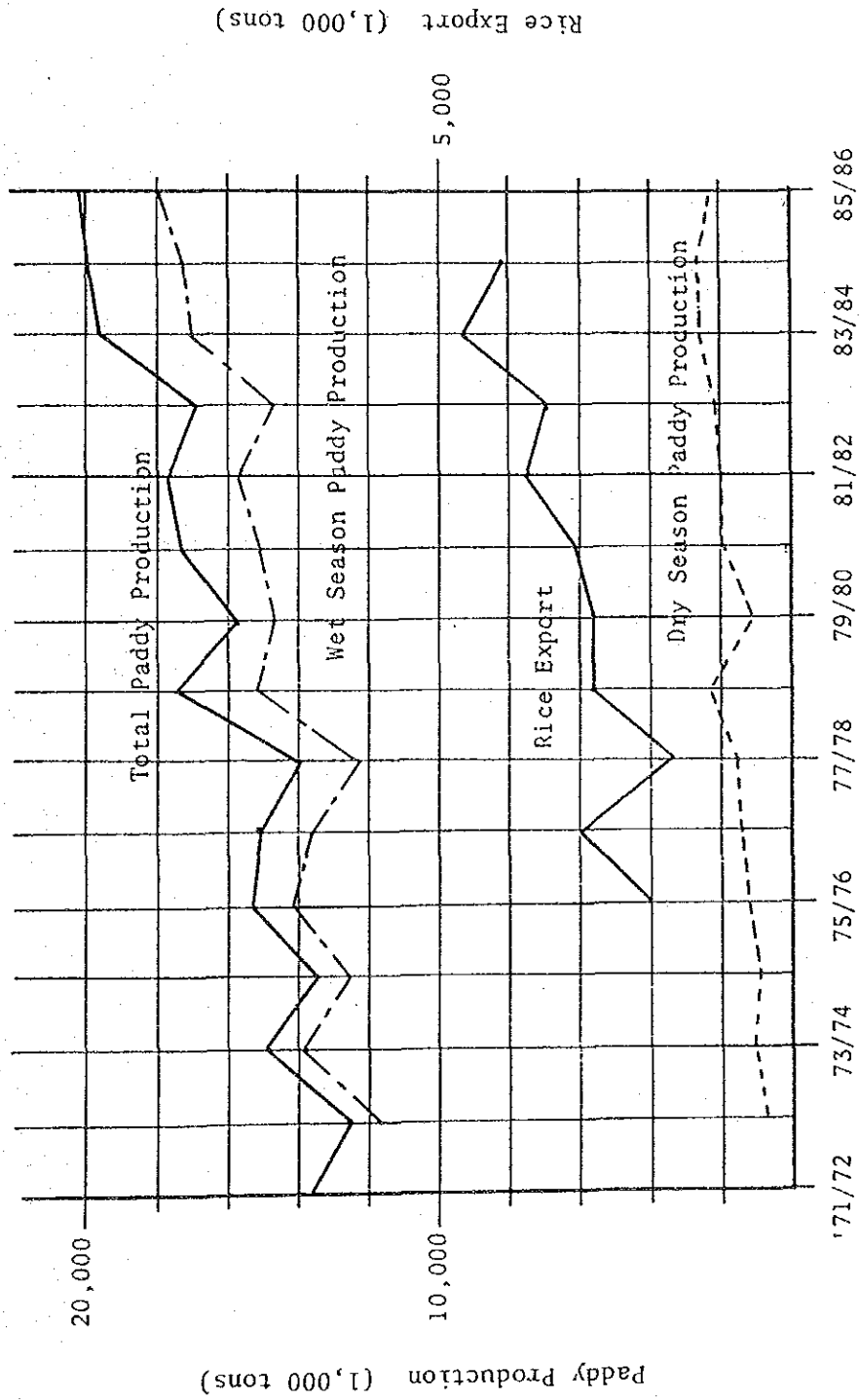
(Unit: 1,000 Tons of Rice)

	1983	1984	1985	1986 ¹	1987 ²
<u>Total Export</u>	11,924	12,558	11,475	12,739	11,855
- U. S. A.	2,331	2,129	1,906	2,401	2,400
- Australia	281	370	450	400	350
- Burma	750	727	450	636	600
- China	580	1,168	1,010	950	900
- Taiwan	533	210	40	169	225
- E. E. C.	846	763	885	1,136	1,045
- India	200	200	200	200	200
- Japan	321	102	-	-	-
- North Korea	250	250	250	250	250
- Pakistan	1,299	1,050	962	1,146	1,100
- Thailand ³	3,476	4,616	4,062	4,524	4,000
- Uruguay	189	155	231	246	230
- Others	868	818	1,029	681	555
<u>Total Import</u>	11,924	12,558	11,475	12,739	11,855
- Bangladesh	82	588	246	90	500
- Brazil	326	-	400	1,250	50
- China	75	100	100	250	600
- Cuba	207	184	200	200	200
- East Europe	291	366	285	290	290
- E. E. C.	1,047	1,246	1,259	1,326	1,090
- Iraq	474	490	475	500	600
- Iran	680	730	600	450	850
- Ivory Coast	434	320	162	351	250
- South Korea	216	7	-	-	-
- Madagascar	185	99	170	150	150
- Malaysia	357	437	480	325	375
- Nigeria	711	400	360	320	325
- Saudi Arabia	491	530	500	500	500
- Senegal	362	375	350	335	360
- United Arab Republic	100	120	130	135	150
- U. S. S. R.	323	150	150	200	200
- Vietnam	30	300	400	500	450
- Others	5,533	6,116	5,208	5,567	4,915

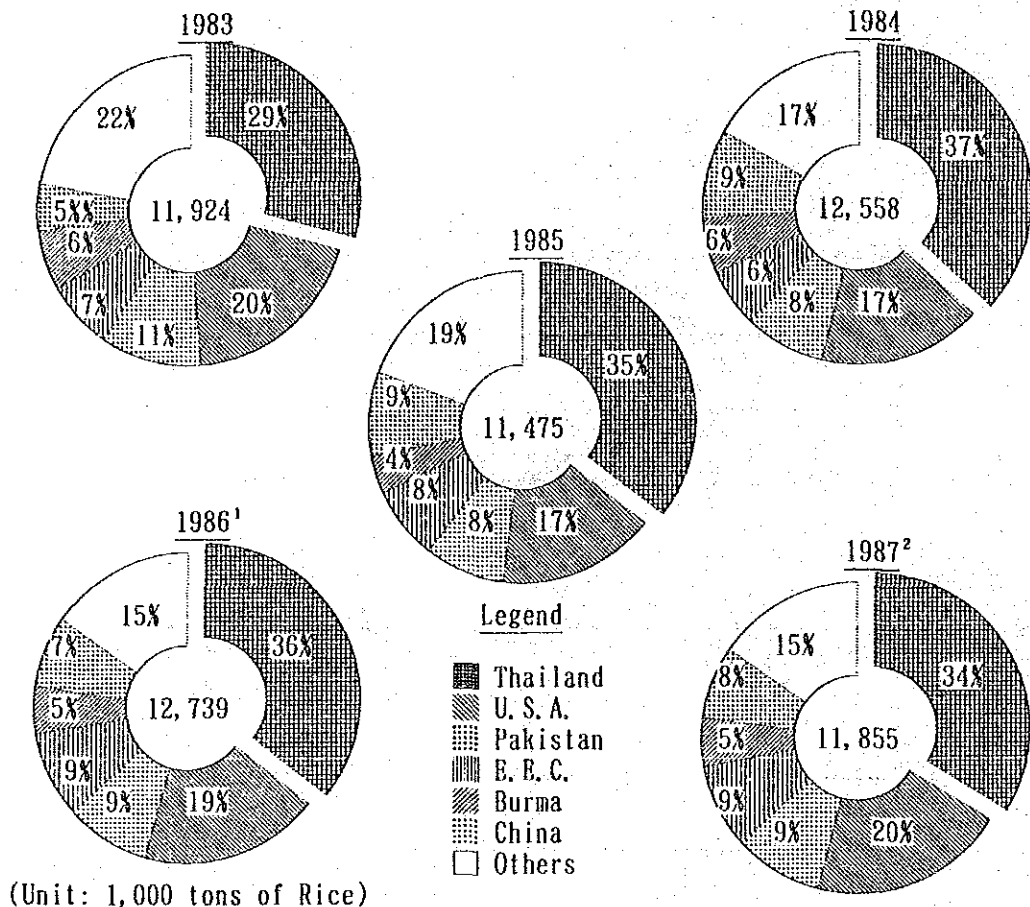
Note: ¹ Preliminary Figure² Estimated Figure³ Customs Department

Data Source: World Grain Situation and Outlook, July 1987

Figure 4-1 Paddy Production and Rice Export in Thailand



Source: Agricultural Statistics of Thailand



(Unit: 1,000 tons of Rice)

Figure 4-2 RICE TRADING IN THE WORLD

¹Preliminary
²Estimated

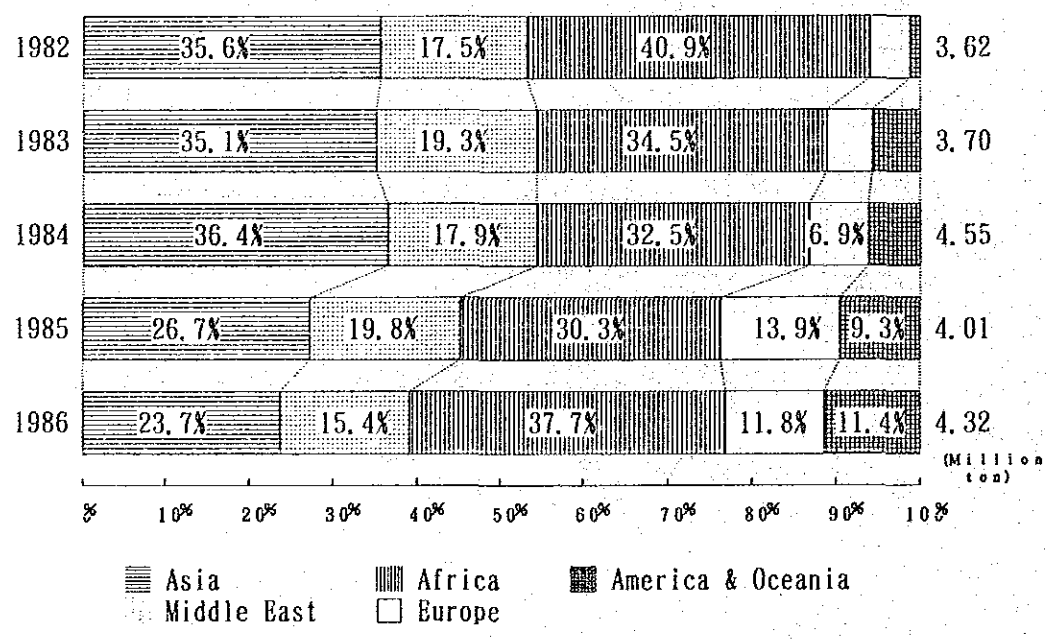


Figure 4-3 EXPORT OF THAI RICE BY MAJOR WORLD REGION

CHAPTER 5 SOCIAL SYSTEM

5.1 Administrative System

5.1.1 Central Level

Thai central administrative organization is composed of the Prime Minister Office and 13 ministries, under which there are about 80 departments. NESDB, Budget Bureau, DTEC and 16 other divisions and departments are in charge of preparing a national development program and budget allocation and the related activities, under the Prime Minister Office (Refer to Figure 5-1).

5.1.2 Local Level

The local administrative system is basically classified into, from top to down, changwat, amphoe, tambon and muban. In the whole Thailand there are 73 changwats as of 1986, and out of which 38 changwats including Bangkok Metropolis are included in the Study Area, with 278 amphoes, 342 sanitary districts and 53 municipalities (Refer to Table 5-1 and Figure 5-2).

5.2 Land Holding System

According to the land reform law of Thailand, the government purchases and compensates for the portion exceeding 50 rai (8 ha) per farm in case of ordinary farm land and 100 rai (16 ha) per farm in case of dairy farm land as land ownership. However, there exist many exceptional measures in the definition of land holding system.

5.3 Education System

Educational system in Thailand is basically divided into three stages, namely a primary one for 7 years, a middle one for 5 years, and an advanced one for 4 years, and the first one is categorized as compulsory system.

The primary education system is further divided into two, a lower school for four years and an upper one for three years. Similarly, the middle education system is done two, a lower school for three years and an upper school for two years in case of a general course, and three years each for both schools in case of a vocational courses. In the advanced education system, there are colleges for two years and a university for four years.

5.4 Taxation System

Taxation system is composed of both direct and indirect taxes, and around 80% of tax revenues depend on the latter. Main taxes are an income tax for an individual and an enterprize, business tax, consumption tax, and custom duties on import and export. In addition, there are a stamp duty, an amusement tax, an advertisement tax, a regional development tax, and a local tax, etc., of which tax rates are mostly low.

Table 5-1 List of Changwats (Provinces) by
Agro-Economics Zone and Region

1. North-Eastern Region

Agro-Economics Zone 1

Nakhon Phanom

Sakon Nakhon

Nong Khai

Udon Thani

Loei

Mukdahan

Agro-Economics Zone 2

Yasothorn

Ubon Ratchathani

Agro-Economics Zone 3

Kalasin

Khon Kaen

Maha Sarakham

Roi Et

Agro-Economics Zone 4

Buri Ram

Si Sa Ket

Surin

Agro-Economics Zone 5

Chaiyaphum

Nakhon Ratchasima

2. Northern Region

Agro-Economics Zone 6

Nakhon Sawan *

Phetchabun *

Uthai Thani *

Agro-Economics Zone 8

Kamphaeng Phet *

Tak *

Phichit *

Phitsanulok *

Agro-Economics Zone 9

Nan *

Phrae *

Lampang *

Sukhothai *

Uttaradit *

Agro-Economics Zone 10

Chiang Mai *

Chiang Rai *

Mae Hong Son *

Lamphun *

Phayao *

3. Central Plain Region

Agro-Economics Zone 7

Lop Buri *

Saraburi *

Agro-Economics Zone 11

Chai Nat *

Nakhon Nayok *

Nakhon Pathom *

Nonthaburi *

Pathum Thani *

Ayutthaya

Sing Buri *

Suphan Buri *

Ang Thong *

Bangkok Metropolis *

Agro-Economics Zone 12

Kanchanaburi *

Prachuap Khiri Khan

Phetchaburi

Ratchaburi

Agro-Economics Zone 13

Chachoengsao *

Prachin Buri

Agro-Economics Zone 14

Samut Prakan *

Samut Sakhon *

Samut Songkhram

Agro-Economics Zone 15

Chon Buri

Rayong

Agro-Economics Zone 16

Chanthaburi

Trat

4. Southern Region

Agro-Economics Zone 17

Chumphon

Nakhon Si Thammarat

Phatthalung

Songkhla

Surat Thani

Agro-Economics Zone 18

Krabi

Trang

Phang-nga

Phuket

Ranong

Satun

Agro-Economics Zone 19

Narathiwat

Pattani

Yala

Note : Changwats marked
by * are included
in the Study Area

Figure 5-1

Organization of Royal Thai Government Ministries

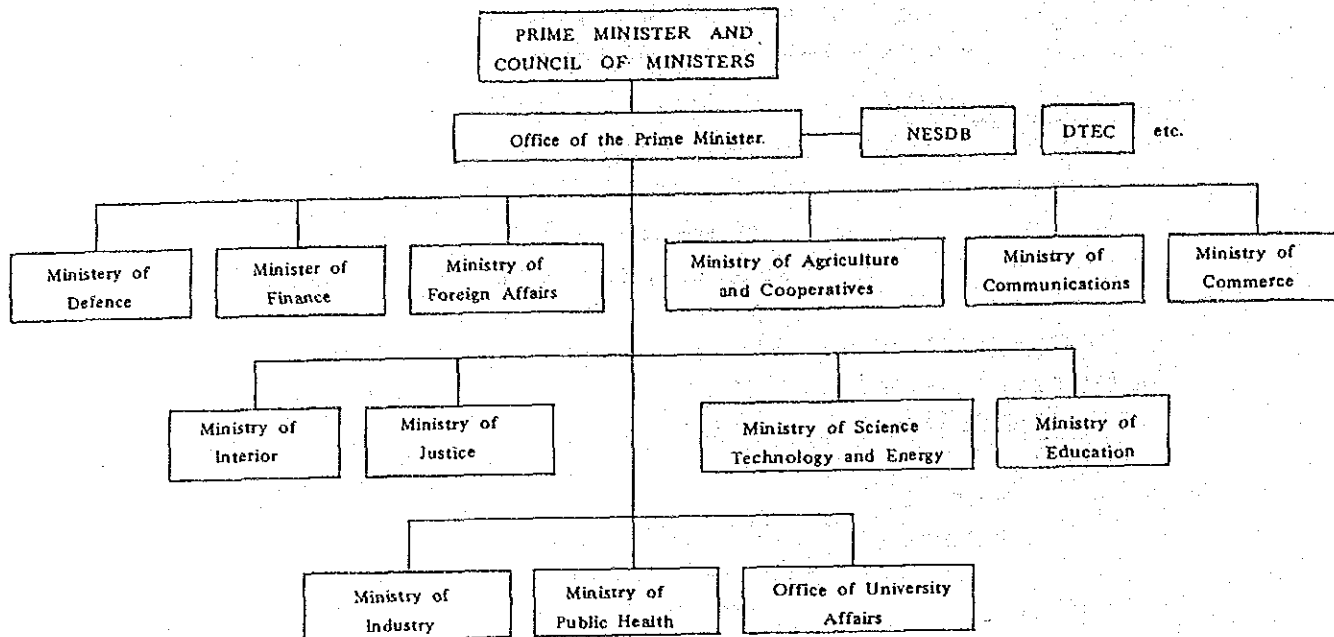


Figure 5-2

Organization Chart of Local Administration in the Study Area

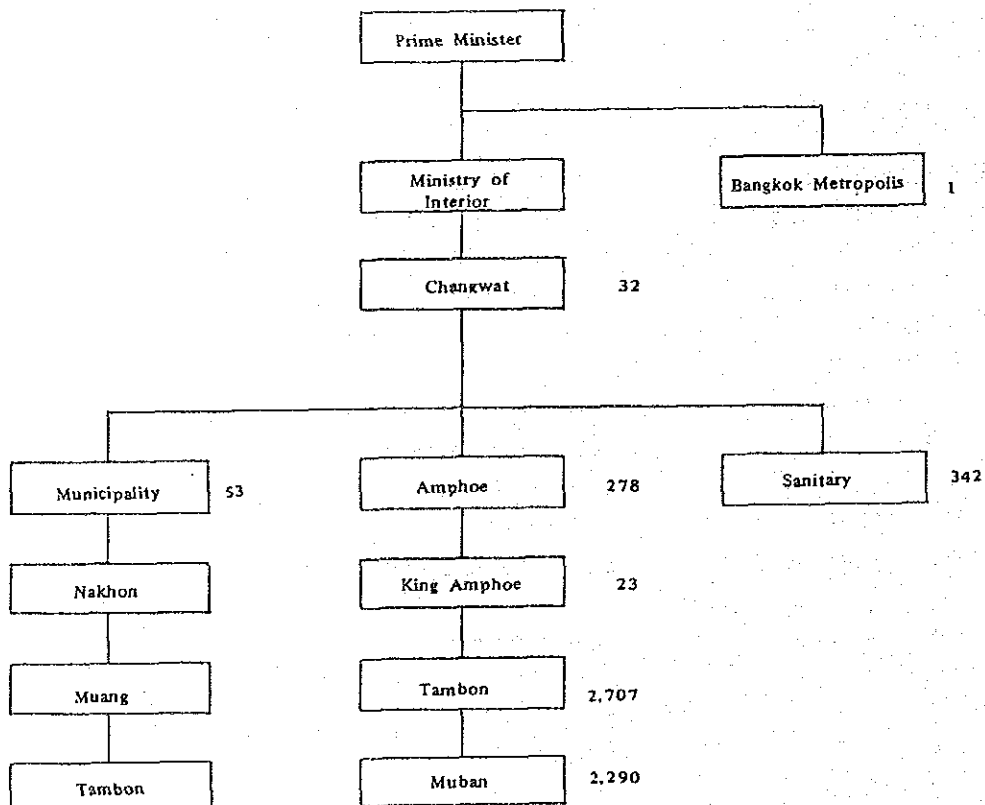


Figure 5-3 Agro-Economic Zone of Thailand

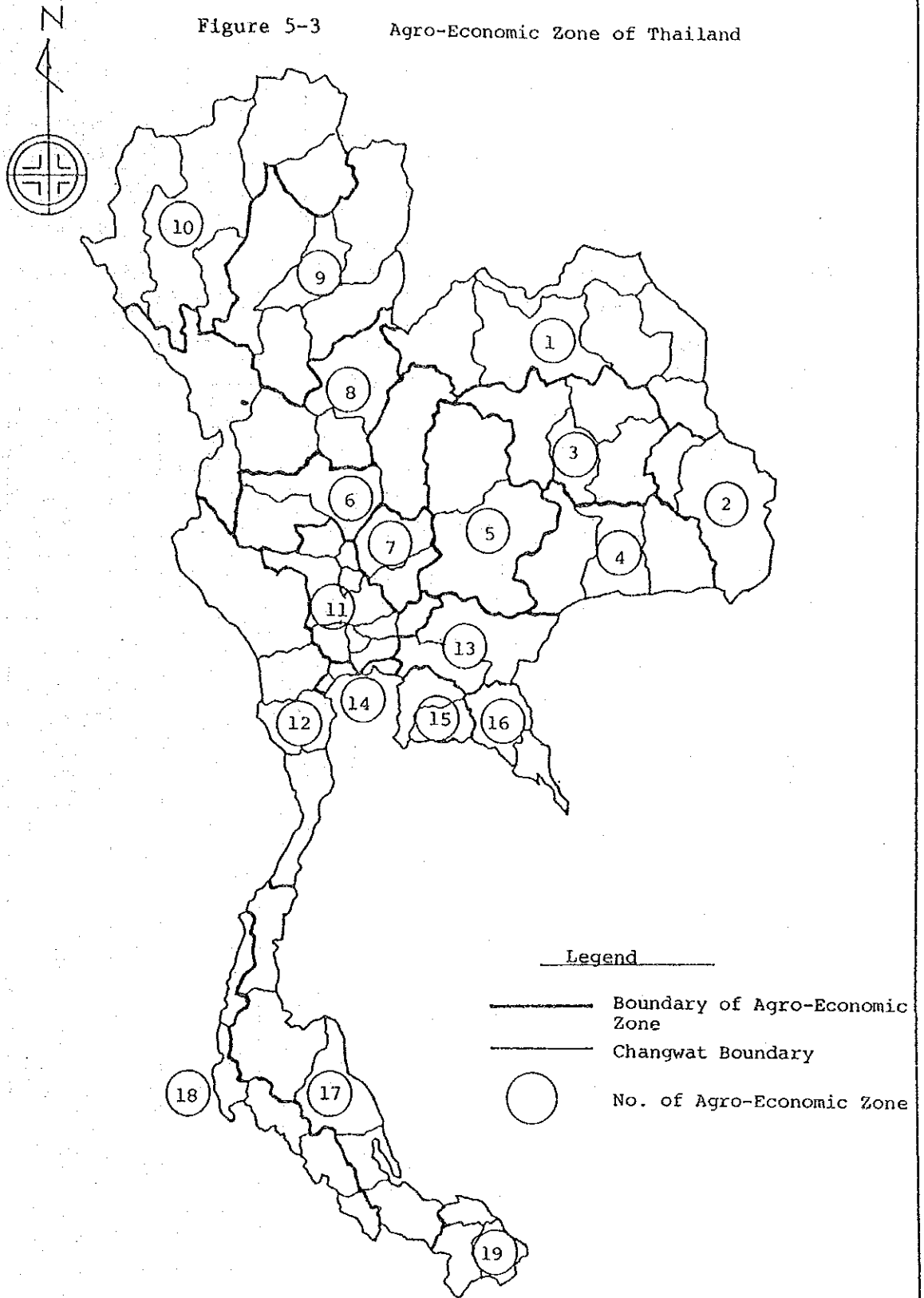
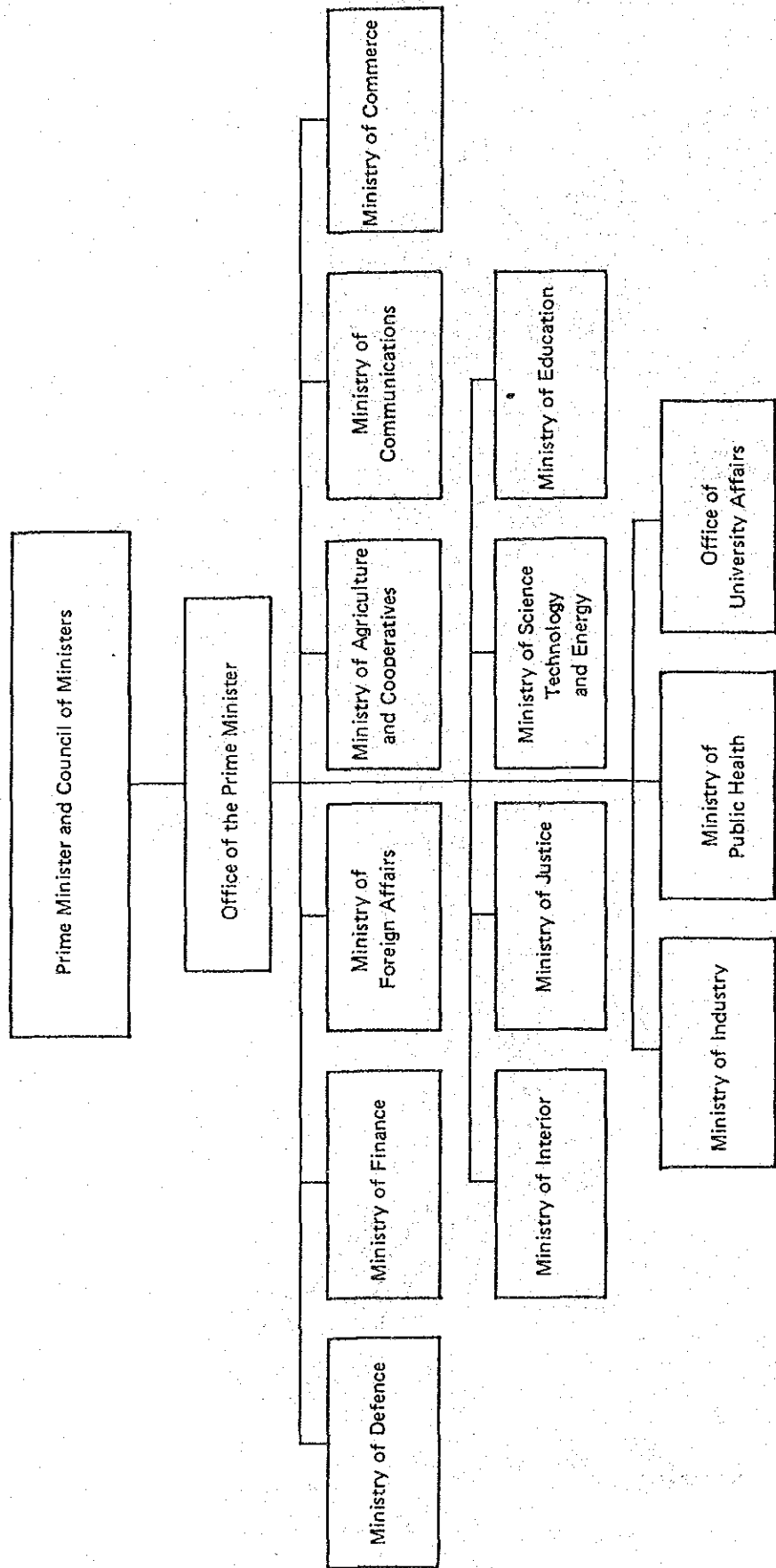


Figure 5-4 The Organizations of the Government of Thailand



CHAPTER 6 DISTRICT DIVISION (ZONING)

6.1 Necessity

The Study Area covers about one third of the whole Kingdom (190,000 sq. km), consisting of full 25 and partial 8 Changwats (Provinces), and plays a quite important role in the national economy. In order to properly clarify different characteristics by certain regions in the Area within a limited time, it has been recognized that division of the Area into several parts under a meaningful demarcation such as administrative boundary, sub-river basin, RID regional boundary, etc., is advantageous.

It is expected that results of this study be helpful and utilized not only to grasp the existing conditions in the Area but also to formulate a proposed cropping pattern appropriate to the selected zone. Furthermore, the regional characteristics obtained through this study shall be applicable for determining the priority of proposed new project implementation as well as establishing a standard and criteria for future investment.

6.2 Changwat Data File and Data Arrangement

Various data and information on agro-socio-economy are usually available in a form of statistics covering the entire Study Area in a consistent manner, which are mostly aggregated and expressed on Changwat basis. The following items have been compiled as a computer file for this study.

- Land Use (1981 - 1985)
- Population and housing (1980 Census)
- Population (1985)
- Cultivation of 9 major crops (1981 - 1986)
(Planted area, harvested area and production)
- Gross regional and provincial products (1981 - 1986)

- Annual irrigated area (1979 - 1985)
- Number of buffalo and cattle (1981 - 1986)
- Rice mills and warehouses (1987)

In order to divide data value of a certain Changwat which extends more than one division, distribution of total land area, farmland, and forest land have been measured by using the available maps, including the mosaic map prepared by the remote sensing, based on which allocation of the data value has been made in accordance with the nature of such data.

6.3 Preliminary Results

The district division has been, mainly, carried out on the basis of RID regional boundary and the existing irrigation project in the Chao Phraya Delta. Some of the results have been incorporated in the several component of this Master Plan Study, of which rather important ones are compiled in the following.

Table 6-1 GENERAL INFORMATION OF CHAO PHRAYA DELTA

Item Code	Project Area (ha)	Irrigable Area (ha)	Population in 1985	No. of Household (1980)		Population (1980)	
				Total	Agricultural	Total	Agricultural
1 PT	16,480	15,411	35,985	7,072	4,582	33,715	22,644
2 TB	34,960	28,698	69,326	12,873	8,246	63,730	42,173
3 SA	59,520	48,800	144,919	26,151	16,550	132,001	86,209
4 DC	26,000	23,112	62,376	11,223	7,140	56,755	37,249
5 PA	66,560	59,200	174,653	31,424	19,993	158,913	104,298
6 BO	64,800	58,400	149,317	29,235	17,963	139,037	88,766
7 CH	84,320	75,888	247,106	49,263	25,512	231,464	124,550
8 YM	37,360	37,260	110,856	22,067	11,201	104,484	54,994
9 PK	32,960	32,960	92,282	17,037	7,384	85,012	38,906
10 BB	25,600	23,072	69,758	12,889	5,013	64,327	26,635
11 CB	70,080	64,960	199,892	36,489	18,124	183,219	95,354
12 PB	76,240	70,000	449,640	66,506	23,014	362,066	130,895
13 PM	45,680	41,825	455,029	63,858	19,682	352,266	112,900
14 PC	56,000	32,000	1,594,634	266,014	13,648	1,387,173	80,375
RID 07	696,560	611,586	3,855,773	652,101	198,052	3,354,162	1,045,948
15 MA	42,240	37,760	87,772	16,763	10,757	81,063	53,759
16 CK	46,800	46,786	139,048	24,070	14,116	116,387	70,131
17 KT	39,360	35,227	120,501	20,878	10,933	102,795	55,516
18 RR	31,040	29,282	100,491	18,098	7,621	90,848	40,328
19 MH	80,480	76,208	225,787	42,342	21,749	202,244	107,802
20 TL	43,520	38,496	129,374	23,363	9,753	117,207	51,637
21 NR	74,000	72,640	225,598	35,846	12,677	189,539	71,051
22 NL	48,320	42,728	111,659	20,617	7,996	102,946	42,523
23 SR	92,480	92,468	1,358,071	228,851	21,091	1,187,248	118,002
24 KD	91,040	84,468	3,220,821	532,809	20,338	2,754,700	119,994
RID 08	589,280	556,063	5,719,122	963,637	137,031	4,944,977	730,743
25 PO	81,600	81,600	414,530	63,181	19,612	327,230	108,565
RID 09	81,600	81,600	414,530	63,181	19,612	327,230	108,565
Total	1,367,440	1,249,249	9,989,425	1,678,919	354,695	8,626,369	1,885,256

Table 6-2 GROSS REGIONAL & PROVINCIAL PRODUCTS IN DELTA (1985)

(Unit: Million Bahts)

Item Code	Agricultural Sector					Non- Agricultural Sector	Gross Provincial Products
	Crop	Livestock	Fishery	Forestry	Total		
1 PT	165	17	6	18	206	346	552
2 TB	307	38	11	13	369	659	1,028
3 SA	625	85	22	3	735	1,377	2,112
4 DC	272	36	9	1	318	591	909
5 PA	763	101	26	4	894	1,652	2,546
6 BO	634	70	23	50	777	1,531	2,308
7 CH	693	160	35	1	889	2,851	3,740
8 YM	274	82	18	-	374	1,241	1,615
9 PK	199	32	23	-	254	943	1,197
10 BB	117	18	19	-	154	723	877
11 CB	575	81	44	2	702	1,988	2,690
12 PB	1,172	187	69	-	1,428	8,773	10,201
13 PM	1,008	176	44	-	1,228	6,807	8,035
14 PC	583	360	423	-	1,366	107,564	108,930
<u>RID 07</u>	<u>7,387</u>	<u>1,443</u>	<u>772</u>	<u>92</u>	<u>9,694</u>	<u>137,046</u>	<u>146,740</u>
15 MA	364	41	12	26	443	817	1,260
16 CK	470	73	12	-	555	1,406	1,961
17 KT	370	66	13	1	450	1,551	2,001
18 RR	247	50	15	1	313	1,621	1,934
19 MH	650	106	34	5	795	2,482	3,277
20 TL	307	61	21	1	390	2,007	2,397
21 NR	607	58	68	0	733	8,751	9,484
22 NL	188	29	31	0	248	1,154	1,402
23 SR	821	328	129	1	1,279	89,082	90,361
24 KD	876	645	715	-	2,236	225,131	227,367
<u>RID 08</u>	<u>4,900</u>	<u>1,457</u>	<u>1,050</u>	<u>35</u>	<u>7,442</u>	<u>334,002</u>	<u>341,444</u>
25 PO	757	190	479	2	1,428	16,507	17,935
<u>RID 09</u>	<u>757</u>	<u>190</u>	<u>479</u>	<u>2</u>	<u>1,428</u>	<u>16,507</u>	<u>17,935</u>
Total	13,044	3,090	2,301	129	18,564	487,555	506,119

Table 6-3 LAND USE IN CHAO PHRAYA DELTA (1985)

(Unit: 1,000ha)

	Farm Land					Forest	Others	Total
	Paddy	Upland	Fruits	Others	Sub-total			
1 PT	15,298	2,290	577	542	18,707	102	7,377	26,186
2 TB	25,995	8,132	887	1,366	36,380	3,650	8,589	48,619
3 SA	50,198	20,595	1,604	3,179	75,576	11,179	11,587	98,342
4 DC	21,722	9,101	691	1,382	32,896	4,941	5,030	42,867
5 PA	60,820	25,482	1,935	3,872	92,109	13,834	14,085	120,028
6 BO	57,963	8,886	2,132	2,478	71,459	1,520	23,692	96,671
7 CH	71,218	2,433	2,614	3,894	80,159	871	13,983	95,013
8 YM	31,234	217	1,153	1,561	34,165	-	6,086	40,251
9 PK	28,672	2,435	801	1,302	33,210	1,173	5,983	40,366
10 BB	21,265	255	566	872	22,958	-	4,338	27,296
11 CB	64,817	13,377	1,883	3,357	83,434	7,041	14,077	104,552
12 PB	59,165	10,708	10,082	6,137	86,092	247	34,147	120,486
13 PM	35,114	10,195	6,961	4,673	56,943	-	32,624	89,567
14 PC	23,803	3,047	5,335	4,526	36,711	-	46,540	83,251
<u>RID 07</u>	567,284	117,153	37,221	39,141	760,799	44,558	228,138	1,033,495
15 MA	37,114	10,180	1,245	1,586	50,125	3,216	16,789	70,130
16 CK	38,543	44,399	1,213	2,873	87,028	5,644	25,411	118,083
17 KT	31,564	32,124	1,146	2,644	67,478	3,424	21,887	92,789
18 RR	27,145	10,206	1,089	2,212	40,652	928	14,379	55,959
19 MH	65,354	26,564	2,156	3,864	97,938	2,812	24,001	124,751
20 TL	35,429	11,787	1,364	2,718	51,298	1,067	17,395	69,760
21 NR	57,733	84	10,725	3,910	72,452	-	16,938	89,390
22 NL	34,063	410	903	1,396	36,772	-	6,949	43,721
23 SR	78,986	8,769	10,456	6,857	105,068	26,357	48,559	179,984
24 KD	52,346	1,974	9,079	8,514	71,913	3,650	88,187	163,750
<u>RID 08</u>	458,277	146,497	39,376	36,574	680,724	47,098	280,495	1,008,317
25 PO	72,621	27,612	11,317	8,749	120,299	53,269	68,688	242,256
<u>RID 09</u>	72,621	27,612	11,317	8,749	120,299	53,269	68,688	242,256
Total	1,098,182	291,262	87,914	84,464	1,561,822	144,925	577,321	2,284,068

(As of 06/1/89)

Table 6-4 CROP PRODUCTION DATA IN THE DELTA (Second Rice)

	1981			1986			Average Yield (kg/ha)
	Planted Area (ha)	Production (ton)	Yield (kg/ha)	Planted Area (ha)	Production (ton)	Yield (kg/ha)	
1 PT	2,478	9,987	4,030	4,635	17,549	3,786	3,871
2 TB	5,001	22,037	4,407	8,782	35,281	4,017	4,159
3 SA	10,874	49,792	4,579	18,029	74,674	4,142	4,306
4 DC	4,608	21,170	4,594	7,830	32,449	4,144	4,311
5 PA	12,903	59,276	4,594	21,925	90,858	4,144	4,311
6 BO	11,847	47,809	4,036	17,149	67,197	3,918	3,966
7 CH	27,962	114,805	4,106	19,455	81,224	4,175	4,134
8 YM	12,371	51,529	4,165	8,700	35,408	4,070	4,126
9 PK	4,831	18,878	3,908	6,402	25,753	4,023	3,973
10 BB	3,116	11,329	3,636	4,006	15,899	3,969	3,823
11 CB	11,462	47,902	4,179	17,510	71,449	4,080	4,120
12 PB	35,826	155,850	4,350	39,396	160,524	4,075	4,206
13 PM	28,569	123,471	4,322	34,469	140,469	4,075	4,187
14 PC	12,848	39,697	3,090	9,619	33,869	3,521	3,274
RID 07	184,696	773,532	4,188	217,907	882,603	4,050	4,114
15 MA	4,200	16,819	4,005	7,246	27,497	3,795	3,872
16 CK	3,265	11,669	3,574	2,988	11,922	3,990	3,773
17 KT	2,285	7,938	3,474	2,830	10,873	3,842	3,678
18 RR	2,812	10,190	3,624	3,648	14,225	3,899	3,779
19 MH	15,256	59,451	3,897	12,333	51,046	4,139	4,005
20 TL	3,843	13,924	3,623	4,986	19,495	3,910	3,785
21 NR	32,205	148,543	4,612	26,595	107,127	4,028	4,348
22 NL	4,924	17,839	3,623	6,389	25,357	3,969	3,818
23 SR	28,211	107,621	3,815	23,103	81,998	3,549	3,695
24 KD	23,041	75,563	3,280	17,893	52,972	2,960	3,140
RID 08	120,042	469,557	3,912	108,011	402,512	3,727	3,824
25 PO	22,842	77,398	3,388	28,057	88,407	3,151	3,258
RID 09	22,842	77,398	3,388	28,057	88,407	3,151	3,258
Total	327,580	1,320,487	4,031	353,975	1,373,522	3,880	3,953

Note: All figures are derived from "Changwat Data File"

Table 6-5 CROP PRODUCTION DATA IN THE DELTA (Major Rice)

	1981			1986			Average Yield (kg/ha)
	Planted Area (ha)	Production (ton)	Yield (kg/ha)	Planted Area (ha)	Production (ton)	Yield (kg/ha)	
1 PT	12,296	30,432	2,475	15,208	40,302	2,650	2,572
2 TB	17,235	41,758	2,423	19,706	53,173	2,698	2,570
3 SA	29,063	69,049	2,376	30,683	84,152	2,743	2,564
4 DC	12,413	29,481	2,375	13,130	36,108	2,750	2,568
5 PA	34,757	82,547	2,375	36,764	101,102	2,750	2,568
6 BO	48,100	123,878	2,575	55,773	151,705	2,720	2,653
7 CH	68,840	180,923	2,628	67,198	182,851	2,721	2,674
8 YM	29,450	72,334	2,456	29,052	74,625	2,569	2,512
9 PK	23,210	49,943	2,152	22,823	54,258	2,377	2,264
10 BB	18,259	38,436	2,105	17,733	40,927	2,308	2,205
11 C	46,747	103,115	2,206	46,927	116,529	2,483	2,345
12 PB	42,276	98,810	2,337	48,198	138,184	2,867	2,619
13 PM	16,288	43,145	2,649	31,622	92,485	2,925	2,831
14 PC	20,022	48,334	2,414	19,824	42,726	2,155	2,285
RID 07	418,956	1,012,185	2,416	454,641	1,209,127	2,660	2,543
15 MA	30,365	69,388	2,285	35,136	82,655	2,352	2,321
16 CK	32,694	82,836	2,534	34,153	76,459	2,239	2,383
17 KT	26,965	64,456	2,390	27,908	64,419	2,308	2,349
18 RR	24,276	52,298	2,154	24,141	58,844	2,438	2,296
19 MH	60,421	156,035	2,582	60,392	155,009	2,567	2,575
20 TL	31,532	67,744	2,148	31,272	75,767	2,423	2,285
21 NR	54,575	120,394	2,206	40,981	125,947	3,073	2,578
22 NL	29,229	61,464	2,103	28,383	65,458	2,306	2,203
23 SR	71,372	151,224	2,119	63,342	157,884	2,493	2,295
24 KD	43,769	120,612	2,756	37,067	82,569	2,228	2,513
RID 08	405,198	946,451	2,336	382,775	945,011	2,469	2,400
25 PO	68,360	163,838	2,397	66,880	163,911	2,451	2,423
RID 09	68,360	163,838	2,397	66,880	163,911	2,451	2,423
Total	892,514	2,122,474	2,378	904,296	2,318,049	2,563	2,471

Note: All figures are derived from "Changwat Data File"

Table 6-6

CROP PRODUCTION DATA

Crop: Maize

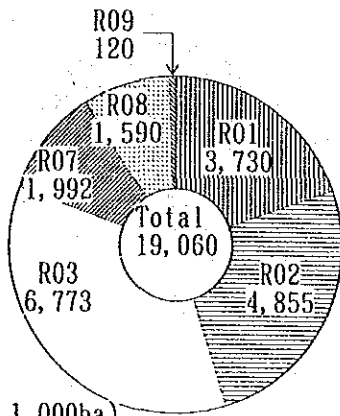
	1981			1986			Average Yield (kg/ha)
	Planted Area (ha)	Production (ton)	Yield (kg/ha)	Planted Area (ha)	Production (ton)	Yield (kg/ha)	
1 PT	365	783	2,145	567	844	1,489	1,746
2 TB	724	1,418	1,959	1,193	1,950	1,635	1,757
3 SA	1,496	2,787	1,863	2,536	4,323	1,705	1,763
4 DC	661	1,232	1,864	1,121	1,911	1,705	1,764
5 PA	1,852	3,449	1,862	3,139	5,350	1,704	1,763
6 BO	1,189	2,502	2,104	1,869	2,842	1,521	1,748
7 CH	137	260	1,898	228	382	1,675	1,759
8 YM	-	-	-	-	-	-	-
9 PK	157	293	1,866	266	454	1,707	1,766
10 BB	-	-	-	-	-	-	-
11 CB	942	1,755	1,863	1,597	2,723	1,705	1,764
12 PB	33	62	1,879	56	96	1,714	1,775
13 PM	-	-	-	-	-	-	-
14 PC	-	-	-	-	-	-	-
RID 07	7,556	14,541	1,924	12,572	20,875	1,660	1,760
15 MA	5,058	11,764	2,326	5,710	11,894	2,083	2,197
16 CK	30,025	74,448	2,480	30,713	53,986	1,758	2,115
17 KT	23,562	58,245	2,472	23,772	46,578	1,959	2,215
18 RR	9,993	24,249	2,427	9,739	26,285	2,699	2,561
19 MH	17,278	42,929	2,485	17,676	30,611	1,732	2,104
20 TL	11,492	27,886	2,427	11,200	30,228	2,699	2,561
21 NR	-	-	-	-	-	-	-
22 NL	-	-	-	-	-	-	-
23 SR	142	280	1,972	526	1,437	2,732	2,570
24 KD	17	24	1,412	117	321	2,744	2,575
RID 08	97,567	239,825	2,458	99,453	201,340	2,024	2,239
25 PO	252	344	1,365	1,712	4,680	2,734	2,558
RID 09	252	344	1,365	1,712	4,680	2,734	2,558
Total	105,375	254,710	2,417	113,737	226,895	1,995	2,198

Note: All figures are derived from "Changwat Data File"

Figure 7-1 DISTRICT DIVISION BY R.I.D. REGIONAL BOUNDARY
(13 sheets)

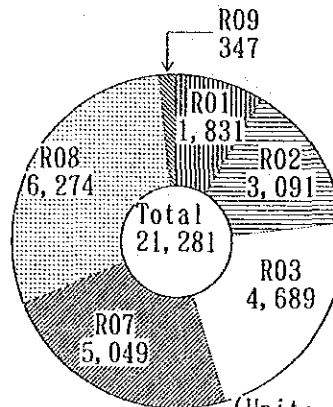
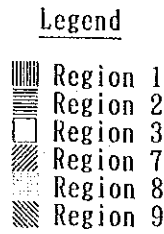
1. General Feature

(1) Occupied Area



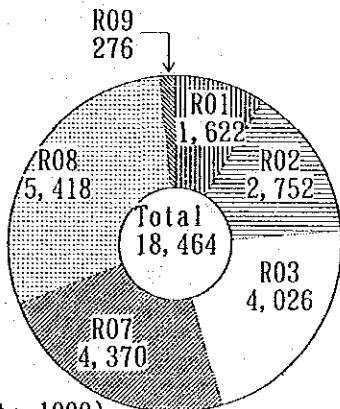
(Unit: 1,000ha)

(2) Total Population (1985)



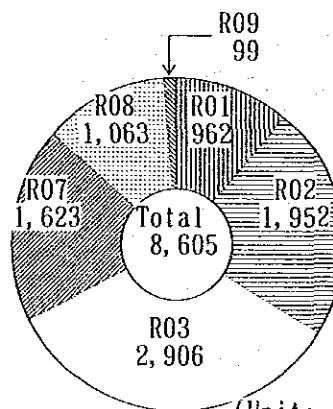
(Unit: 1,000)

(3) Total Population (1980)



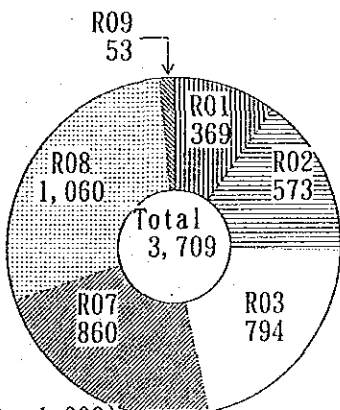
(Unit: 1000)

(4) Agricultural Population (1980)



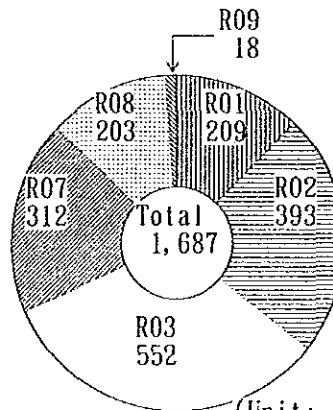
(Unit: 1,000)

(5) Total Household (1980)



(Unit: 1,000)

(6) Agricultural Household (1980)

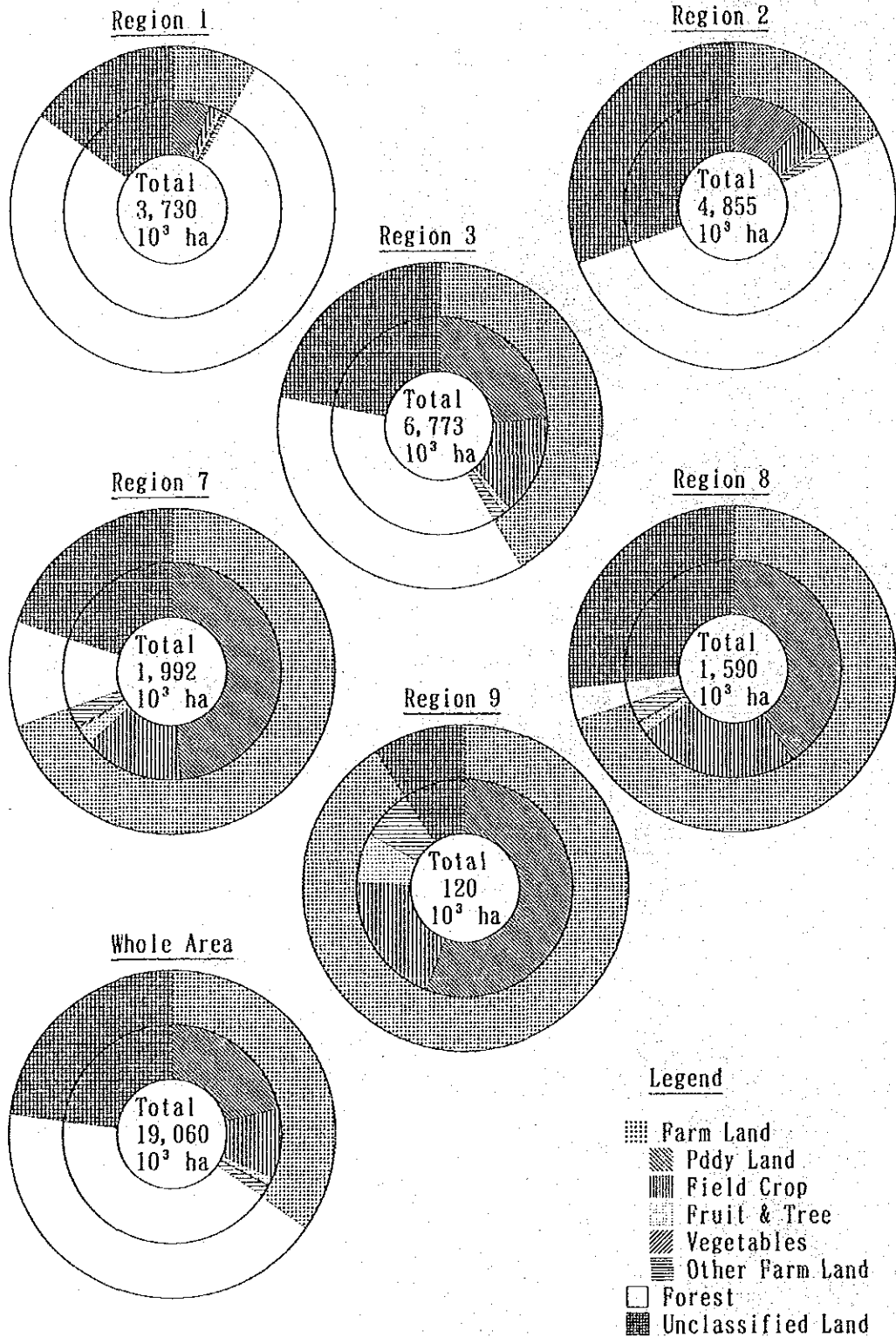


(Unit: 1,000)

Note: The Master Plan Study Area covers a part (about 3.3%) of the jurisdiction of RID Regional Office No. 9.

DISTRICT DIVISION BY RID REGIONAL BOUNDARY
(Master Plan Study Area - 13 sheets)

2. Land Use Pattern by Related RID Regional Offices



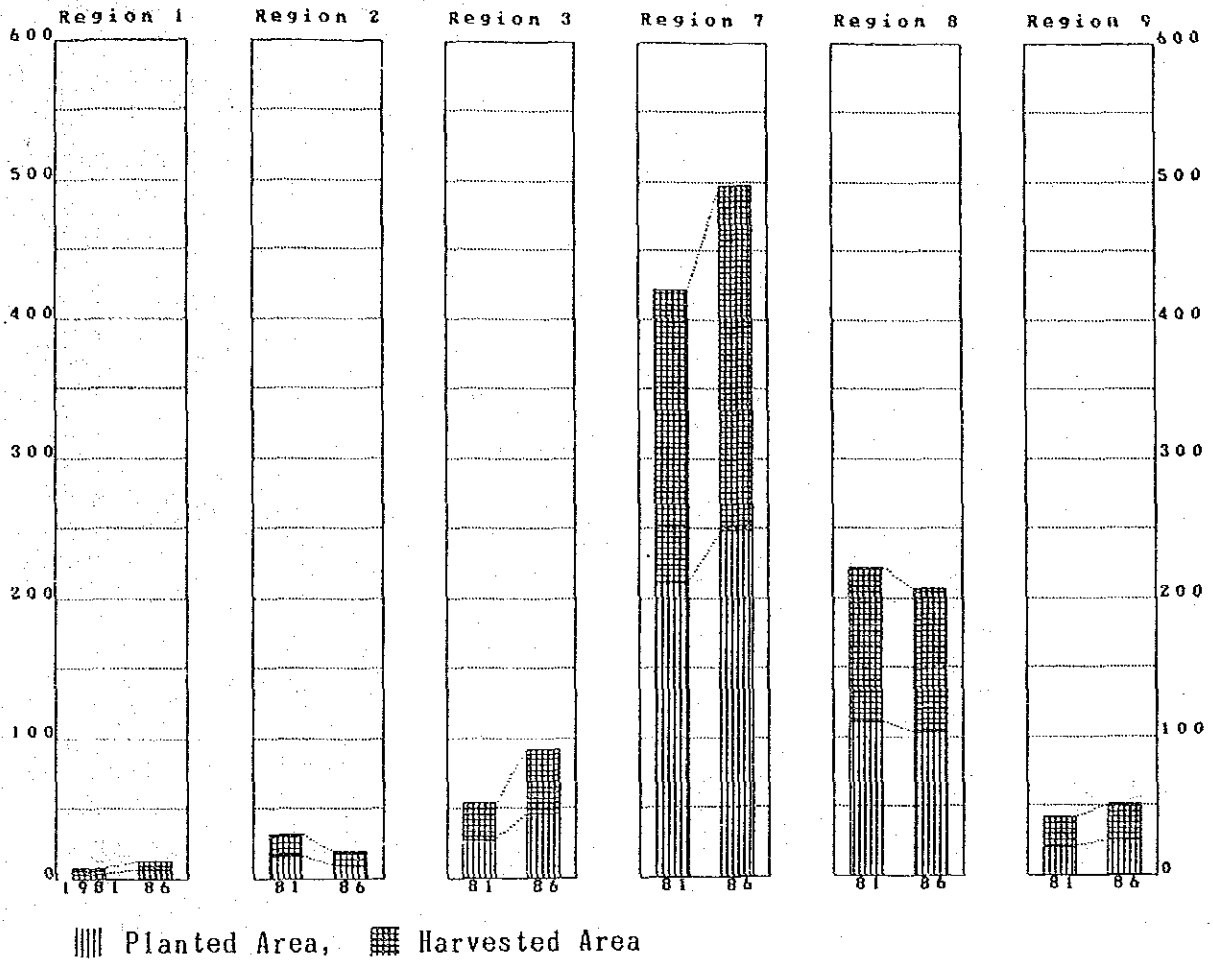
Note: The Master Plan Study Area covers only a part (about 3.3%) of the jurisdiction of RID Regional Office No. 9.

3. Crop Production

(1) Second Rice

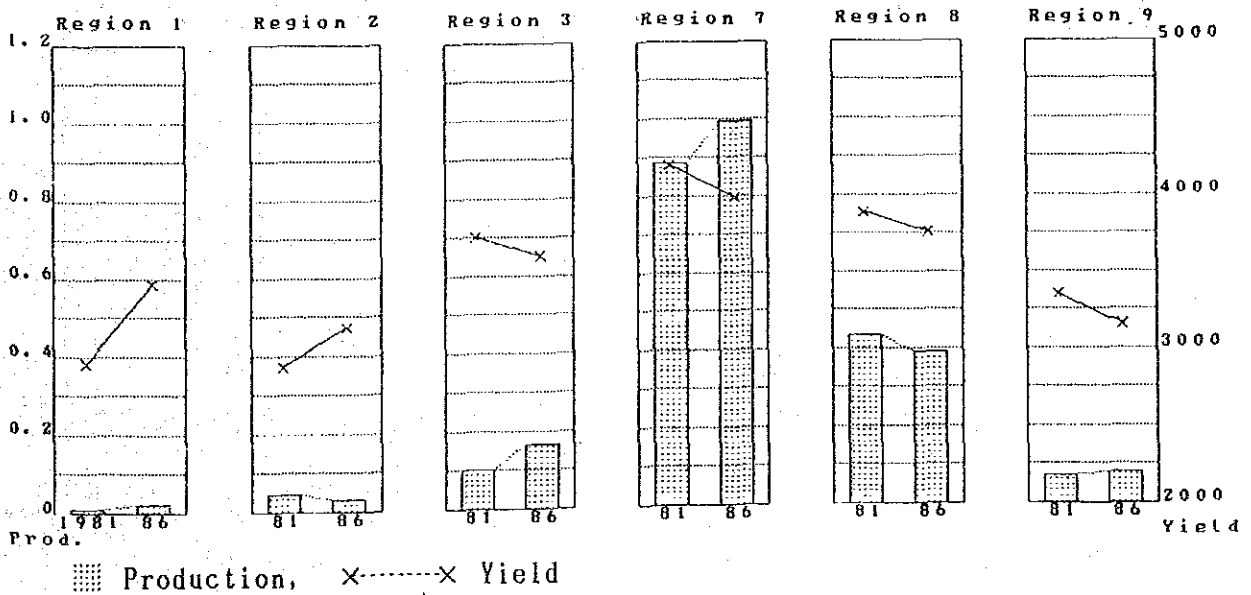
(a) Planted and Harvested Area

(Unit: 1,000ha)



(b) Production and Yield

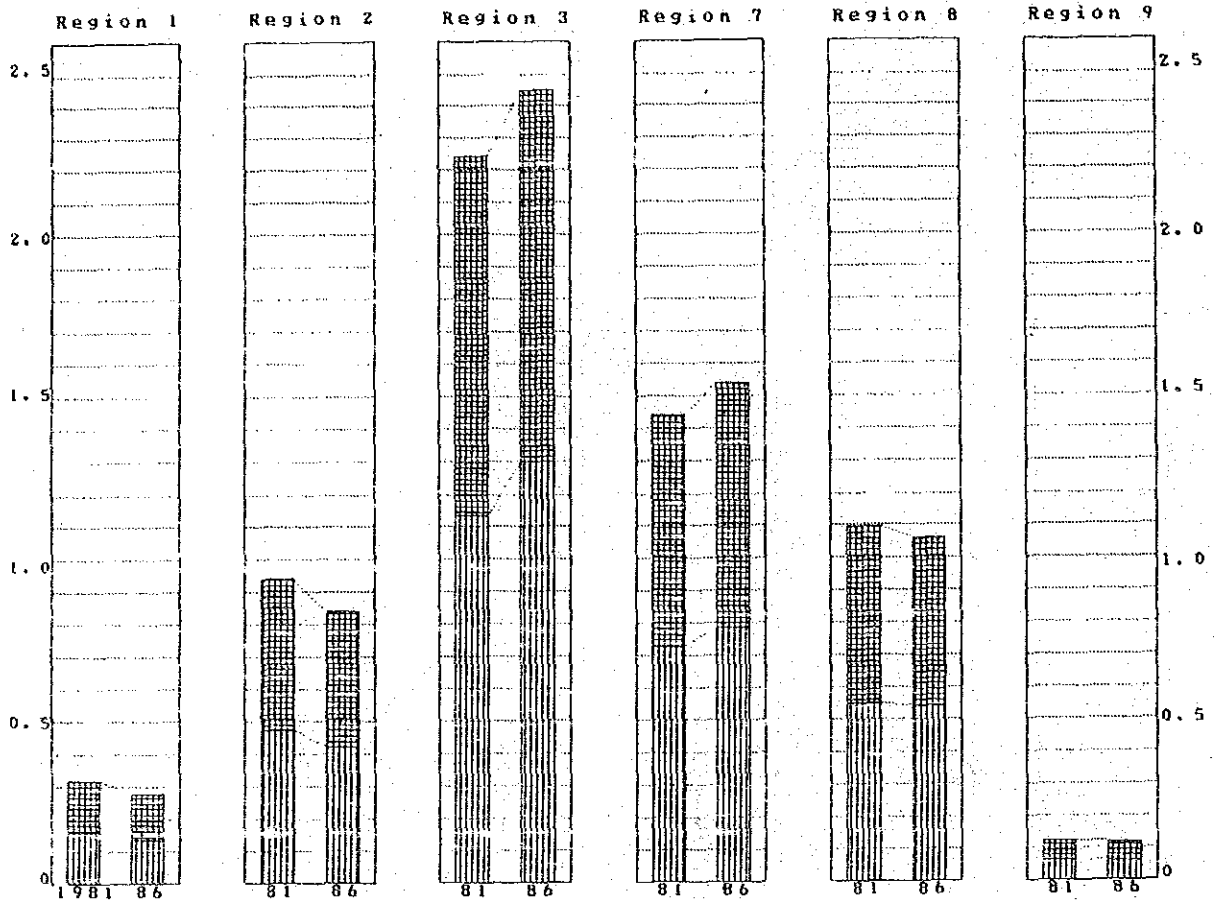
(Unit: Production in million ton; Yield in Kg/ha)



(2) Major Rice (Wet Season)

(a) Planted and Harvested Area

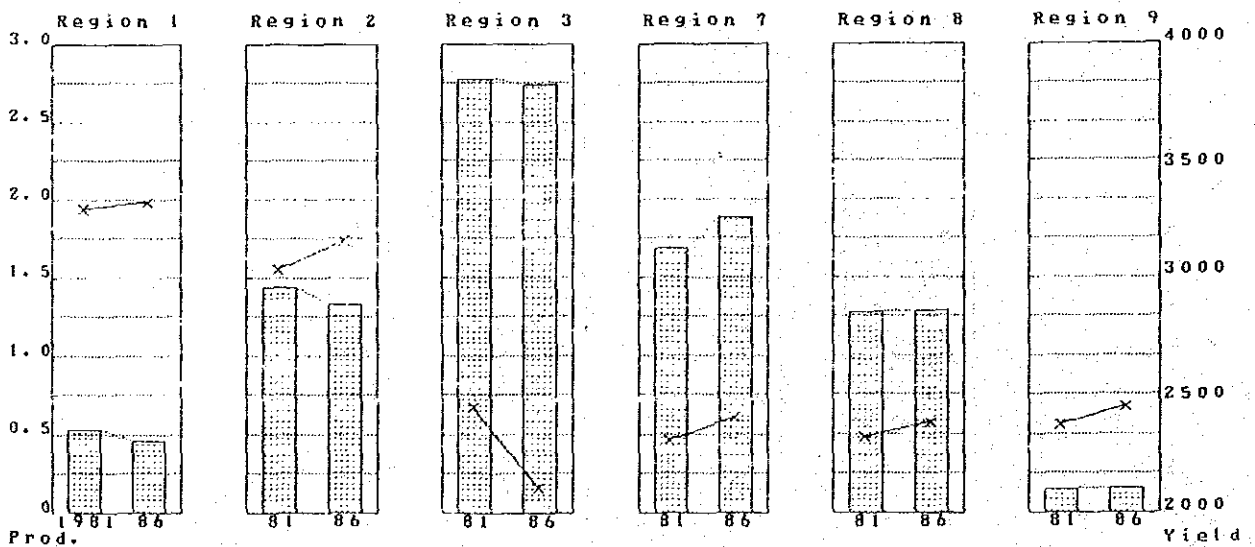
(Unit: Million ha)



Planted Area, Harvested Area

(b) Production and Yield

(Unit: Production in million tons, Yield in Kg/ha)

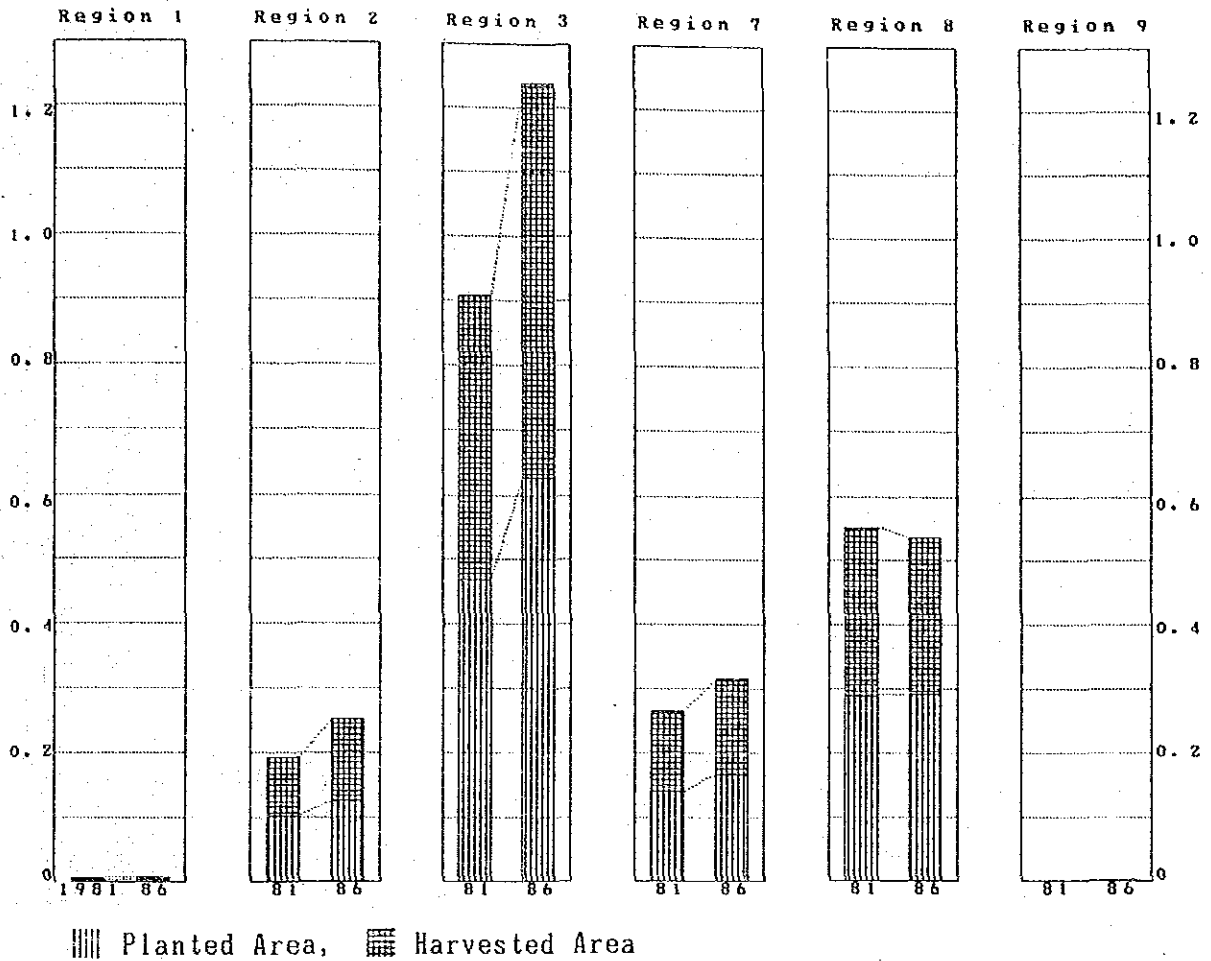


Production, Yield

(3) Maize

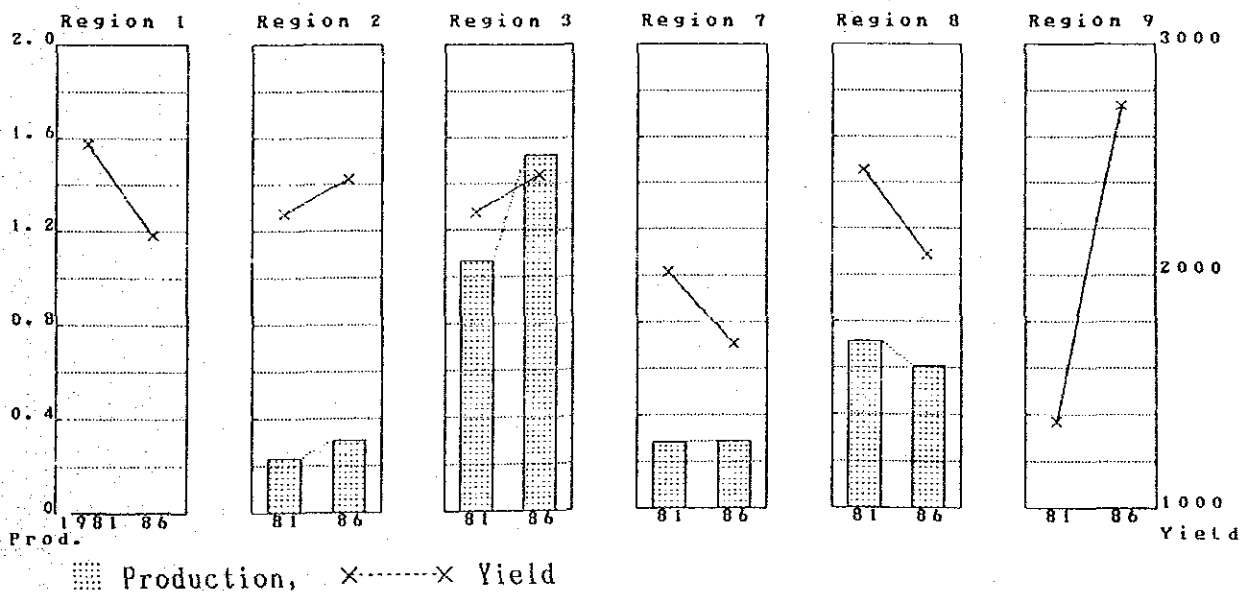
(a) Planted and Harvested Area

(Unit: Million ha)



(b) Production and Yield

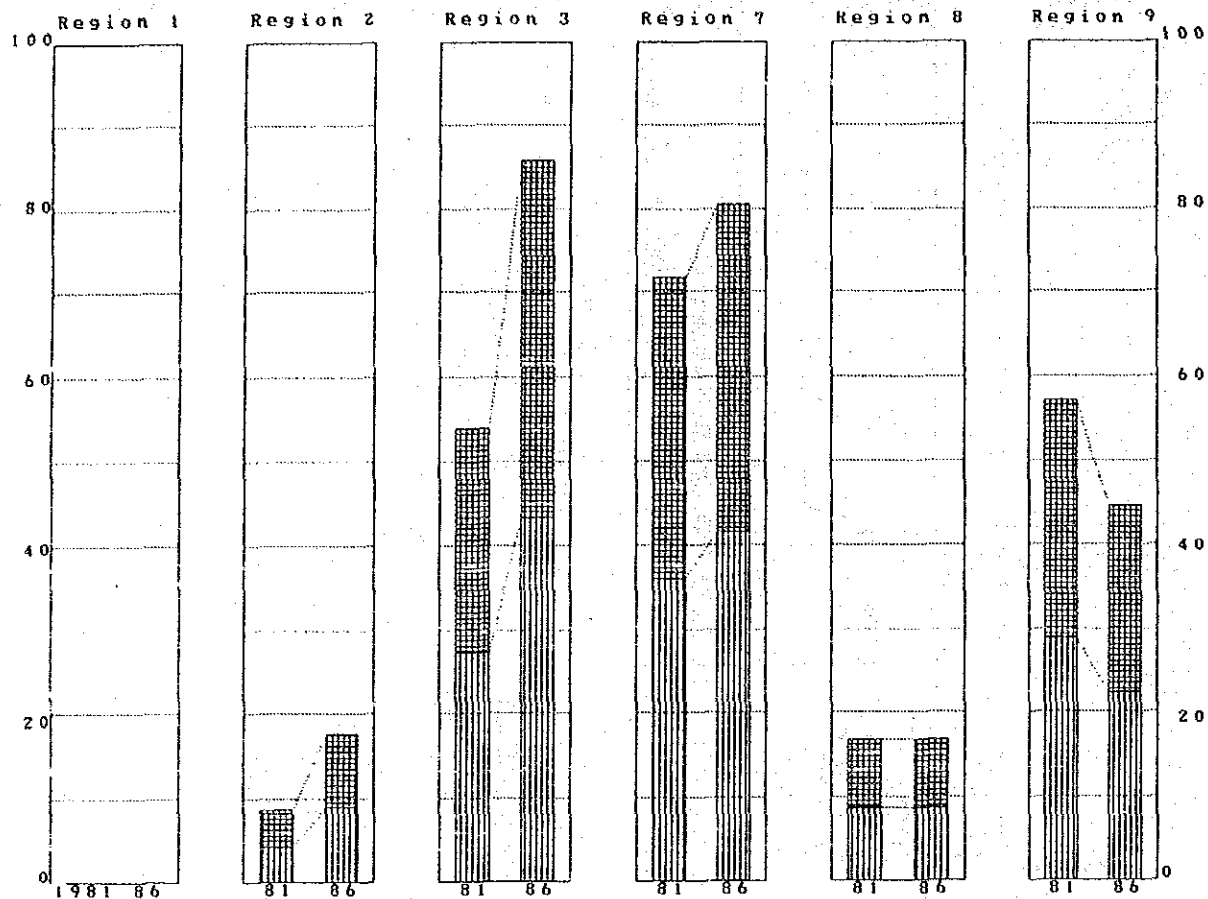
(Unit: Production in million ton, Yield in Kg/ha)



(4) Cassava

(a) Planted and Harvested Area

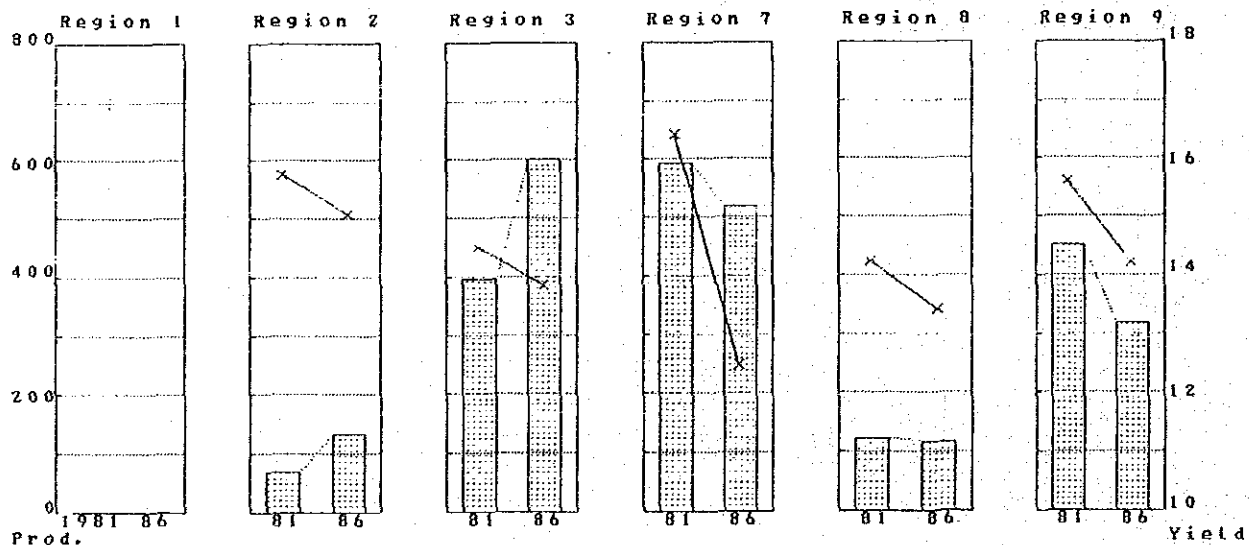
(Unit: 1,000ha)



||||| Planted Area, ■■■ Harvested Area

(b) Production and Yield

(Unit: Production in 1,000 ton, Yield in ton/ha)

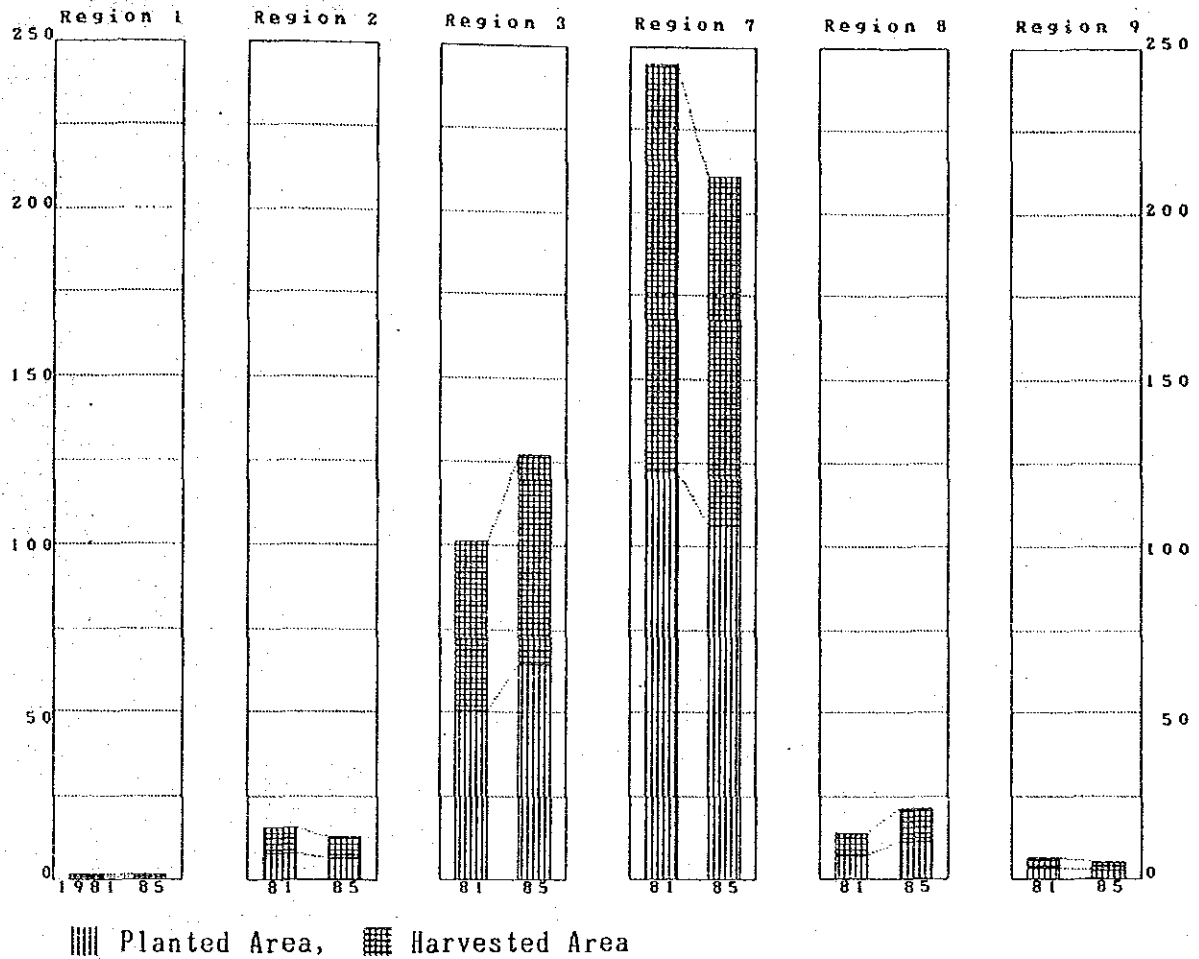


■■■ Production, ×-----× Yield

(5) Sugarcane

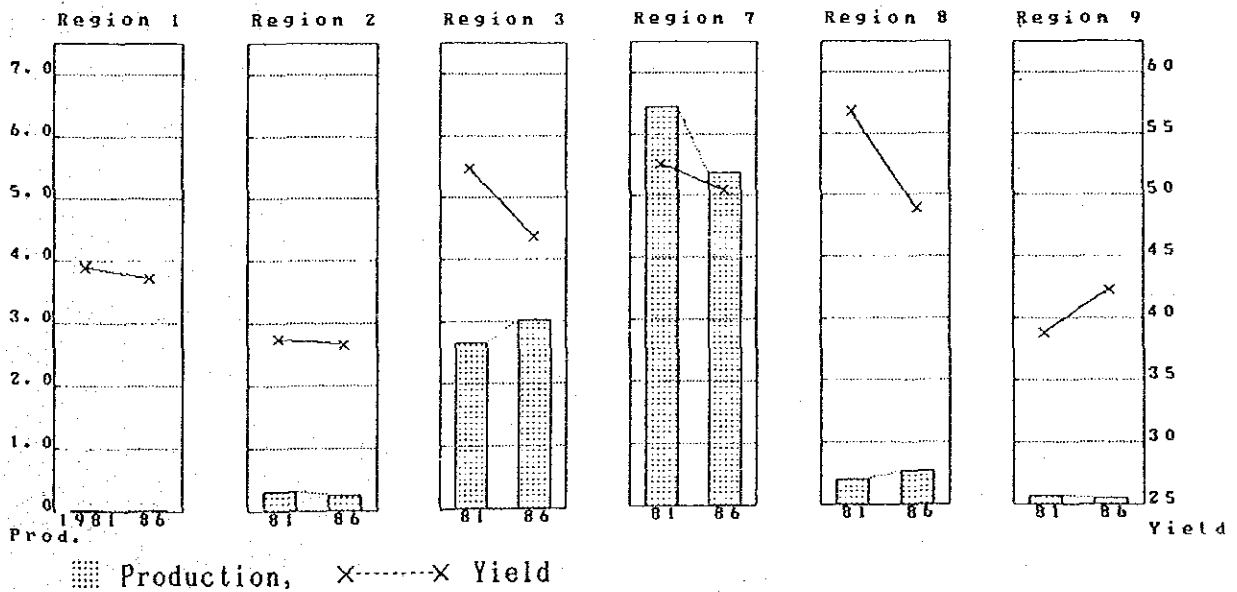
(a) Planted and Harvested Area

(Unit: 1,000ha)



(b) Production and Yield

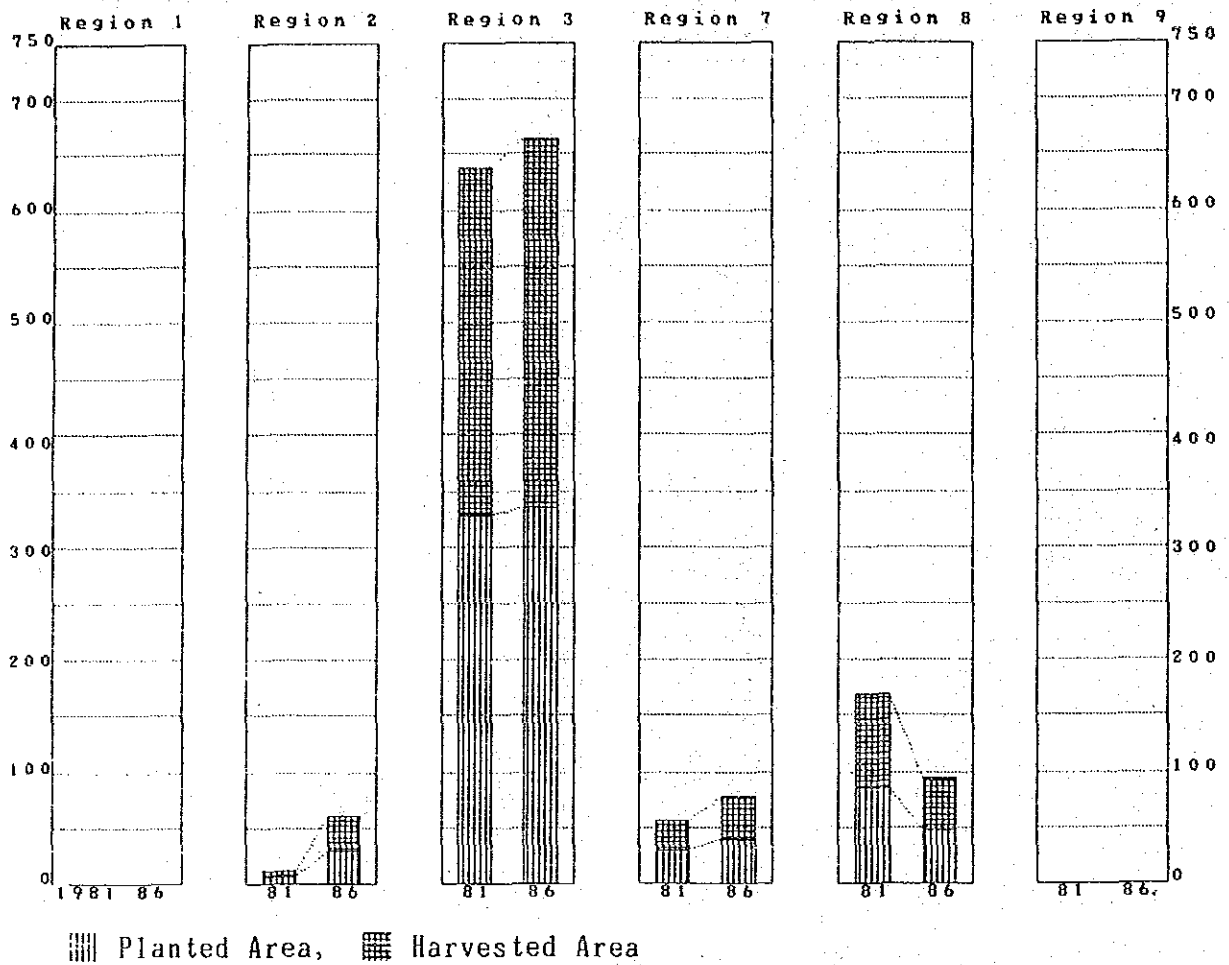
(Unit: Production in million ton, Yield in ton/ha)



(6) Mungbean

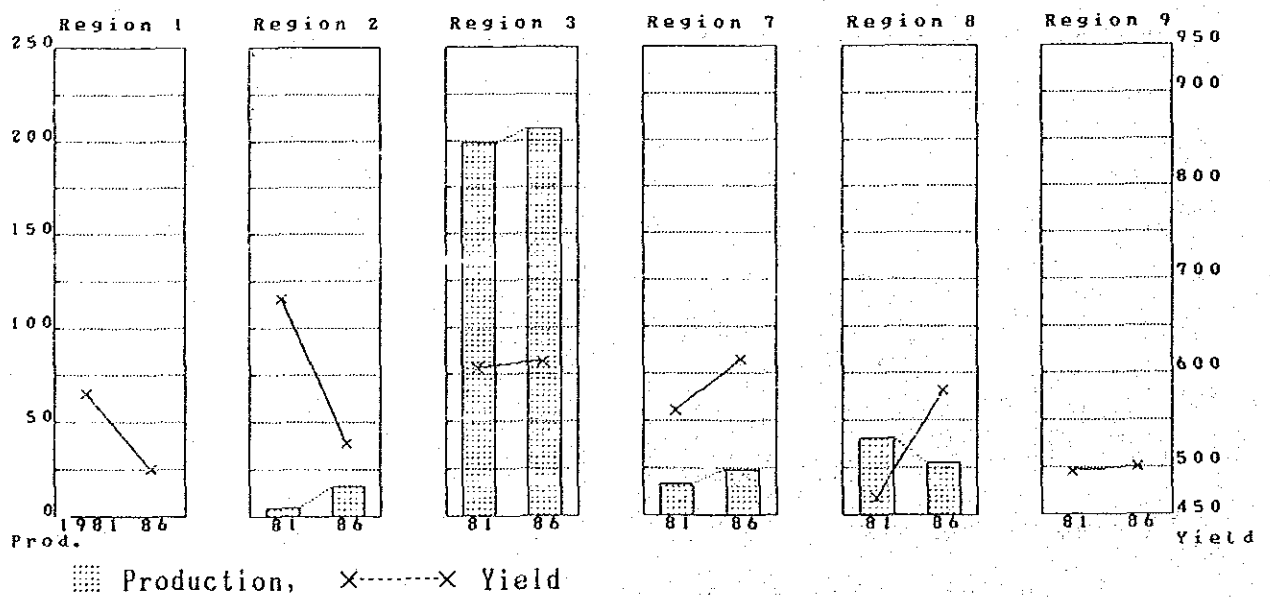
(a) Planted and Harvested Area

(Unit: 1,000ha)



(b) Production and Yield

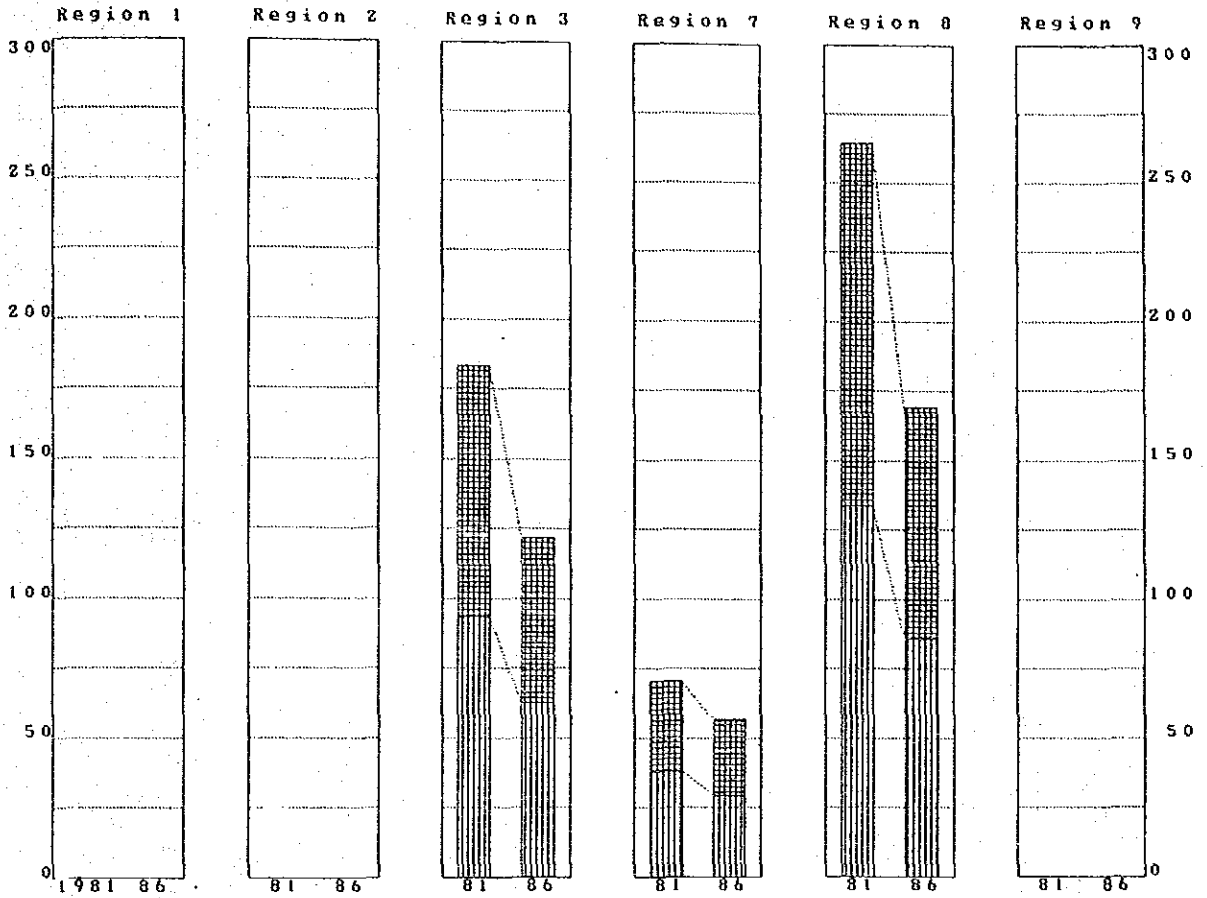
(Unit: Production in 1,000 ton, Yield in Kg/ha)



(7) Sorghum

(a) Planted and Harvested Area

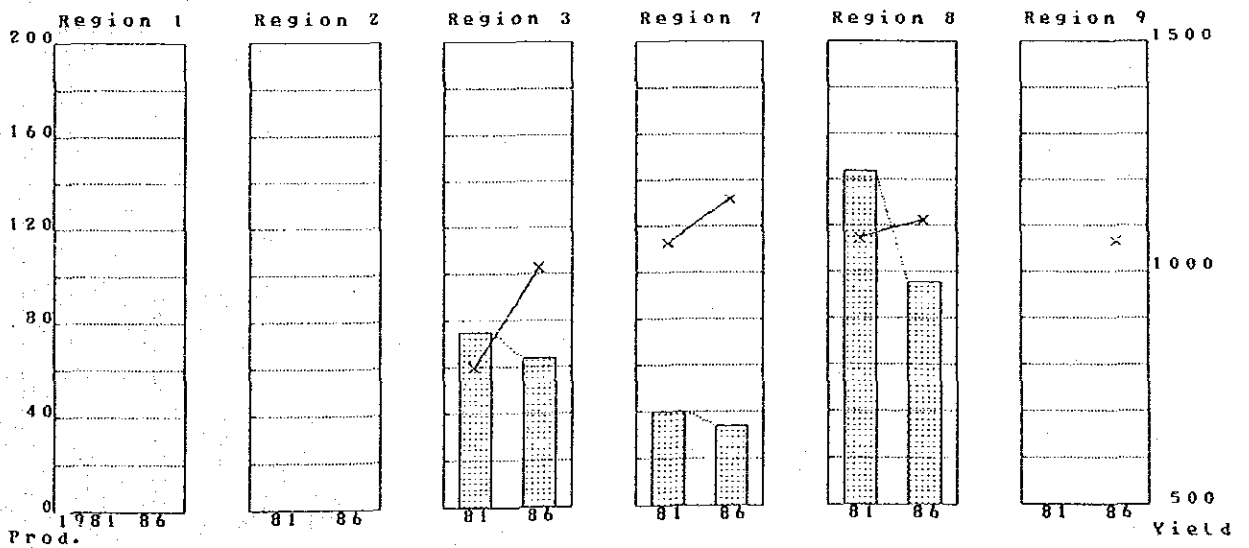
(Unit: 1,000ha)



|||| Planted Area, ■■■ Harvested Area

(b) Production and Yield

(Unit: Production in 1,000 TON, Yield in Kg/ha)

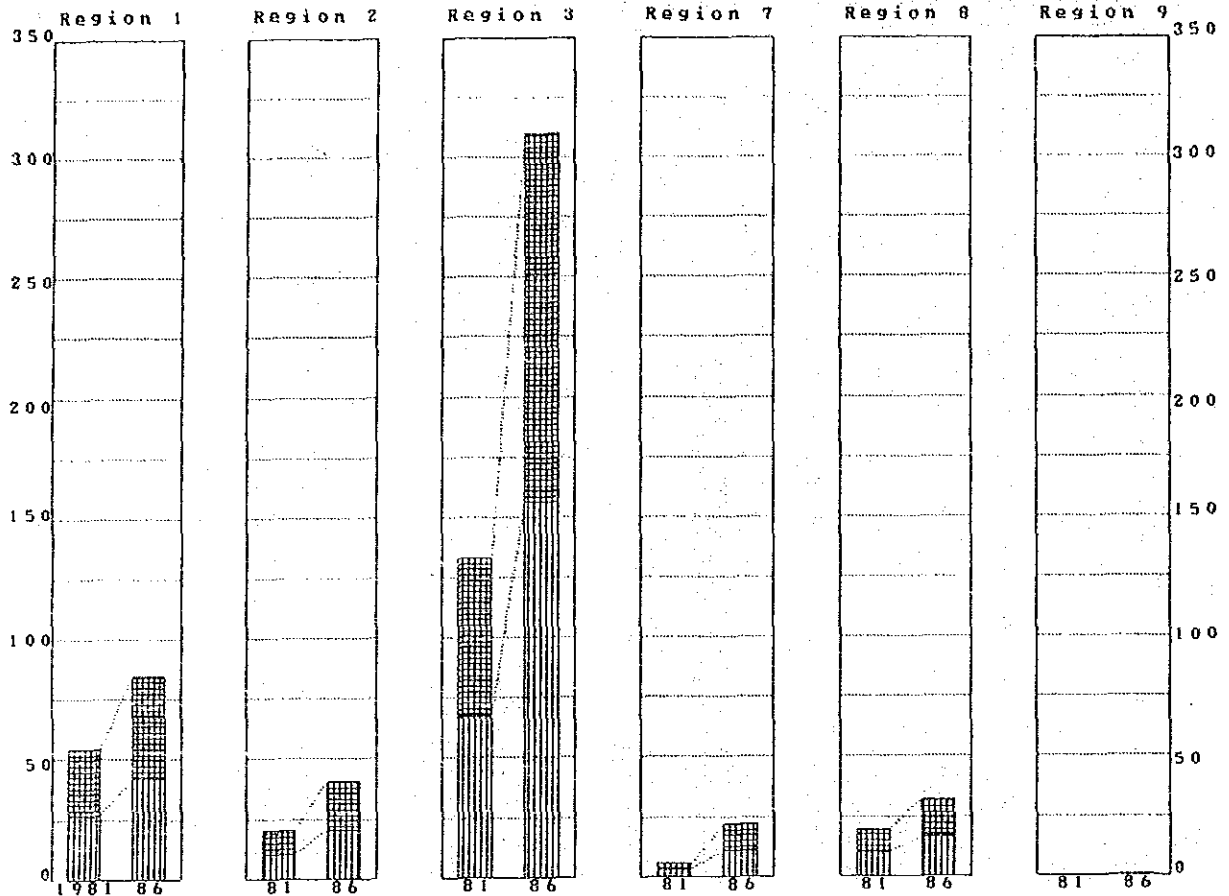


■■■ Production, X-----X Yield

(8) Soybean

(a) Planted and Harvested Area

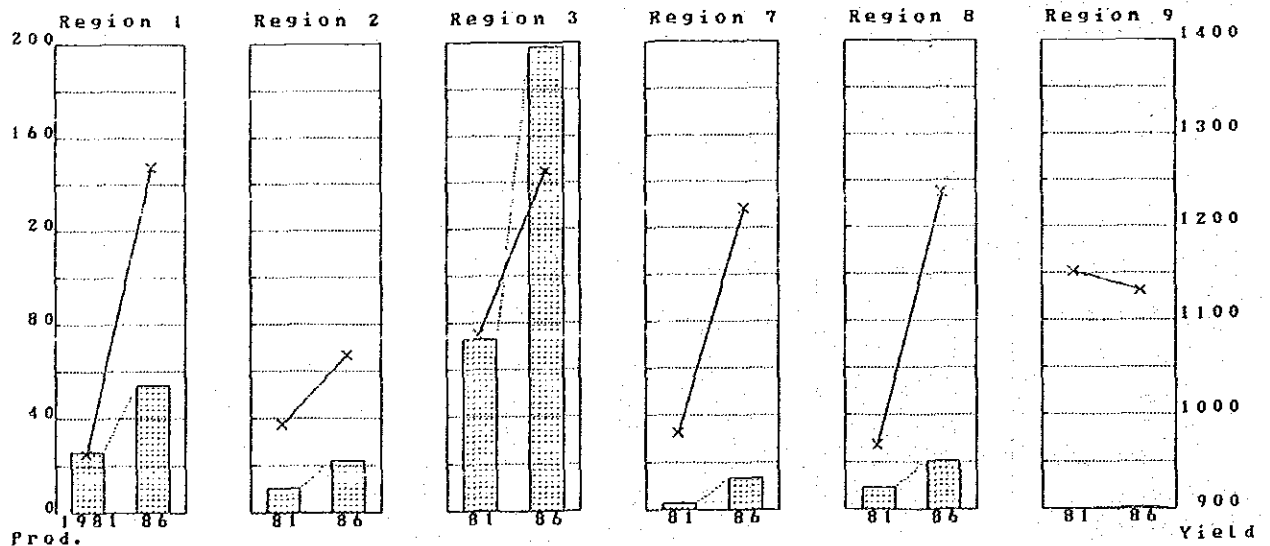
(Unit: 1,000ha)



▨ Planted Area, ▩ Harvested Area

(b) Production and Yield

(Unit: Production in 1,000 ton, Yield in Kg/ha)

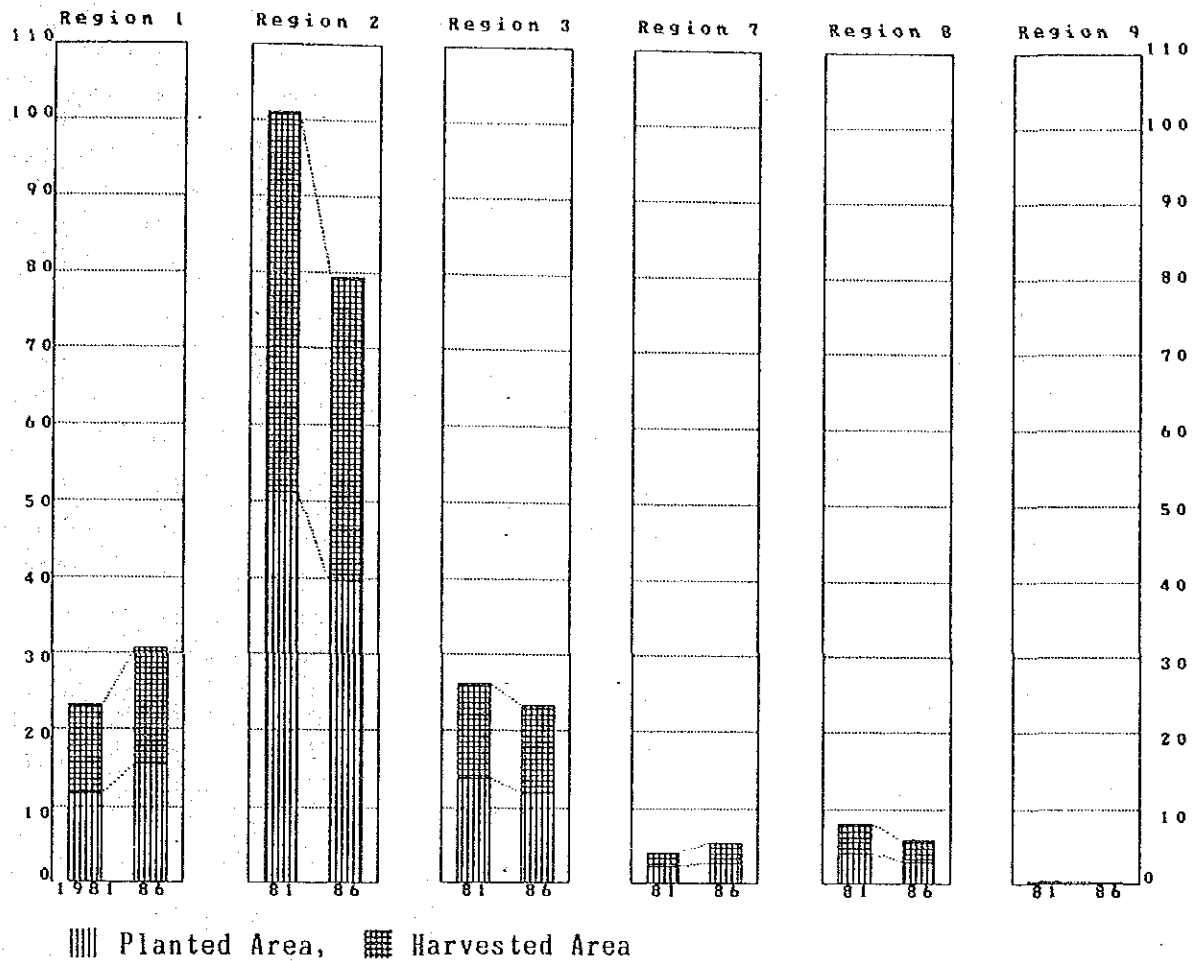


▨ Production, ×-----× Yield

(9) Groundnuts

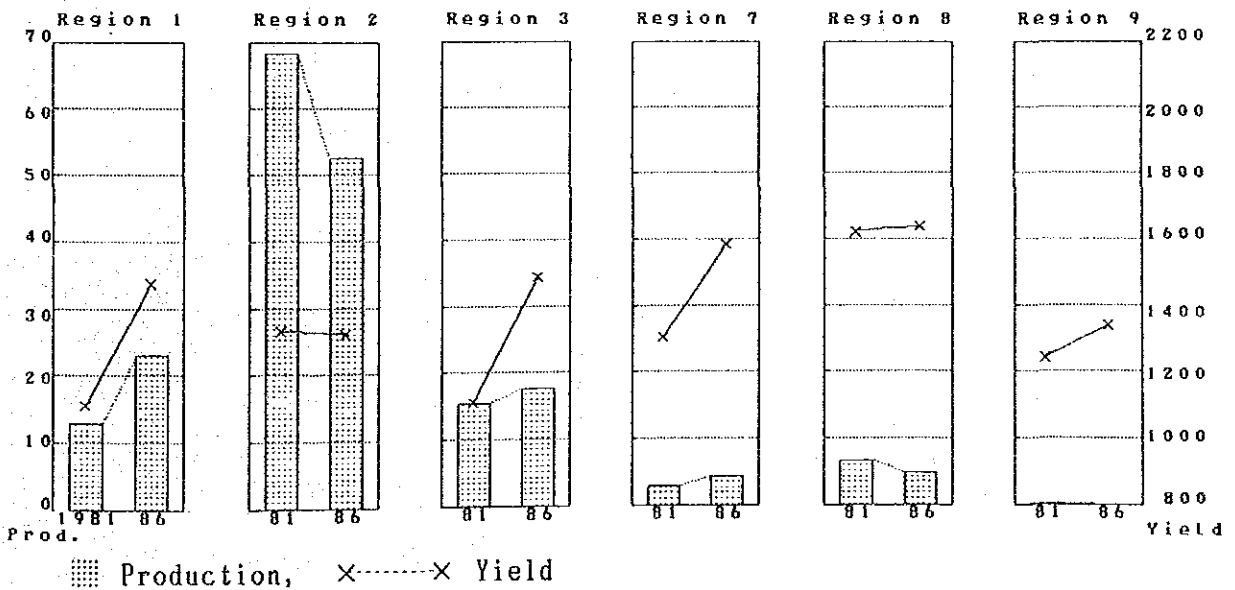
(a) Planted and Harvested Area

(Unit: 1,000ha)



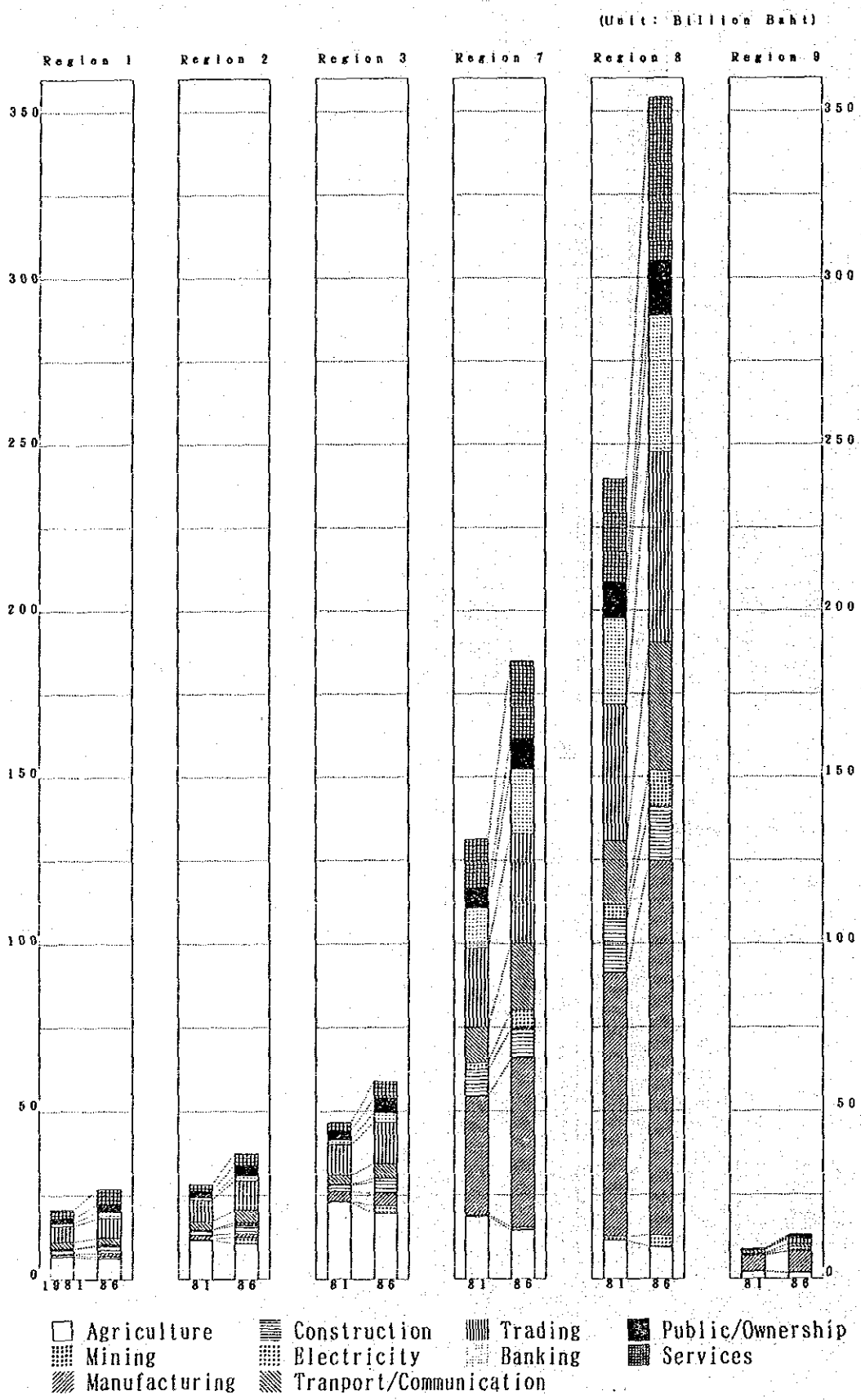
(b) Production and Yield

(Unit: Production in 1,000 ton, Yield in Kg/ha)



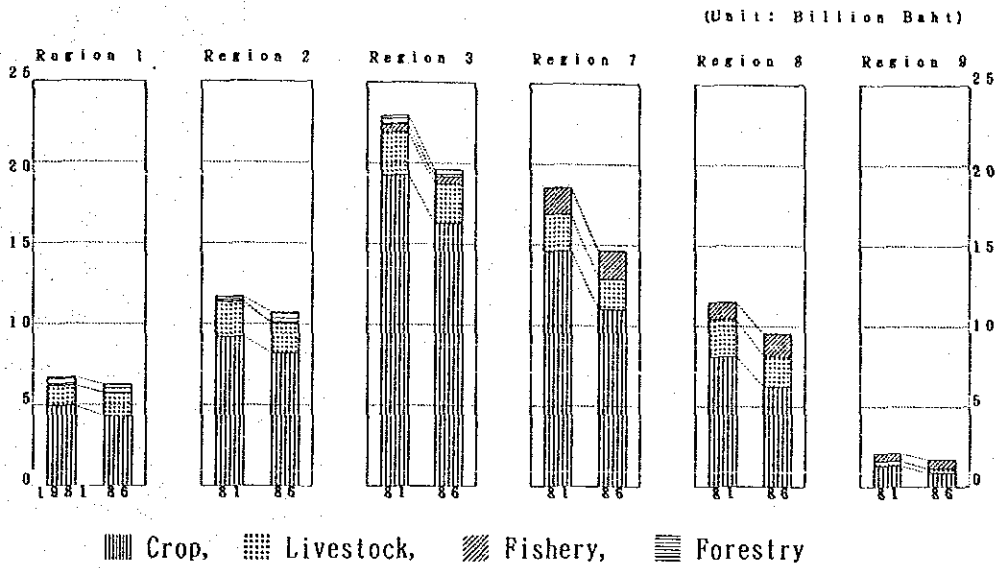
4. Gross Regional Products (GRP)

(1) RID Region-wise GRP



(2) Gross Regional Products - Agricultural Sector

(a) Trend (1981 -- 1986)



(b) Share by RID Regional Offices (1986)

(Unit: Million Baht)

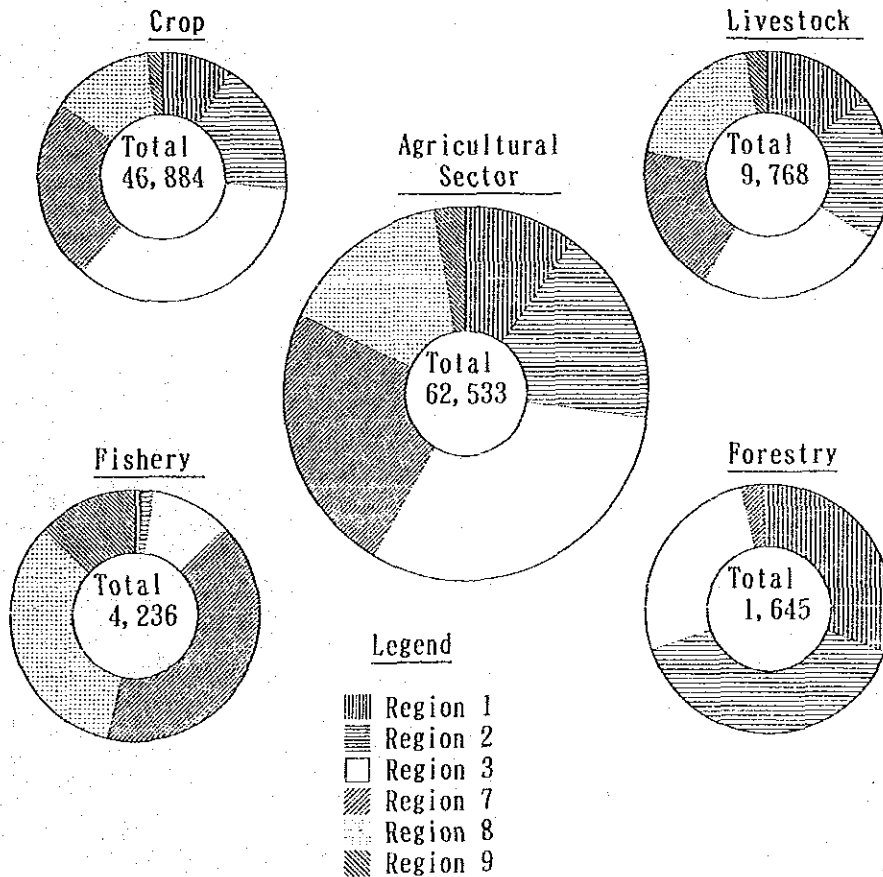
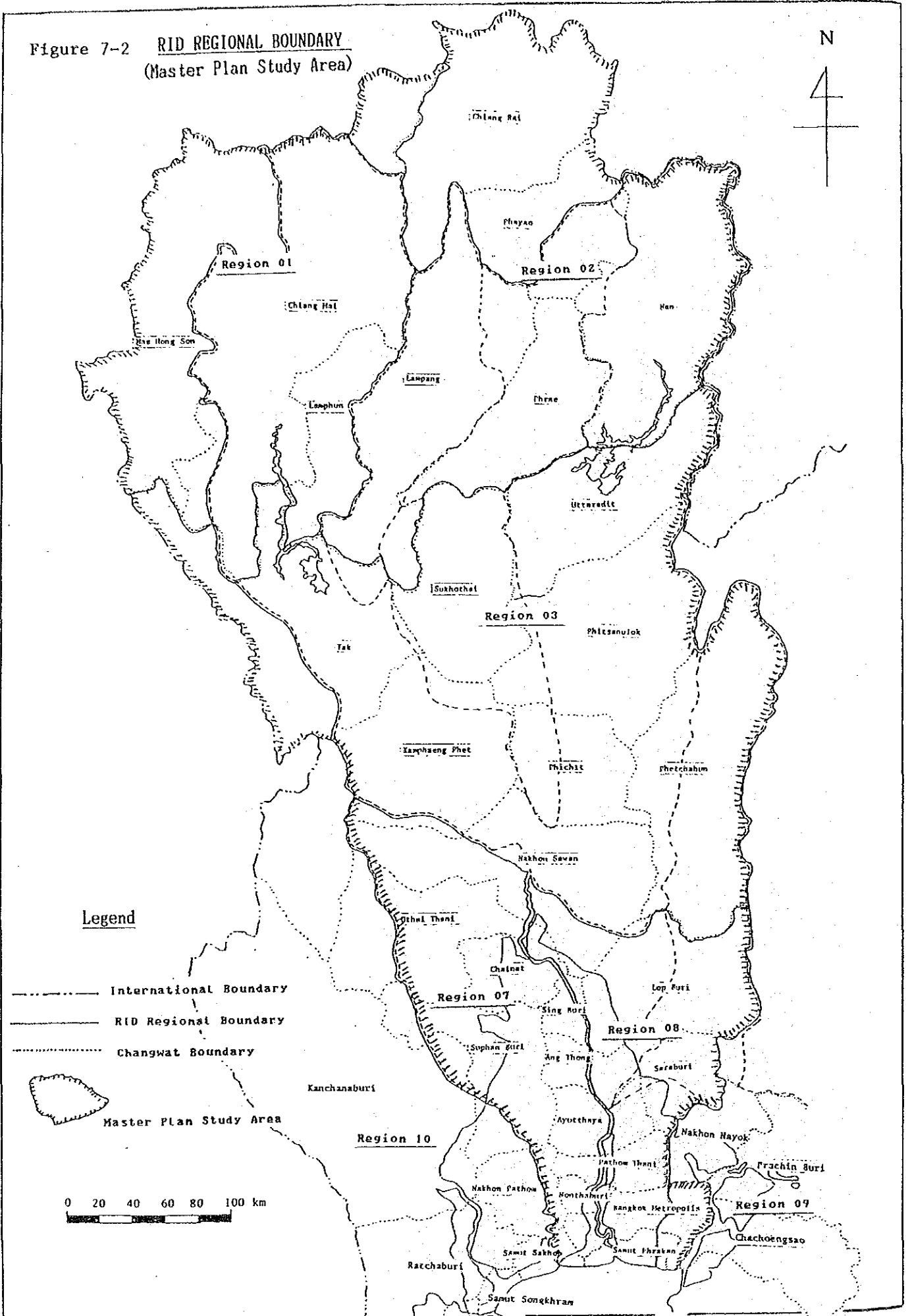
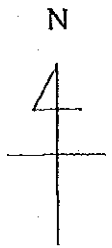


Figure 7-2 RID REGIONAL BOUNDARY
(Master Plan Study Area)



CHAPTER 7 SUPPLY AND DEMAND FOR FARM PRODUCTS

7.1 General Outlook

According to FAO's "Agricultural Commodity Projections to 1990", with only few expectations among individual commodities, global effective demand including import demand for agricultural commodities is projected to grow much more moderately over the decade of 1980s than in the preceding decade. Accordingly, production of most commodities at global level would also show more modest advances and opportunities for export growth would be more constrained than in 1970s.

International markets of agricultural commodities continue to be subject to large swings in prices, usually due to short-term changes in supply which are difficult or impossible to predict. However, the general tendency in the agricultural commodities outlook to 1990 is that supplies in international markets will be ample and effective demand will be met well within the limits of production capacity at global level. Thus, for most commodities it is expected either that some downward pressure on real prices will occur, or that market supply and demand would be in approximate balance at the price levels which prevailed in the years around 1980.

This would imply that for commodities whose prices are very low at present, such as rice, dairy products and rubber, there would be some improvement in prices by the end of the decade. Conversely, for commodities whose prices recently have been unusually high, some downward adjustment is in prospect.

On the demand side, the predominant determinants of market requirements of most commodities in the medium- and long-term are population and income growth. In this connection, the basic assumption is that population growth, except in Africa, will continue to slow down over the 1980s. Also, the growth of real income in most regions is assumed to rise at a slower pace in the remainder of the 1980s than in

the decade of the 1970s, although an improvement is assumed compared with the first half of the 1980s. In particular, in the developed countries population is increasing very slowly and, in most of them, consumption levels are already high and further income growth is expected to be only moderate. Thus, final demand for most agricultural commodities in these countries is expected to show only small increases. In the developing countries, also, the general picture is one of slower growth in effective demand. However, their relatively high rate of population growth and of faster income growth, combined with the greater responsiveness of demand to income growth, mean that much of the addition to global consumption requirements is expected to occur in the developing countries.

An important consequence of the projected slow-down in final demand is that derived demand for agricultural raw materials plus animal feeds is also projected to rise more slowly than in the 1970s. For these commodities also, technical and market developments which affect competition among commodities are important determinants of demand.

On the supply side, prospects for production have been assessed on the basis of likely developments in areas, livestock numbers and yields, on the assumption that national commodity policies would continue unchanged in most cases. For the main food and feed commodities, the projections approach takes into account the interplay of demand, supply and prices to the extent that market forces form part of the national policy framework.

Major findings of the projections by commodities are as follows;

- Generally slow growth in demand for sugar, tropical beverage crops and fruit
- Modest prospects for trade expansion in cereal markets
- Surplus capacity, despite adjustment measures, in markets for livestock products

- Slower growth of demand, production and trade in the oilseeds sector
- Mixed market prospects for the main agricultural raw materials

7.2 Main Trade Issues Arising from the Projections

As mentioned above, a major finding of the projections is the slowdown in demand growth for most agricultural commodities, especially in the developed countries, compared with 1970s. Coupled with this, production of some commodities in a number of large importing countries and regions is projected to increase faster than their domestic consumption. For instance, in cereals as a whole, this situation is expected to occur in the USSR, eastern Europe, China, India and the EEC, among others. Although the opposite tendency - demand outstripping domestic production - is projected for cereals in many other countries, notably in Africa and the Near East, the overall effect is for global gross imports of cereals to grow by only 1.8% a year during the 1980s compared with 7.1% in the 1970s. A similar situation of slower growth in trade is a major characteristic of the projections for nearly all other commodities, as indicated in Table 7-1.

A number of import policy issues stem from the projected slow-down in the growth of volume of commodity trade, particularly as the outlook for most commodity prices in international markets does not appear promising for exports. Consequently, it is predictable that Thailand would still face severe situation in her exporting agricultural commodities including rice.

Table 7-1 WORLD IMPORT PROJECTIONS FOR MAJOR AGRICULTURAL COMMODITIES

	VOLUME		GROWTH RATE	
	1979-81 (Average)	1990 (Projected)	1979-71 to 1979-81	1971-81 to 1990
	(million tons per year)		(percent per year)	
Sugar	23.3	21.9 to 22.8	1.5	-0.2 to -0.6
Coffee	3.7	4.2	1.6	1.1
Cocoa	1.4	1.6	0.9	1.1
Tea	0.8	0.9	1.9	1.8
Bananas	7.0	7.5	1.7	0.7
Citrus Fruit	15.7	20.5	6.4	2.7
<u>Cereals</u>	<u>224.5</u>	<u>269.1</u>	<u>7.1</u>	<u>1.8</u>
Wheat	96.9	115.1	5.8	1.7
Coarse Grains	115.1	139.6	8.6	1.9
Rice, milled	12.5	14.4	4.3	1.4
Dairy Products	43.0	49.6	6.4	1.4
<u>Meat</u>	<u>10.7</u>	<u>11.7</u>	<u>4.5</u>	<u>0.8</u>
Bovine Meat	4.9	5.4	3.5	1.0
Sheep and Goat Meat	1.0	1.2	2.0	1.8
Pigmeat	3.1	3.3	4.5	0.5
Poultry Meat	1.7	1.7	11.8	0.2
Fats and Oils	20.2	27.0	5.4	2.9
Oilmeal Proteins	19.7	23.8	6.1	1.9
Rubber	3.3	4.0	1.4	2.1
Cotton	4.7	4.7	1.7	0.0
Jute and Jute Products	1.6	1.5	-2.0	-0.6
Sisal and Products	0.4	0.3	-5.6	-3.7

Data Source: FAO Agricultural Commodity Projections to 1990

Table 7-2 PRODUCTION, CONSUMPTION AND STOCK OF PADDY/RICE IN THE WORLD

	1982/83	1983/84	1984/85	1985/86	1986/87 ¹
Total Production (Million Tons of Paddy)	420.4	454.0	468.6	470.9	465.9
- Argentine	0.3	0.5	0.4	0.4	0.4
- Australia	0.5	0.6	0.9	0.7	0.6
- Bangladesh	21.3	21.8	21.9	22.6	23.2
- Brazil	7.8	9.0	9.0	10.3	10.5
- Burma	14.4	14.3	14.3	14.9	14.8
- China	161.2	168.9	178.3	168.5	171.1
- E. E. C.	1.6	1.5	1.7	2.0	1.9
- India	70.7	90.2	87.5	96.2	90.0
- Indonesia	33.6	35.3	38.1	39.0	38.4
- Japan	12.8	13.0	14.8	14.6	14.6
- South Korea	7.3	7.6	8.0	7.9	7.9
- Pakistan	5.2	5.0	5.0	4.4	5.2
- Thailand ²	16.9	19.5	19.9	20.3	18.7
- U. S. A.	7.0	4.5	6.3	6.1	6.1
- Others	59.8	62.3	62.5	63.0	62.5
Consumption (Million Tons of Rice)	290.1	308.8	313.9	316.4	320.7
- Bangladesh	14.6	14.9	14.9	15.2	15.9
- China	112.4	117.1	123.9	117.2	119.5
- India	48.5	58.2	56.7	62.4	61.3
- Indonesia	23.7	25.3	25.2	26.2	26.6
- South Korea	5.3	5.5	5.5	5.8	5.7
- U. S. A.	2.0	1.8	1.9	2.1	2.4
- Others	83.7	85.9	85.8	87.5	89.7
Stock at the end of year (Million Tons of Rice)	17.3	17.2	22.3	26.3	22.7
- Bangladesh	0.3	0.1	0.5	0.4	0.2
- India	3.5	6.0	7.5	9.0	7.5
- Indonesia	1.7	1.6	2.8	2.8	2.1
- South Korea	1.5	1.2	1.4	1.3	1.2
- Thailand	0.8	1.1	1.5	1.4	1.0
- U. S. A.	2.3	1.5	2.1	2.5	1.9
- Others	7.2	5.7	6.5	8.9	8.8

Note: ¹ Estimated Figures

² Office of Agricultural Economics, MOAC

Data Source: World Grain Situation and Out-look, July 1987

Table 7-3 PRODUCTION, CONSUMPTION AND STOCK OF MAIZE IN THE WORLD

(Unit: Million tons)

Name of Country	1982/83	1983/84	1984/85	1985/86	1986/87 ^P
<u>Production</u>					
U. S. A.	209.2	106.0	194.9	225.5	209.6
Brazil	19.5	21.0	22.0	20.0	22.5
Mexico	7.0	9.3	9.9	10.5	10.0
Argentina	9.0	9.2	11.5	12.1	12.0
South Africa	4.1	4.4	7.8	8.0	9.0
Thailand	3.5	4.0	4.4	5.2	4.1
E. E. C.	22.6	21.8	23.1	25.8	24.5
U. S. S. R.	14.7	13.3	13.6	14.4	12.4
East Europe	36.5	33.4	35.4	33.5	37.3
China	60.3	68.2	73.4	63.8	69.0
Others	53.7	56.9	62.4	62.3	64.6
<u>Total</u>	<u>439.9</u>	<u>347.5</u>	<u>458.4</u>	<u>481.0</u>	<u>475.1</u>
<u>Consumption</u>					
U. S. A.	137.6	121.7	131.3	133.5	138.5
West Europe	37.2	34.9	33.3	31.6	31.2
U. S. S. R.	21.1	22.0	32.9	24.4	18.5
Japan	14.2	14.6	14.2	14.3	15.2
China	62.8	68.0	68.2	57.9	64.8
Others	145.3	152.7	157.2	157.6	164.7
<u>Total</u>	<u>419.2</u>	<u>414.1</u>	<u>437.1</u>	<u>419.3</u>	<u>432.8</u>
<u>Stock</u>					
U. S. A.	89.5	25.6	41.9	102.6	145.3
Others	17.3	14.7	19.7	20.7	20.2
<u>Total</u>	<u>106.8</u>	<u>40.2</u>	<u>61.5</u>	<u>123.3</u>	<u>165.5</u>

Note: ^P Preliminary

Data Source: World Grain Situation and Outlook, January 1987

CHAPTER 8 PRELIMINARY PROJECT EVALUATION

8.1 Basic Concept on Method of Evaluation

A planning and/or a project is, generally, composed of three components, namely, facility/structure, information, and organizational/human factor. Such planning and/or project aiming improvement of operational system as this Master Plan Study, places more significance on information component. Therefore, it is necessary to introduce a probability and/or a forecast concept (Degree of Uncertainty), when computing benefit and cost which are a basis of project evaluation, taking into consideration overall frame and/or structure of the planning and the system. The cost and benefit can be treated as variables by dividing them into the said three components, and an optimum investment amount could be estimated on the basis of the interrelation among the three components as shown in Figure 8-1.

Secondly, since the study area covers vast area, even the Chao Phraya Delta as main beneficial area does around 1.3 million hectares, it is possible to formulate optional planning, by coping several established management level (ex. Level-0 thru Level-4) with the district division (zoning). Then, it is easy to work out a solution given by the "Parato Optimum" through the said methodology as well as to determine priority on the identified project(s) (See Figure 8-2).

Relation between the objectives and the effects of RID water management system improvement can be summarized in the following: (a) increment in cropping area through saving irrigation losses, (b) increase in crop yield through improving reliability in irrigation water supply, and (c) increase in cropping intensity through crop diversification (See Table 8-1 and Figures 8-3 and 8-4).

It is rather difficult to measure a benefit arising from the organizational system (human factor) in monetary terms, therefore, the

relation between the facilities system and the information one can be expressed in three dimensions as shown in Figure 8-3.

Input data for the cost are obtainable by a technical/engineering information data-base (through implementation of the "Water Management Model Project", and those of benefit for a facility by the method ordinarily used. The benefit arising from the information one could be estimated by the concept of probability and/or forecast, while no data on the component is presently available in the entire basin. Therefore, available data experienced in the other projects/areas, shall be provisionally applied. In this context, it is prerequisite to immediately commence the proposed model project so as to obtain the necessary data and information to be applicable to the entire river basin.

8.2 Preliminary Project Evaluation

The relation among the water management level, the identified projects/studies and the development target is summarized in the following;

PROJECT & STUDIES IN THE IMPROVED WATER MANAGEMENT SYSTEM

<u>Project / Study</u>	<u>Manage. Level</u>	<u>Imple. Term</u>
(1) Water Management Model Project	until Level-4	short-term
(2) Monitoring/Communication System Improve. Project	until Level-2 until Level-3 until Level-4	short-term medium-term long-term
(3) Data Management System Improvement Plan	(to be formulated during/after imple. of the Model Project)	
(4) Irrigation and Drainage System Improve. Project	until Level-2 after Level-2	medium-term long-term
(5) Study on Comprehensive River Basin Development Plan		short-term
(6) Study on Crop Diversification Promotion Center		short-term

N.B. Short-term implies 5-7 years, while medium-term 8-15 years and long-term over 15 years.

8.2.1 Short-term Project/Study

Out of the short-term projects/study listed up in the above, "(5) Study on Comprehensive River Basin Development Plan" and "(6) Study on Crop Diversification Promotion Center" are to be carried out for the purpose of investigating possibility on any component which comprises the improved water management system, therefore, it is not the stage to quantitatively evaluate benefits arising from these studies, at this moment.

On the other hand, having a characteristic of pilot project for the improved water management system (IWMS), the proposed water management model project is to be carried out for the purpose of experimentally implementing the IWMS and obtaining and preparing the required data and information for the realization of the IWMS. Therefore, it is, similar to the above two studies, rather difficult to quantitatively evaluate the benefits. However, it could be expected to realize future image of the IWMS as well as to increase income of participating farmers and to make farming practices more efficient, when the agencies and farmers concerned will make their efforts to positively cooperate for the project.

By implementation of the monitoring/communication system improvement project (until Level-2), it could be expected to increase efficiency of water resources utilization in the entire basin by 5 - 10 percent, including use of side flows. The incremental amount is estimated at about 1,000 MCM by which about 80,000 ha of paddy field could be additionally irrigated in the dry season (See Chapter 4, para. 4.3.5 of this report). On the basis of the figure, a preliminary project evaluation has been carried out by two cases; (1) planting paddy only, and (2) planting paddy and upland crops (soybean as representative) in half, over the estimated incremental cropping acreage.

The basic figures applied for the evaluation are summarized as follows;

<u>Item</u>	<u>Unit</u>	<u>Dry Season</u>	
		<u>Paddy</u>	<u>Soybean</u>
1. Average Water Requirement	m ³ /ha/season	7,690	5,000
2. Crop Yield	Kg/ha	4,000	1,128
3. Farmgate Price	¥/ton	2,600	5,600
4. G.P.V.	¥/ha	10,400	6,317
5. Production Cost	¥/ha	7,172	3,790
6. N.P.V.	¥/ha	3,228	2,527
7. Cropping Share			
Case-1	ha	80,000	-
Case-2	ha	40,000	61,500

On the basis of the above figures, an internal rate of return on the component has been computed as shown in the following (See Tables 8-2 and 8-3);

Preliminary Project Evaluation for
Monitoring/Communication Improvement (Level-2)

<u>Item</u>	<u>Unit</u>	<u>Paddy only</u>	<u>Paddy + Upland</u>
- Investment Cost	¥ million	947.0	947.0
- Implementation Period	year	4	4
- O & M Cost	¥ million	10.5	10.5
- Project Benefit (Full)	- ditto -	258.2	284.5
- Project Life	year	30	30
- I.R.R.	%	17.4	18.9

Although the above result is preliminary and further analysis is required, it is obvious that more efficient improvement way for the water management could be expected by implementation of this project without providing a big scale civil work. Consequently, it is necessary to promote the required countermeasures for realization of the improved water management system in the entire basin, including the proposed water management model project.

8.2.2 Middle-term Project

The item and cost of those project included in the middle-term project are summarized in the following;

<u>Name of Project</u>	<u>Management Level</u>	<u>Project Cost</u> (฿ million)
- Monitoring/Communication System Improvement	until Level-3	1,258
- Data Management System Improvement	-	107
- Irrigation and Drainage System Improvement	until Level-2	1,050

At this moment, it is rather difficult to evaluate these medium-term projects with economical indicators such as E.I.R.R., it could be expected that these projects bring about increase of dry season cropping area as would be realized in the short-term projects as well as the replacement effect in the main water use facilities. In order to obtain basic data to be required for calculation of such benefits/effects, it is inevitable to implement the proposed model project.

8.2.3 Long-term Project

The projects included in the long-term are (1) Monitoring/Communication System improvement (until Level-4), (2) Data Management System Improvement (until Level-4) and (3) Irrigation and Drainage System Improvement (after Level-3). Through implementation of these long-term projects, the improved water management system would be established in the entire Chao Phraya River Basin, and furthermore such benefits/effects could be expected as prosperous expansion of the basin agriculture, increase in farmers income, improvement and stabilization of living standard of inhabitants in the basin. Therefore, these project should be promoted aiming realization of the improved water management system for the entire Chao Phraya river basin, taking into consideration the results provided by the short- and middle-term project and the financial conditions.

Table 8-1 RELATION BETWEEN BENEFIT AND COST UNDER RID'S WATER MANAGEMENT SYSTEM

Benefit \ Cost	Facilities (F)	Information (I)	Organization (H) (Human Factor)	Remarks
Cropping Area(A)	⊙	⊙	△	Saving of Irrigation Losses
Crop Diversifying Ratio (D)	⊙		○	Influencing to Cropping Area
Crop Yield (Y)	○	○	△	Improvement of Reliability on Water Supply
Remarks	Rehabilitation, On-Farm Facilities Model Project, etc	Monitoring/Communication System Pj, Model Project, etc	Training Program, Extension Services Systematization	

⊙: Strongly related, ○: Moderately related, △: Indirectly related

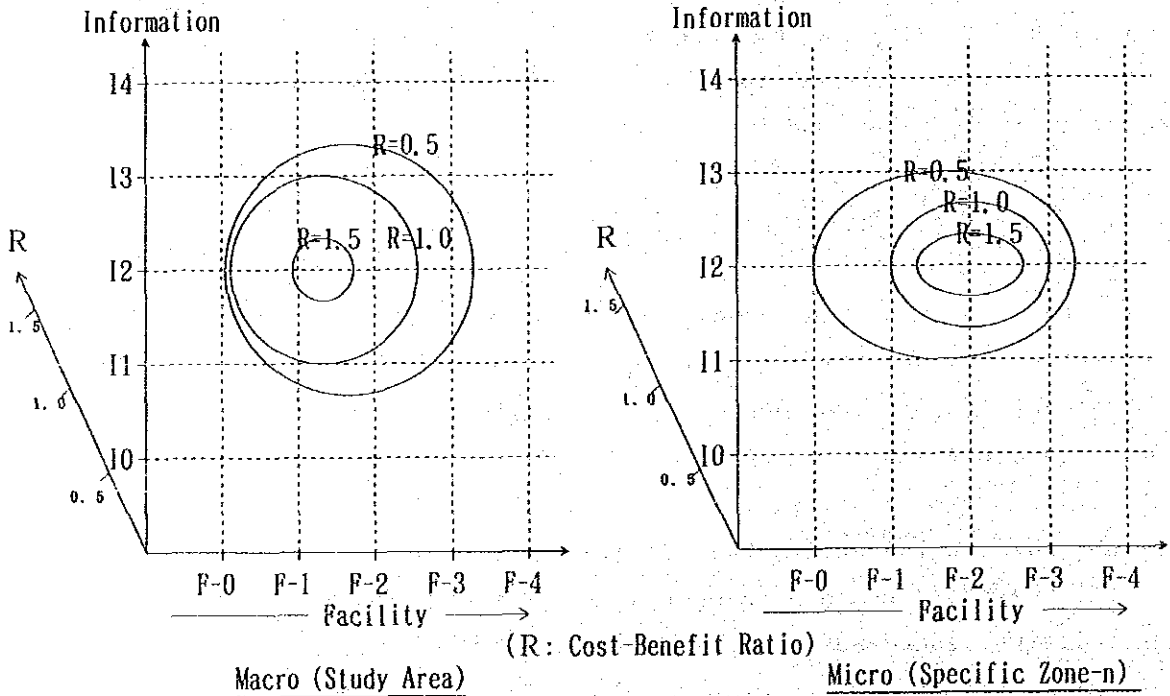


Figure 8-3 THREE DIMENSIONAL RELATION ON PROJECT EVALUATION

Table 8-2

***** CALCULATION OF INTERNAL RATE OF RETURN *****
 PROJECT NAME: CHAO PHRAYA WATER MANAGEMENT
 CASE: PADDY ONLY

(UNIT: 1,000 BAHTS)

DISCOUNT RATE	+++++ PRESENT WORTH BENEFIT	+++++ COST	B/C RATIO
5.00 %	2854983.	957145.	2.98
6.00 %	2470497.	920792.	2.68
7.00 %	2149708.	887791.	2.42
8.00 %	1880477.	857610.	2.19
9.00 %	1653237.	829829.	1.99
10.00 %	1460342.	804103.	1.82
11.00 %	1295723.	780154.	1.66
12.00 %	1154507.	757757.	1.52
13.00 %	1032776.	736727.	1.40
14.00 %	927310.	716904.	1.29
15.00 %	835526.	698161.	1.20
16.00 %	755302.	680388.	1.11
17.00 %	684894.	663495.	1.03
18.00 %	622844.	647399.	0.96
19.00 %	567956.	632032.	0.90
20.00 %	519232.	617337.	0.84
21.00 %	475834.	603262.	0.79
22.00 %	437046.	589760.	0.74
23.00 %	402278.	576792.	0.70
24.00 %	371021.	564322.	0.66

 INTERNAL RATE OF RETURN ----- 17.4 %

Table 8-3

***** CALCULATION OF INTERNAL RATE OF RETURN *****
 PROJECT NAME: CHAO PHRAYA WATER MANAGEMENT
 CASE: PADDY + FIELD CROP

(UNIT: 1,000 BAHTS)

DISCOUNT RATE	+++++ PRESENT WORTH BENEFIT	+++++ COST	B/C RATIO
5.00 %	3145631.	957145.	3.29
6.00 %	2722005.	920792.	2.96
7.00 %	2368557.	887791.	2.67
8.00 %	2071921.	857610.	2.42
9.00 %	1821545.	829829.	2.20
10.00 %	1609012.	804103.	2.00
11.00 %	1427634.	780154.	1.83
12.00 %	1272041.	757757.	1.68
13.00 %	1137913.	736727.	1.54
14.00 %	1021714.	716904.	1.43
15.00 %	920586.	698161.	1.32
16.00 %	832195.	680388.	1.22
17.00 %	754620.	663495.	1.14
18.00 %	686252.	647399.	1.06
19.00 %	625777.	632032.	0.99
20.00 %	572092.	617337.	0.93
21.00 %	524276.	603262.	0.87
22.00 %	481540.	589760.	0.82
23.00 %	443231.	576792.	0.77
24.00 %	408793.	564322.	0.72

 INTERNAL RATE OF RETURN ----- 18.9 %

(Ordinary Method)

$$R = \frac{B}{C} \quad \Rightarrow \Rightarrow \Rightarrow \Rightarrow \Rightarrow$$

(Proposed Method)

$$R = \frac{B_f + B_i + B_h}{C_f + C_i + C_h}$$

Where; R: Benefit Cost Ratio, B: Benefit, C: Cost
 f: Facility, i: Information, h: Organization (Human Factor)

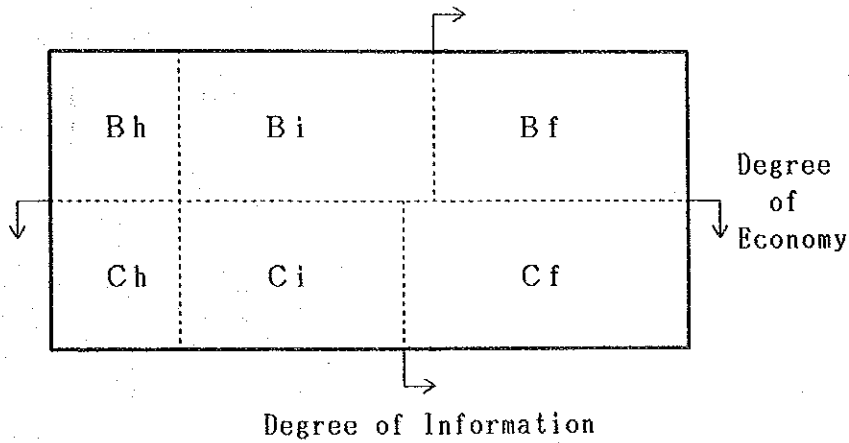


Figure 8-1 COMPOSITION OF BENEFIT-COST RATIO

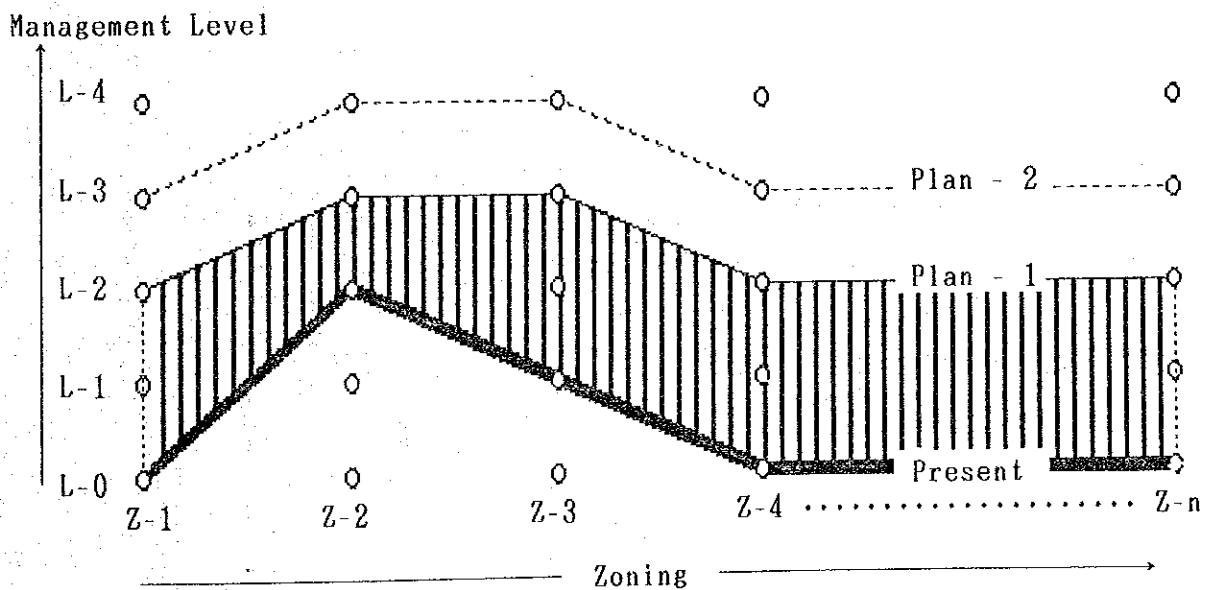


Figure 8-2 COMBINATION OF MANAGEMENT LEVEL AND ZONING

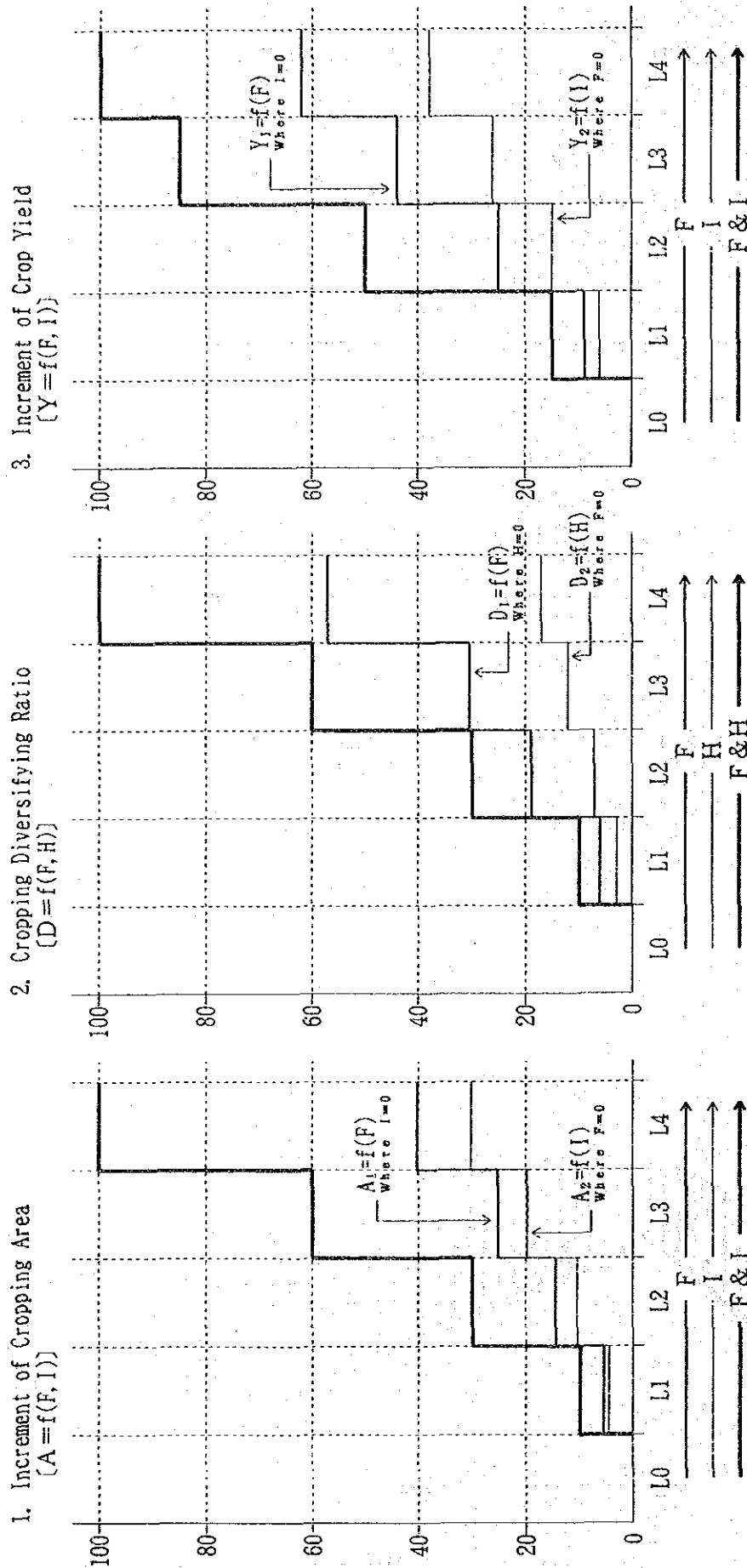


Figure 8-4 FUNCTIONAL EXPRESSION AMONG BENEFIT COMPONENTS

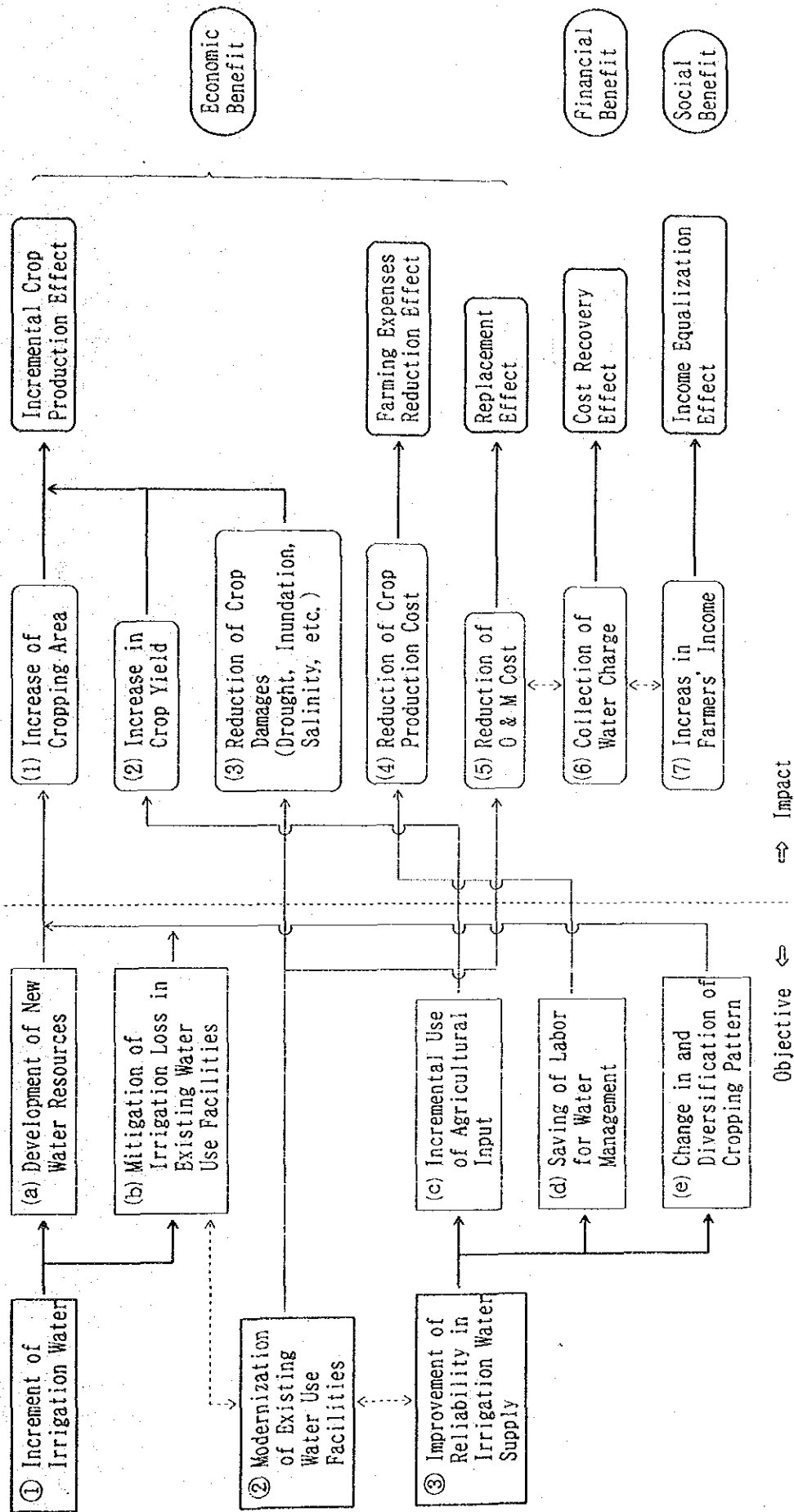


Figure 8-5 RELATION BETWEEN OBJECTIVE AND IMPACT OF WATER MANAGEMENT SYSTEM IMPROVEMENT

