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JAPAN INTERNATIONAL COOPERATION AGENCY

THE GOVERNMENT OF THE KINGDOM OF THAILAND
NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT BOARD

THE STUDY ON THE REGIONAL DEVELOPMENT PLAN FOR THE LOWER NORTHEAST AND THE UPPER EAST REGIONS IN THE KINGDOM OF THAILAND

FINAL REPORT

2. Industry

September, 1993

NIPPON KOEI CO., LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY

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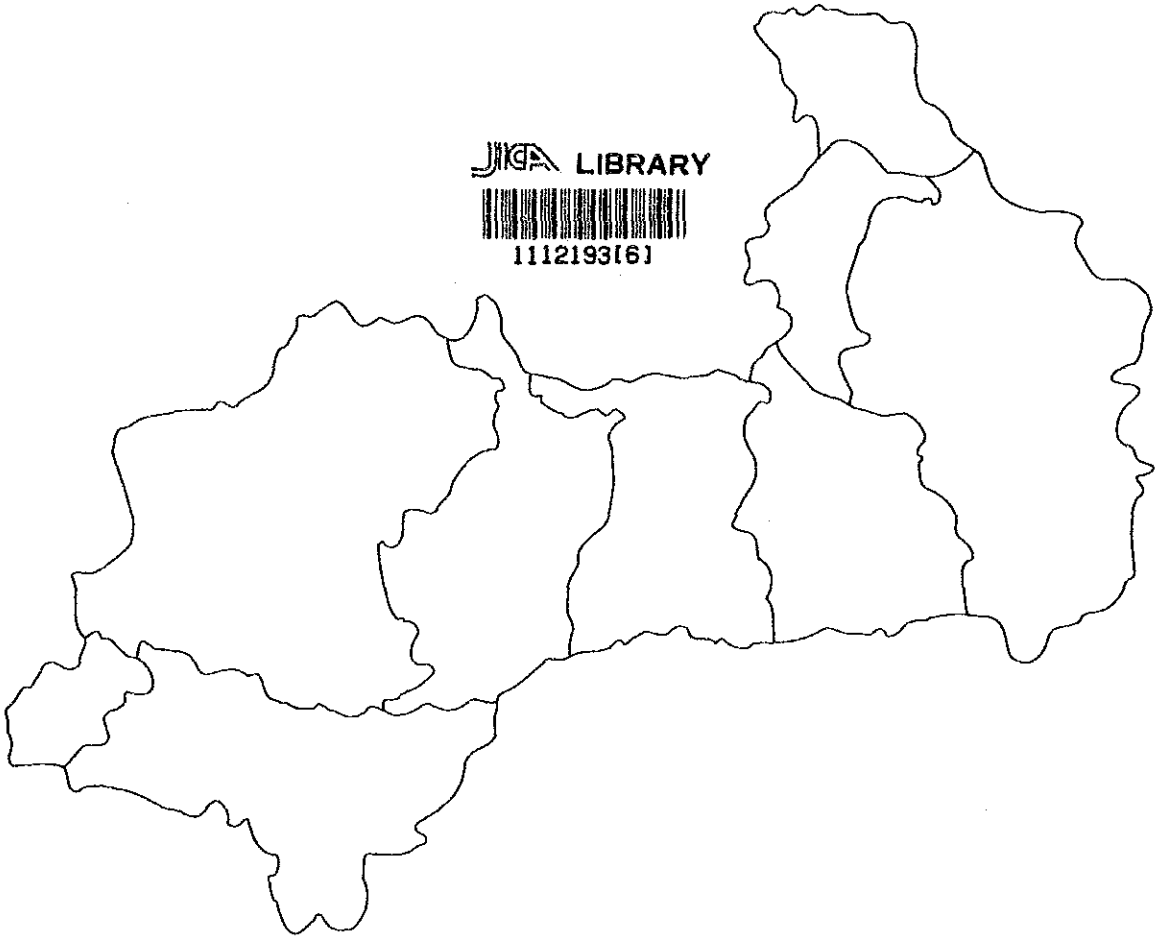

2. Industry

September, 1993

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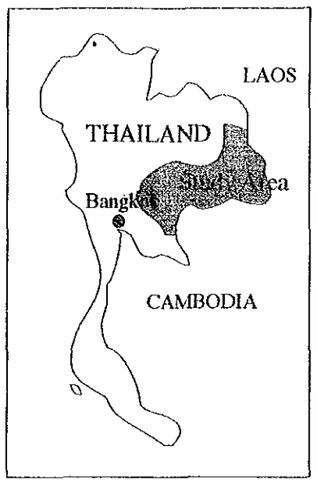

LEGEND

- International Boundary
- Provincial Boundary
- 202 National Highway (Number)
- Railway
- Airport
- National Park
- Major Tourism Attraction

Major City (Population)

- 100,000~500,000
- 50,000~100,000
- 25,000~ 50,000
- 10,000~ 25,000

N

SCALE

0 6.5 32.5 65.0

km

Laos

Huai Huat
Mukdahan
Savannakhet
Mukdahan
212
202
Yasothon
202
Amnat Charoen
212
23
Pha Taem
Ubon Ratchatani
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Warin Chamrap
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Det Udom
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201
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(Khorat)
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Note : Basic elements of this map composition were derived from the Geographic Information System (GIS) Database developed in the study.

Location Map of Study Area

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Abbreviations

AAT	Airports Authority of Thailand [MOTC]
ADB	Asian Development Bank
AED	Agricultural Extension Department [MOAC]
BAAC	Bank for Agriculture and Agricultural Cooperatives [MOF]
BMA	Bangkok Metropolitan Area
BMR	Bangkok Metropolitan Region
BOB	Bureau of the Budget [OPM]
BOI	Board of Investment [OPM]
BOT	Bank of Thailand
CAO	Changwat Administration Organization [MOIT]
CAT	Communication Authority of Thailand [MOTC]
CDD	Community Development Department [MOIT]
CPD	Cooperatives Promotion Department [MOAC]
CRDP	Coordinating Committee for the Royal Development Projects
DFPOT	Dairy Farming Promotion Organization of Thailand [MOAC]
DOA	Department of Aviation [MOTC]
DOH	Department of Highways [MOTC]
DOLA	Department of Local Administration [MOIT]
DRDC	District Rural (or Regional) Development Committee
DTEC	Department of Technical and Economic Cooperation [OPM]
EGAT	Electricity Generating Authority of Thailand [OPM]
ESBC	Eastern Seaboard Committee [NESDB]
ERTAT	Expressway and Rapid Transit Authority of Thailand [MOIT]
ETOT	Express Transportation Organization of Thailand [MOTC]
FIO	Forest Industry Organization [MOAC]
GCST	Government Cold Storage Organization [MOAC]
IEAT	Industrial Estate Authority of Thailand [MOID]
IFCT	Industrial Finance Corporation of Thailand
IPD	Industry Promotion Department [MOID]
ITD	Internal Trade Department [MOC]
JICA	Japan International Cooperation Agency
JPPCC	Joint Public / Private Consultative Committee [BOI]
LDD	Livestock Development Department [MOAC]
LNE-UE	Lower Northeast - Upper East
LTD	Land Transport Department [MOTC]
MOAC	Ministry of Agriculture and Cooperatives
MO	Marketing Organization [MOIT]
MOC	Ministry of Commerce
MOD	Ministry of Defence
MOE	Ministry of Education
MOF	Ministry of Finance
MOFF	Marketing Organization for Farmers [MOAC]
MOID	Ministry of Industry
MOIT	Ministry of Interior
MOPH	Ministry of Public Health
MOTC	Ministry of Transport and Communications
MOUA	Ministry of University Affairs
MSTE	Ministry of Science, Technology and Environment
NEB	National Environment Board [MSTE]
NESDB	National Economic and Social Development Board [OPM]

NESDC	National Economic and Social Development Committee
NHA	National Housing Authority [MOIT]
NRDC	National Rural (or Regional) Development Committee
OARD	Office of Accelerated Rural Development [MOIT]
OCSC	Office of the Civil Service Commission [OPM]
OECF	Overseas Economic Cooperation Fund (Japan)
OPM	Office of Prime Minister
OPP	Office of Policy and Planning [MOIT]
PDA	Provincial Development Committee
PEA	Provincial Electricity Authority [MOIT]
PRDC	Provincial Regional Development Committee
PRDCC	Provincial Rural (or Regional) Development Coordination Center
PWA	Provincial Waterworks Authority [MOIT]
PWD	Public Works Department [MOIT]
PWO	Public Warehouse Organization [MOC]
RFD	Royal Forest Department [MOAC]
RID	Royal Irrigation Department [MOAC]
SNRDC	Office of the Secretary to the National Rural (or Regional) Development Committee
SRT	State Railway of Thailand [MOTC]
TAT	Tourism Authority of Thailand [OPM]
TCPD	Town and Country Planning Department [MOIT]
TOT	Telephone Organization of Thailand [MOTC]
TRDC	Tambon Rural Development Committee
UNDP	United Nations Development Program
UNIDO	United Nations Industrial Development Organization
USAID	United State Agency for International Development

Abbreviation of Measures

Length

mm	=	millimeter
m	=	meter
km	=	kilometer

Area

ha	=	hectare
km^2	=	square kilometer

Volume

l	=	lit = litre
m^3	=	cubic meter
MCM	=	million cubic meter

Weight

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

Time

sec	=	second
hr	=	hour
d	=	day
yr	=	year

Money

US$	=	U.S. dollar
B	=	Baht

Energy

kcal	=	kilocalorie
J	=	joule
MJ	=	megajoule
HP	=	horsepower
TOE	=	tons of oil equivalent
kW	=	kilowatt
MW	=	megawatt
kWh	=	kilowatt-hour
GWh	=	gigawatt-hour

Others

%	=	percent
°	=	degree
'	=	minute
°C	=	degree Celsius
cap.	=	capita
md	=	man-day
mil.	=	million
no.	=	number
pers.	=	person
PCU	=	passenger car unit
ppb	=	parts per billion

Unit Conversions

1 rai	=	0.16 hectare

INTRODUCTION

This report presents an overview of the industrial sector focusing on manufacturing industries in the nine provinces for which an integrated regional development plan is being prepared. The principal aim is to present a picture of the existing conditions, and an assessment of potential and constrints and its role in the regional economy in the future. The report identifies target industries to be promoted in the Study Area and proposes a set of measures to realize the targeted growth which derives from that for GRDP. The implication of the projected levels of growth for industrial land, employment requirements and the likely locational development pattern are also presented.

A significant level of industrialization is planned for the Study Area with the expectation that the support measures will be undertaken by the national government, state owned enterprises, and local governments so that industrial investments by private sector may be encouraged to comply with.

Industrial sector is projected to create an average of 40,000 jobs per annum over the plan period. The industry and service sectors are projected to absorb all new entrants into the labor force. The industry sector is projected to create new employment at an average rate of 4.5% per annum throughout the period 1992-2010. The growth in employment will be close to double this level during the 7th Plan period and will gradually decline to around 2.5% at the end of Master Plan period.

This report starts with a discussion of national industrial development objectives, and then the brief summary of performance and structure of Thai industry (Chapter 3) provides further guidelines on types of industries suitable for the Study Area, and the likely characteristics of these industries. This is followed by a detailed discussion of existing industries in the Study Area, and industry characteristics (Chapter 4). The locational pattern within the Study Area and the directions of future development are presented in Chapter 5.

The last Chapter presents a discussion of the development plan for the industry sector. It indicates the levels of development by manufacturing product lines, and suggests support measures and projects to attain the planned growth.

CHAPTER 1

POLICY IMPLICATIONS FOR INDUSTRIAL DEVELOPMENT IN THE SEVENTH NATIONAL ECONOMIC AND SOICAL DEVELOPMENT PLAN

1.1 Industrial Development Objectives

The Seventh Plan has three major objectives, i.e, (1) maintenance of current development momentum, (2) redistribution of income and decentralization of development, and (3) acceleration of man power development and upgrading quality of life. Each objective sets targets implied for industrial development with corresponding policies measures or guidelines. The six target industries, designation of Nakhon Ratchasima as regional industrial center and expanded cmpulsory education and environmental standard are set under each objective, which are summarized as follows.

Policy Implications for Industrial Development in the 7th National Economic and Social Development Plan

Objectives	Targets	Policy Measures
a. Maintain economic growth rate at appropriate levels to ensure sustainability and stability	• Industrial sector growth rate 9.5% • Agro-industry sector growth rate not less than 5.5% • Export growth rate not less than 14.7% • Share of industrial export not less than 80% • Designation of target industries • Standard industrial product classification not less than 2,500 items	• Promote and support industry as a whole (fiscal/financial) • Revamp tax and privilege systems • Improvement of rules, regulations and promotion policy (Factory Act 1969, Machinery Registration Act 1971, IEAT Act 1979) • Widensing and deepening of privatization • Speed up expansion of infrastructure services • Provide training and upgrade labor skill level in incooperation with business enterprises • Enhance technological capability of industry to increase productivity and competitiveness (Sub contract systems and research development) • Encourage use of Industrial Product Standard System
	Agro-industry	• Support modern agricultural management system • Set up a national committee on agro-industrial policy • Set up a center to promote agro-industrial development • Allow importation of inputs when necessary
	Textile industry	• Reduce protective import duties for upstream and intermediate industries • Set up industrial estate for the bleaching and dyeing industry • Set up an institution to help develop technology
	Metal working industry	• Reduce protection of local car assembly industry • Support and enhance capability of machinery industry and intermediate metal products factories • Speed up specification of these industrial product standards
	Electronics industry	• Encourage large scale investment in electronics industry to use as many locally produced parts as possible to stimulate development of support industries • Promote electronics industries with long term market potential • Encourage industrial plant and private educational institutions to have great role in skill training
	Petrochemical industry	• Reduce the protective import tariffs • Permit private investment in the sector without constraints • Change the role of government from direct investor to coordinator of investment
	Iron and steel industry	• Promote the private sector to invest in the production of upsteam iron industry • Support increase in production capacity of steel sheets in freely competitive environment • Readjust structure of import tariffs for finished steel and semi finished products

Policy Implications for Industrial Development in the 7the National Economic and Social Development Plan

Objectives	Targets	Policy Measures
b. Redistribute income and decentralize development to the regions and areas more widely	• Industrial decentralization to the region • Designated regional industrial center North : Chiang Mai, Phitsanulok, Nakhon Sawan Northeast : Khon Kaen, Nakhon Ratchasima Central : Saraburi, Ratchaburi South : Suratthani, Songkhla	• Decentralize administrative and decision making authority to government agencies at regional and provincial levels • Develop administrative and managerial capability of local entrepreneurs by providing training courses • Promote greater application of production subcontracting systems • Develop marketing system for small-scale and cottage industries • Encourage both public and private financial institutions to expand credit to provincial industries • Disseminate industrial and marketing information to entrepreneurs in the provinces • Speed up development of public infrastructure facility • Expand public support services for industries such as training, product development etc. • Develop industries in the new economic zones and set up a specific responsible public organization
c. Accelerate the development of human resources and upgrading quality of life, environment and natural resource management	• Expand basic education from 6 to 9 years Transition rate 46.6% to 73% • Expand employment opportunity for another 2.8 million workers 32.02 millions to 34.85 millions 14.65 (non farming) • Reduction of water pollution BOD to 4 ppm Lower Chao Phraya, Tha Chin, Costal Tourist destinations, Bangkok and its vicinity areas, Chiang Mai, Sakhon Nakhon etc. • Reduce and control noise level to 85 decibels	• Set standard as well as enforce control measures for pollutants generated by industrial plants • Enforce the pollutor-pays-principle (PPP) • Improve organization, role and legal framework for efficiency in environment management • Mobilize investment for reduction and control of pollution in various froms • Support relocation of pollution generating industries within Bangkok Metrolopolis and vicinity towns to designated areas • Encourage use of clean or pollution free technology in the production process • Construct comprehensive wastewater treatment system • Encourage waste recycling for productive use and promote utilization of recycled water • Control construction and expansion of industrial plants which generate water pollution problems • Support establishement of industrial estates, industrial zones, flats and condominiums for industrial factories • Formulate measures for prevention of noises and vibrations in industrial establishments • Support application of technology which helps reduce volumes of solid wastes as well as recycling of solid wastes • Encourage investment in the construction of central hazardous waste treatment plans for industrial factories

CHAPTER 2

INDUSTRIAL DEVELOPMENT IN THAILAND

2.1 Industrial Structure and Performance

Thailand is one of the fastest growing economies in the world. Rapid growth started in Mid 1960's. The average per capita income growth rate was 4% between 1965-1987. The growth has accelerated since 1987 with an estimated GDP growth rate of 13.2% in 1988, 12% in 1989, and 10% in 1990. The growth in the non-agricultural sectors was even higher throughout the period (Table 1).

Composition of broad industry sector

The engine of growth has been manufactured exports. This is reflected in the growing share of industry in GDP as shown below.

The Share of Industry in GDP (%)

	1981	1986	1988	1990
Industry	30.1	31.9	33.6	36.8
Mining	2.8	3.1	3.2	3.6
Manufacturing	22.3	23.6	24.8	26.1
Construction	5.0	5.2	5.6	7.2

Source : Table 1

The recent growth in the share of construction is due to a number of diverse elements. There has been a strong demand for residential units both in cities and rural areas. The rapid growth in private manufacturing investment, investment in services (particularly hotels), and the large public infrastructure projects have also contributed to the growing share of construction.

The sub-sectoral share of mining largely reflects that of the other two sub-sectors as it appears to be dominated by quarrying-largely for the construction industry. Production share of mineral raw materials for manufacturing has been small.

Performance

The recent rapid growth of industry in Thailand was led by manufactured exports. Other demand sources of growth are domestic demand in urban areas, foreign private investment, and finally public investment in infrastructure.

The fastest growing manufactured exports were textiles, electronic goods, footwear, leather goods, and processed food (Table 2). Fairly high levels of export growth were also achieved in jewelry. In the domestic market, car and motorcycle demand grew by close to 50% over the last four years. Growth rates of over 20% per annum were also observed in beverages (mostly beer), steel bars, and cement. The latter two also reflect the rapid rise in infrastructural and industrial investment which grew to 36.8% of GDP in 1990-largely a result of foreign private investment from Japan, Taiwan, Hong Kong and Singapore.

Throughout the period 1987-1990, construction and mining is estimated to have grown at about the same rate as manufacturing. The construction sector grew by 21.7% per annum in 1987-1990 as a result of the demand from the private sector in manufacturing, services (hotels), and residential units. Additional impetus was provided from the large public infrastructure projects.

Mining output has grown mainly in response to increased production of fuel ores, quarrying and ores for local supplies. Relatively rapid rates of sectoral output were maintained (20% in 1988-1991) despite production and export declines in traditional mining output: tin ore and tungsten. Tin concentrate production declined from 23,022 tons in 1985 to 19,979 tons in 1990, while tungsten production declined from 1,137 tons to 530 tons during the same period.

2.2 Structure and Performance of Manufacturing in Thailand

2.2.1 Composition of value-added in manufacturing

Thailand has a diverse manufacturing sector, but its structure is still largely depending on activities of consumer related products. No product or product group dominates the sector (Table 3). The largest sub-sector was textiles, and accounted for 14% of manufacturing value added in 1989. This was followed by jute mills with 9.3%. The other two product groups with a significant share were jewelry and motor vehicles, each contributed 6%.

It is quite surprising that the share of food processing value added was very small at 7.2%. Seemingly important product lines such as rice milling, cassava processing,and production of dairy and other livestock products accounted for less than 1% of manufacturing value added each. Production of food and feed appears extremely low also by comparison to that of beverages/tobacco : 8.53% v.s. 16.3% in 1981 and 7.18% v.s. 12.9% in 1989.

As in food, forestry based products including paper and printing have a small and declining share : 6.35% in 1981 and 4.9% in 1989. This small share of consumer goods industries is surprising, because these were industries that were most highly protected during the first phase of import substitution.

The share of electric appliances (including electronics) is very small (less than 2% in 1989) despite the rapid growth in exports. This appears to be due to both the small share of the sub-sector in total output and the limited value added/output ratios, because the sector is basically of assembly type and is dependent on imported inputs.

Another striking feature of the manufacturing sector's composition is the small share of metal industries and machinery (2.6% in 1989). This sub-sector's share of manufacturing value added is around half of that of non-metallic mineral industries which have grown at very high rates in response to expansion in construction, particularly cement, cement products, glass and housing related products such as bricks, tiles, and sanitary ware.

2.2.2 Manufacturing employment

The most comprehensive source of employment data is the National Statistics Office. It provides information through labor force surveys based on residences. As such, it

includes employment information for both cottage type as well as that in large enterprises. Its time series data are difficult to reconcile with macro economic performance as discussed below. It also does not provide details on sub-sectors.

Ministry of Industry's data, based on factory registration, are comprehensive in sub-sectoral breakdown but cover less than 40% of total manufacturing employment. This is due to the exclusion of cottage type employment.

There are four sources of information on the member of manufacturing enterprises and manufacturing employment. The National Statistical Office (NSO) conducts periodic surveys of these, the most up to date being conducted in 1987. NSO also provides information through labor force surveys.

The Ministry of Industry has two separate sources of information. According to the Factory Act BE 2512, any industrial enterprises employing more than 6 employees or utilizing more than 2 H.P. of machinery have to register with the Industrial Works Department of the Ministry. In addition, the provincial office of the Ministry maintains a record of all registered enterprises, regardless of their size. As a result, the number registered with the Ministerial Provincial office tends to be higher than those in the central register.

According to the NSO, the total manufacturing employment in the Kingdom in 1989 was 2.77 million.[1)] On the same basis, the employment in 1987 is reported to be 2.44 million. Comparable information for the same year[2)] reported by the survey of Industrial Establishments of NSO reports manufacturing employment to be 918,000. The NSO industrial establishment data seem to cover 38% of manufacturing employment.

Based on the NSO labor force data (including cottage type employment), manufacturing employment has grown by 3.6% per annum between 1981-86, and by 2.6% per annum during 1987-89. These growth rates do not match that of GDP, and is hard to interpret.

Available data allow for limited inferences on the differences in labor productivity between factory type employment and cottage industries. According to NSO, value-added of enterprises employing 10 workers or more was 230 billion baht in current prices in 1986. Of this, 201 billion bahts were generated by enterprises employing more than 20 workers.

The NESDB estimate of manufacturing value added for the same year is 259 billion. The difference between the two would be due to production in small enterprises which employed 1.56 million workers in 1986. The implied value added/worker is 37,000 baht in current prices in 1986.

The large enterprises, in contrast, produced value added of 231,000/worker. The difference in productivity is, thus, more than six times. Some of this is due to

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1) Results of Round 3 (August).

2) The respondents are questioned about the situation during the previous year, and as such NSO data would be comparable to the previous year as reported by the Ministry of Industry.

differences in sectoral composition and capital intensity, but the available information does not permit such analysis.

2.2.3 Manufactured exports and leading sectors

A combination of favorable external factors and domestic policies have resulted in very high levels of growth in Thailand's exports. The value of exports have increased four-fold between 1981-1990. Almost all of this growth was due to manufactured products whose value increased by 8.2 times, or 26.4% per annum.

The highest rates of growth in manufactured exports were observed in textiles, electronic goods, footware, leather goods, and processed food (Table 2). Fairly high levels of growth were also observed in jewelry. These growth rates are identical to output growth performance, discussed in Section 2.1 above, indicating that exports were the main determinant of output growth.

These changes are reflected in the composition of manufacturing sector value added given in Table 3. This change is most significant in the case of textiles, jewelry, transport equipment and electrical machinery. The share of all these product groups in manufacturing value added increased substantially over the period 1981-1989.

Many of these leading export industries in Thailand are of assembly nature. They rely heavily on imported inputs. A substantial part of these export oriented, high growth industries are initiated by foreign private investors who provide the technology, finance, and marketing.

For the medium term, the government's emphasis is on development of intermediate industries. These industries are to provide locally manufactured inputs both to export oriented industries and to consumer goods industries producing for the domestic market.

Two major sub-sectors that are to be promoted in this category are basic metal industries and basic chemicals. Both of these are targeted for development in the ESB. Another important intermediate product to be developed is textiles to support the growing garment exports.

In terms of specific products, the Seventh Development Plan has identified seven target groups. Major support measures are to be instituted to enhance their productivity and growth. These product groups are 1) machinery and metal working industry, 2) electronics, 3) textiles, 4) food industry, 5) plastics, 6) iron and steel, and 7) gems and jewelry. The specific measures to be adopted and instruments to be used are still being formulated.

2.2.4 Government incentives and support measures

(1) Incentives

Investment incentives

Both Thai and foreign investors are provided with a range of incentives for BOI approved new and expansion projects based on the Investment Promotion Act B.E. 2520, which are summarized in the following six categories.

Guarantees
- Against nationalization
- Against competition of new state enterprises
- Against state monopolization of the sale of products similar to those produced by promoted person
- Against price controls
- Permission to export
- Against imports by government agencies or state enterprises with taxes exempted

Protection Measures (subject to justifications and needs)
- Imposition of surcharge on foreign products at a rate not exceeding 50% of the CIF value of for a period not more than one year at a time
- Import ban on competitive products
- Authority by the Chairman to order any assisting actions or tax relief measures for the benefit of promoted projects

Permissions
- To bring in foreign nationals to undertake investment feasibility studies
- To bring in foreign technicians and experts to work under promoted projects
- To own land for carrying out promoted activities
- To take or remit abroad foreign currency

Tax Incentives
- Exemption of business taxes on imported machinery
- 50% import duty reduction on machinery which is subject to import duty greater than or equal to 10%
- Reduction of import duties and business taxes of up to 90% on imported raw materials and components
- Exemption of corporate income taxes three to eight years with permission to carry forward losses and deduct them as expenses for up to five years
- Exemption of up to five years on withholding tax on goodwill, royalties or fees remitted aboard
- Exclusion from taxable income of dividends derived from promoted enterprises during the income tax holiday

Additional Incentives For Enterprises in the Special Investment Promotion Zones
- Maximum reduction of 90% of business tax on the sales of products for a period up to five years
- Reduction of 50% of corporate income tax for five years after the termination of a normal income tax holiday or from the date of income earning
- Allowance to double the cost of transportation, electricity and water supply for deduction from taxable corporate income
- Allowance to deduct from the taxable corporate income up to 25% of the investment costs of installing infrastructure facilities for 10 years from the date of income earning

Additional Incentives for Export Enterprises

- Exemption of import duties and business taxes on imported raw material and components
- Exemption of import duties and business taxes on re-exported items
- Exemption of export duties and business taxes
- Allowance to deduct from taxable corporate income the amount equivalent to 5% of an increase in income derived from exports over the previous years, excluding costs of insurance and transportation

Sectoral selectivity of incentives

The broad framework within which priority sectors (products) are identified have seven targets. These are 1) export production, 2) promotion of industries which form the base for further stages of industrial development, 3) development of public utilities and basic infrastructure, 4) contribution to technological development, 5) conservation of natural resources and reduction of environmental problems, 6) location of operations in the provinces, and 7) conservation of energy or replacement of imported energy supplies.

Further strengthening of the industrial base (target (2) above) is generally interpreted to mean the development of basic chemical and metal industries which will produce the intermediate products in the downstream industries, particularly plastics and metals. Development of textile industry to support the garment industries is also viewed within this group, though this industry is relatively more developed (particularly spinning and weaving) compared with the first two which have not been established as yet. Projects that support growth of agricultural and agro-industry products are also viewed in that group, because they have been an important component of Thai traditional exports. The export value added of these products, as a proportion of export revenues, is much higher than the import dependent electronics, textiles and garments, and jewelry.

Conspicuously missing from the framework for investment promotion is any reference to medium/small scale industries. Although the objectives of the Master Plan for the Study Area and the three main objectives of the Seventh Development Plan include income generation in rural areas by improved productivity in agriculture and rural based industries, the investment incentive system excludes investments in most sectors which are below a minimum size. It is unlikely that the medium/small enterprises (SME's) can effectively utilize the investment/export incentives unless the present system is changed drastically which is highly unlikely. One possible direction of change would be to shift from the present positive list to a negative list (only specifying industries not to be encouraged) and providing incentives to all investments and exports as a matter of right, and not as a privilege.

The list of projects/sectors eligible for incentives is fairly inclusive. Even products not included in the list may be added by applying to the Board of Investment (BOI). At present, 96 types of activity are listed, agricultural products-22, minerals, metals and ceramics-5, chemical and chemical products-14, mechamical and electricals-8 and others-57. Each activity has guidelines as to minimum investment capital required, minimum Thai shareholding, minimum export level and other conditions. A number of activities have been suspended from the investment promotion list (forming a negative list) since the early 1980's. These include plantations, some agro-processing (yeast, cornflour, and animal feed), production of agricultural machinery, and some metal and plastic products. It is probably due to perceptions that these investments would occur without incentives or there is sufficient domestic production capacity.

Investments under the incentive system

The total investment approved by BOI has averaged 350 billion baht per annum over the period 1989 - 1991 (Table 4). For the period 1989 - 90, when comparable data are available, the promoted investments accounted for 72% of total gross domestic investment, though not all of the approved projects would be actually undertaken, and there is a time lag between investment approvals and actual investment. Even with these modifications, over half of the total investment appears to have been undertaken under the BOI privileges. The coverage of BOI investments is probably even larger for new investments compared with the expansion of the existing plants.

Sectoral and locational distribution of projects receiving incentives.

In line with the government policies discussed in Chapter 1, the government introduced zoning systems for location specific incentives to promote decongestion of the BMR and accelerated development in the outer regions.

The BMR is designated as Zone 1 and its surrounding 10 provinces of Samut Songkhram, Ratchaburi, Kanchanaburi, Suphanburi, Ang Thong, Aythaya, Saraburi, Nakhon Nayok, Chachoengsao and Chon Buri as Zone 2. The remaining 57 provinces plus Laem Chabang Industrial Estate are designated as Zone 3. In Zone 3, the additional 21 activities are listed as eligible for promotion. They are rubber products, animal products, processing of metal, special types of paper, mechanical equipment, electrical equipment, engines, vehicle components and parts, sports equipment, musical instruments or toys, plastic and plastic coated products, cloth umbrella, lenses spectacles or parts, natural and sythetic fibre products, socks, carpets packaging materials, footwear, jewelry boxes and textile products. These activities do not require export except for garments. The minimum investment capital, excluding the cost of land and working capital is 500,000 baht.

(2) Support Measures

Three areas where public services are critical for the development of national technological capability are science and technology services, industrial finance, and manpower training. The development of regional industries is also dependent on the availability of the physical infrastructure (power, water, waste disposal, and transportation), and enhanced links with the sources of raw materials and markets.

Technology services

Technological capability is improved by importing capital equipment, promoting foreign direct investment, promoting domestic firms to produce under licence that embodies state of art technology, and developing local technology and disseminating information on both the locally developed/adopted technologies and those available from outside. Financial and fiscal support to private enterprises to acquire these technologies and strengthening their capacity to effectively utilize them (including manpower training) are an integral part of the policy in this area.

The tax barriers to the import of capital goods into Thailand have never been excessive. Even during the import substitution policies, pursued until the early 1980's, the import tax on essential goods not locally produced was less than 5%, and for basic goods it was less than 15% after the adjustments made in April 1985. In

recent years, about 70% of imported capital goods was undertaken under the BOI privileges which provides a waiver from import taxes and other non-tariff barriers.

The import barriers were further reduced after the introduction of value added tax at the beginning of 1992. Import duties were lowered and the system simplified to reduce protection and distortions. Import duties on machinery and equipment were lowered to 5% across the board. This measure stimulated the replacement of old machinery and equipment by imports. The duty on computers was reduced from 20 ~ 30% to 5%. For parts imported for assembly, the rate was reduced from 10 to 1%.

The focal point for transfer of technology to the local/provincial industries from abroad and the basic research results from universities are the Ministries of Industry and Science, Technology and Energy. The Industry Ministry's Department of Science Services has six units (all located in Bangkok) which provide services to the private industry. The department provides analysis and testing services to certify and control the quality of industrial products. It also runs a science and technology information service. It establishes, maintains and disseminates national measurement standards in science and technology and provides training services for the public and private sectors.

In addition, the Ministry operates a network of regional research centers which specialize in research relevant to the products of the region. This includes the Thailand Management Development and Productivity Center, and the Metal working and Machinery Industries Development Institute (MIDI).

Within the Ministry of Science, Technology and Energy, there are six different units that are involved in improving the local technological capability. Sector specific work is undertaken by TISTR while general support is provided by, among others, the Technology Transfer Center, the Department of Science Services and the three specialized research centers (biotechnology, materials technology, and electronics and computer technology).

Two distinct strategies may be pursued for technology development. One would be concentration on research and import of the most modern available technology. The other strategy is to insure the dissemination of the best available local technologies.

Finance

The major source of finance in Thailand are commercial banks. They accounted for 74% of all deposits and 75% of all lending as of the end of 1990. The banks provide both short and long term loans to the industry. Parallel to the growth of manufacturing output and exports, the share of industrial lending has increased steadily : from 10.6% in 1989 to 25.8% of commercial bank lending in 1989. The banks also have considerable equity investments in manufacturing enterprises.

Concessionary credit to medium and small scale industries is provided by the Industrial Finance Corporation of Thailand (IFCT). The size of IFCT lending is small (less than 6% of total lending to the manufacturing sector up to the end of 1990), and the interest rate charged by IFCT is not significantly different from that of commercial banks.

Nonetheless, the Bank can potentially play a key role by lending to small/medium size enterprises. It can guarantee loans from other private sources. It can also make

funds available by selling any investments of the company, and can furnish administrative, managerial and technical advise. Of the six branches of IFCT, two are in the Northeast : one in Nakhon Ratchasima, and one in Khon Kaen.

Two other sources of funding are available for smaller industrial companies. One is through the Small Industries Finance Corporation of Thailand (SIFCT) which is the joint venture between the IFCT and commercial banks. The other source is the recently enacted Small Industry Loan Guarantee Scheme.

Technical training

In Thailand vocational training institutes offer three types of certificates. A certificate of Vocational Education is awarded after three years of study following nine years of basic education. A certificate of Higher Vocational Education (P-V-S) is awarded after two years of further training. Lastly, the P-V-T (Advanced Certificate of Vocational Education) requires two years of vocational training following the completion of pre-university well.

Information on the number of such schools in the Study Area and the number of graduates is not available at this stage. In the medium to long term, the availability of skilled manpower will be critical, because the main industries to be developed in the region will be skill intensive light industries.

CHAPTER 3

PRESENT CONDITIONS AND DEVELOPMENT POTENTIAL

3.1 Overview

3.1.1 Position of Study Area in Thailand

The table below shows the present picture of uneven distribution of industrial activities compared with that of population among the seven (7) regions of the Kingdom. Though the Study Area's population share of 17.7% is two points higher than that of the BMR, its share of value added is only 2.3% as against that of 76.3% of the BMR. The Study Area is the least developed area in manufacturing sector in the Kingdom.

Value Added in Manufacturing in 1989 (million baht in 1972 prices) and population (in million)

	Value Added		Population	
Whole Kingdom	137.3	100%	55.9	100%
BMR	104.8	76.30%	8.7	15.60%
Central	4.8	3.50%	2.8	5.00%
Western	4.7	3.40%	3.3	5.90%
Eastern	9.9	7.20%	3.6	5.90%
Southern	2.5	1.80%	7.0	12.50%
Northern	4.7	3.40%	10.9	19.50%
Northeastern (including Study Area)	5.9	4.30%	19.6	35.10%
Study Area	3.2	2.30%	9.9	17.70%

Source: NESDB - NAD
Note: The Study Area includes two provinces of the Eastern region.

3.1.2 Industrial production trends

A salient feature of the manufacturing industry of the Study Area is the lopsided pattern of subsectoral composition. Though it appears that there are some errors in tabulation by activity in the above original data and a certain discount is required, the agro-industries consisting of the main four products of slaughter house, rice mills, alcoholic beverage, and cotton and jute have a dominant share of 75.2% in value added of the manufacturing industry as against that of 17.9% of the national average.

The share of agro-industries varies by sub-region. Prachin Buri sub-region has highest share at 85.4% of which alcoholic beverage has a share of 77.4%. Surin sub-region has the lowest share at 57.5% among the four sub-regions primarily due to lack of alcoholic beverages. This may be a reason why the per capita GRDP of Prachin Buri sub-region is nearly two folds of that of Surin sub-region. According to the industrial sample survey conducted by NSO in 1987, value added of the beverage is 55.1% as against the food industry's average of 18.6%.

The regional manufacturing industry has achieved an average annual growth rate of 5.2% during the period from 1981 to 1989, while the national average was 6.0%. As shown in Figure 3.1 (a), the rapid growth rate appeared in 1988 following the same national trend after 1987.

The sub-region, Nakhon Ratchasima, Ubon Ratchathani, Surin and Prachin Buri registered growth of 6.8%, 9.6%, -14.3% and 13.3% respectively in the period 1984-89. The decline of Surin subregion is primary due to termination of alcohol production in 1985. This trend is shown in Figure 3.1 (b).

The average annual growth rates of 10 sub sectors during the same period were as follows.

1.	Food processing	8.7%
2.	Textile	-0.4%
3.	Wood products	-4.4%
4.	Paper and pulp	-0.1%
5.	Chemical products	1.9%
6.	Non metallic products	7.3%
7.	Basic metal products	4.2%
8.	Machinery	-12.7%
9.	Transport equipment	11.2%
10.	Other industries	7.7%

In terms of growth rates, transportation equipment, the food processing, other industries and the non metallic products performed better than the regional average of 5.2%. On the other hand, the machinery, wood products, textile, and paper and pulp (printing) registered declines in output. The machinery sector has probably lost its market share due to competition with those in the Central region. The textile sector (jute products) has also lost market by introduction of man made fiber, and has faced decline in local supply of raw materials.

3.1.3 Number of manufacturing establishments

There are two data from the Industrial Works Department (IWD), Ministry of Industry which were used for analysis. The first data show the trend of the number of manufacturing establishments by province in the Study Area from 1987 to 1989. The second one is the computer printouts of the registered companies of the 9 provinces of the Study Area excluding the rice mills, as of June 1992. According to the Factory Act BE 2512, any company employs a minimum of 7 workers or equipment with 2HP has to register with the IWD. The Act was amended partly this year to up scale the criteria for registration.

The first data indicate that there was a total of 15,413 establishments including 11,733 rice mills and average annual rate of increase is 3%. With these figures, it is estimated that the current number would be around 17,000. While the second data indicate the non rice milling establishments of 4,818 with the following composition by types of activity.

		Number	%
1.	Food processing	2,154	44.7
2.	Textile	126	2.6
3.	Wood and furnitures	298	6.2
4.	Paper and pulp	46	0.9
5.	Chemical products	96	2.0
6.	Non metallic products	548	11.4
7.	Engineering and machinery	938	19.5
8.	Other industries	612	2.7
	Total	4,818	100.0

Note : Rice mills would be around 12,000 in number.

Among them growing types of activities are cassava processing mills, silk yarn and apparels, plastic products, ceramic and concrete products, aluminium, tin and stainless products, general and agricultural machinery, vehicle body, motor cycle assembly and jewelry.

3.1.4 Employment

Data of the two sources are used for analysis. One is the Labor Force Survey, 1989 by the NSO and another is the IWD's data of June, 1992 for non rice milling establishments. According to the NSO data, there was 160.5 thousand in wet season and 290.3 thousand in dry season in the Study Area for manufacturing workers. This volatile movement of manufacturing workforce may simply portrays the present manufacturing activities of the Study Area. The manufacturing industry of the Study Area seems to be still a supplementary activity to agriculture or seasonal activity in general. Majority of industrial activities have targeted for their small market where most of people engage in farming during wet season. Entrepreneurs can't afford to make large capital investments for production facilities because of marketing and financing problems and depend on seasonality labor.

According to the IWD's data, there are 81,117 workers based on the declaration of applicants for license. Therefore the average size of employment per establishment of non rice milling is approximately 17 persons. On the other hand assuming the average size of employment per rice mill at two workers, the total work force of this subsector will become 24,000. Accordingly it can be estimated that 105 to 110 thousand workers are employed by the registered manufacturing companies and the rest of 50 to 180 thousand are either engaging in the small scale activities which do not require registration with IWD and or out migrating to industrial activities of other regions.

Employment structure by type of activity excluding rice mills is as follows.

		Number	%
1.	Food processing	25,270	31.2
2.	Textile	24,679	30.4
3.	Wood and furnitures	6,554	8.1
4.	Paper and pulp	338	0.4
5.	Chemical products	3,076	3.8
6.	Non metallic products	8,020	9.9
7.	Engineering and machinery	7,377	9.1
8.	Other industries	5,785	7.1
	Total	81,117	100.0

3.1.5 Investment

Since investment data covering all scales of industrial activities are not available, the data from two sources, i.e. IFCT and BOI, are used for analysis.

IFCT has committed long term loans for 252 projects of the Northeast region amounting to 1,492.9 million baht from 1960 to 1991, of which 831 million baht or 55.7% was committed in 1991. Though the details are not available, it is presumed that annual project number and amount committed by the bank have increased with rapidly in the recent years. Yet the share of the Northeast region of receiving loans from the bank in 1991 was only 2.6% of the national total. The Study Area's share may be around 50% of that of the Northeast, which is considered much below the share of the contribution to the GDP in manufacturing by the Study Area.

There are 89 projects approved for the Study Area during the period from January 1985 to August 1991 and which are distributed into the following types of industry.

1.	Agro-industries, agri-business and food processing	49.44
2.	Mining and quarrying	15.73
3.	Textiles, wearing apparel and leather industries	4.49
4.	Furniture and fixture	3.37
5.	Chemicals and chemical products	5.62
6.	Non-metallic mineral products	6.74
7.	Iron and steel products and other metal products	1.12
8.	Machinery	7.87
9.	Transport equipment	1.12
10.	Services	3.37
11.	Other industries	1.12
		100.0%

Source : IFCT

The first four groups are considered as local resource based industries and have a share of almost two thirds of the approved projects. Based on the data of IFCT, the average capital investment per job in approved projects in the Kingdom in 1991 was 2.136 million baht while that of the Northeast region was 0.356 million baht. This may explain the industry characteristics in the Study Area.

There were 156 projects approved by BOI for three years from 1989 to 1991 with the total investment amounts of 29,828.1 million baht (Table 6). Nakhon Ratchasima is the center of attraction of industrial investments in the Study Area with outstanding

share of about 60% in terms of the number of projects and employment generation. Prachin Buri and Ubon Ratchathani has a share of about one fourth of Nakhon Ratchasima respectively. Their combined share is almost 90% of the regional total, while the share distribution in investment amount among the three provinces differs from the project number and employment. Nakhon Ratchasima decreased its share to 40% while Prachin Buri and Ubon Ratchathani increased to 30% to 24% respectively. The average investment amount per project and per job is 191 and 0.516 million baht respectively.

3.1.6 Manpower development

The Study Area has abundant human resources and has supplied a large number of workers to the outer regions, particularly to the BMR, to support not only their industrial but also other various activities.

I-sarn people are well known as easily trainable and industrious. It is the biggest wealth of the region. However, the existing public facilities for education and training of industrial workers in the region are lagging far behind (For details, refer to the Sector Report 11. "Socio-Economic and Social System"). Under these circumstances, a complementary training facility called Choonhavan Technology Training Center was established recently by private sector initiative at Suranaree Industrial Zone, Nakhon Ratchasima. Also the Suranaree University of Technology will open in the coming June and will have a substantial impact on the future industrialization of the region.

3.2 Agro-Industries

As defined in this report, agro-industry includes processing of primary agricultural products for food and animal feed. This definition excludes processing of fiber, forestry products and beverages. It includes seven major categories. These are 1) livestock products, 2) grain milling and bakery products, 3) fruit and vegetable processing, 4) edible oils, 5) sugar, 6) seafood, and 7) animal feed.

At present, agro-industry value added and employment in the Study Area are dominated by rice milling and cassava processing. The two accounted for 73 % of agro-processing employment in 1988 in the Study Area. Little or no growth is expected in these two-subsectors due to expected changes in domestic and foreign demand. There is little seafood production in the Study Area and none of the production is processed. The future growth in the Study Area, therefore, depends on growth of livestock production and processing, oil seed processing, animal feed industry in response to the changes in the first two sub-sectors, sugar industry, canning of fruits and vegetables, and bakery products.

The major bottleneck to the development of agro-industry in the Study Area is the limited availability of raw materials (primary agricultural products). Markets, investment capital and technology pose less problems than primary production. In the case of livestock, the major constraint to further growth is government regulations. Each of these issues are discussed below with reference to specific product groups.

3.2.1 Livestock products

(a) Meat production

The dominant meat product in the region is poultry. The poultry industry in the region serves both the domestic and the export markets.

The industry is new and the production is well integrated. Large broiler operations in the region include all phases of production: parent stock, hatcheries, broiler raising, feed production, processing of broilers, and marketing. Broilers are marketed as whole in the regional and national markets. Most exports occur in de-boned meat cuts, individually packed. Export markets are highly diversified including Japan, EC and USA.

The hot climate, and availability of cheap labor for broiler raising and processing are the major competitive advantages of the industry. The industry is new in Thailand and operates at a high level of technical efficiency.

The further growth of the broiler industry and layer operations for egg production depends on the availability of low cost, high quality feed. Most of the protein ingredients in feed are imported. High quality fish meal is provided as a by-product of the large tuna canning industry.

The industry, however, may be over-integrated due to concerns with animal health. In the western Europe and the U.S., a large part of the broiler raising is undertaken by individual farmers while the central operations are undertaken within the large companies. This creates employment and income for independent small farmers who need to own no more than the land on which broiler houses are built.

Two other components of the meat industry are cattle/buffalo and swine raising. Their growth have been severely curtailed by government regulations on slaughtering.

Thailand has a fairly unique system of maintaining a state monopoly on slaughter house operations. It makes a major policing effort to force farmers and traders to use these facilities. The regulations on private sector operations of the slaughter houses have effectively kept the private sector out of slaughter house operations. The extremely poor record of the publicly operated slaughter houses, on the other hand, has not only prevented the development of the livestock sector, but probably has been very detrimental for environment and public health/hygiene.

One slaughter house visited in Nakhon Ratchasima had absolutely no equipment, no butchers, no waste disposal/treatment facilities, and no cold storage. The livestock owners who are supposed to use this building are expected to bring their own butchers and knives and remove the carcasses immediately as there is no cold storage.

Partly as a result of this, Thailands' production of red meat has been tiny compared with the sizeable livestock population. The country had close to 5.4 million head of cattle in 1990. The number of slaughters (off-take) during the same year was 404 thousand. The performance was even poorer in the region (Table 7).

The ratio was similar for buffalos. In countries with developed livestock sectors the off-take rate is as high as 30% of the herd.

These ratios are based on official slaughter figures and understate the true yield of the livestock herd. This, however, is probably balanced by the movement of livestock into the region illegally from abroad via Mynmar from as far away as India and Bangladesh.

The production per head is probably equally poor. The average carcass weight is likely to be between 100-150 kgs., while the average of EC is close to 300 kgs. There is enormous room for productivity growth with appropriate policies; meat production could be increased by up to 4 to 6 times and milk production even more with the same herd size. This calls for rationalization of the rules on processing industry, government support for breed improvement; strengthening of the feed base, and further mechanization of agriculture and changes in land use composition to improve the ratio of cattle to buffalos.

The extremely low efficiency of cattle/buffalo herd is apparent when compared with other countries. The Thai cattle herd is 20% larger than that in Japan. Japanese meat production, despite the smaller herd, is 3 times that of Thailand. Japanese milk production, on the other hand, is 48 times that of Thailand. The productivity per head of cattle in New Zealand is two times for meat and 32 times for milk as that in Thailand.

The bottleneck created in slaughtering has also prevented the development of the meat industry. The slaughter houses provide the inputs for industries such as sausage making, hot dogs, canned sweet and sour pork, meat balls, and other products. It also adversely affects the development of feed industry for which meat and bone meal and blood meal would be important protein ingredients.

The highly distorted structure of the meat industry is reflected in data on number of plants and employment by the Ministry of Industry. According to this source, there were eight licensed slaughter houses in the Study Area employing 93 workers. Plants that further processed meat into meat products, in contrast, has developed considerably further with 71 work places providing employment for 694 workers.

The critical first step in re-structuring and developing this product line is changes in government regulations (Chapter 5).

(b) Number of slaughterhouses

There were 662 recorded slaughterhouses in Thailand in 1992. About half of these (382) were in sanitary districts and are owned by Sanitary District Administrations. There was a similar number owned and operated by municipalities (129) and the private sector (115). The rest were in rural areas and owned by Changwat Administrative Organizations. Of these, 56 (8.5% of total) were in the Study Area.

Most of the slaughterhouses in the Study Area are in sanitary districts. Nakhon Ratchasima, Prachin Buri and Buri Ram appear to be particularly well served. They had 13, 9 and 7 slaughterhouses in sanitary districts.

None of the slaughterhouses in the Study Area and few in Thailand, however, meet the basic hygiene standards. Only four of 115 private slaughterhouses in Thailand

are certified by the Ministry of Agriculture as meeting the standards set by importing countries. One meat processor in Thailand is certified as export quality in addition to the four who also operate slaughterhouses. All five are in the Bangkok Area.

All of the five certified enterprises are primarily export oriented. Their products are reportedly priced at about 15% above comparable quality products sold in the domestic market. Because of their inability to compete in the domestic market, they are presently operating at around 30% of their capacity.

All existing slaughterhouses, except those five and some private operations integrated with poultry production, are substandard. They lack basic hygiene conditions, equipment, cold storage facilities, and waste treatment facilities.

(c) Development strategy

Given the large number of existing facilities, a reasonable strategy is to promote upgrading of existing facilities rather than to build large new plants. The existing facilities could be brought to acceptable standards by improving the operations, adding basic equipment, cold storage, and strict enforcement of waste discharge standards.

A key issue is ownership. All of the 56 slaughterhouses in the Study Area, except one in Si Sa Ket, are publicly owned. The public sector will not and should not undertake upgrading. It is unlikely that private investment could be mobilized without privatization or long term leases. Either of these may result in achieving acceptable standards.

Another major barrier is the slaughter tax. Livestock farmers who use the registered facilities pay a fee which consists of three components. One is a service fee-presumably for use of the space. Another is a charge for the use of waiting area. Finally, there is a tax. The first would be reasonable if decent facilities and skilled workers to perform the task were provided. The last two, particularly the tax, is difficult to understand.

On the one hand, the Thai government is concerned with low farm incomes and is trying to improve farm incomes by various support measures. At the same time, it penalizes livestock farmers by taxing them. This distorts the pattern of agricultural output against livestock.

It is unlikely that even the upgraded slaughterhouses would be utilized if this is accompanied with a tax burden. There will continue to be a strong incentive for illegal activity to avoid the tax.

The development of this industry in the provinces is likely to change the structure of meat processing industry around Bangkok as well. Instead of trucking live animals and undertaking processing with serious environmental consequences in or around Bangkok, facilities in the BMA would receive carcasses from the upgraded slaughterhouses. The processing for the higher income segment of the domestic market and exports could be undertaken in packing/processing facilities in these central areas.

(d) Dairy industry

There appear to be only two major dairy plants in the Study Area processing around 200 tons of milk/day. All of the milk comes from pure breed and cross-bred cattle recently introduced into the area. The local cattle are not milked even for self-consumption.

One dairy plant is privately owned and produces half of the milk processed in its own dairy farm. The rest is purchased from farmers within a 20 kms. radius of a milk collection center. The other is government owned and relies more heavily on milk supplied by farmers.

All milk is processed into pasteurized and sterilized milk for fresh consumption. Even then, the plants can not meet the demand for fresh consumption. This is reported to be the pattern for the whole country as well. The demand for cheese, yoghurt and other dairy products is met through imports (of milk powder). At present, imports supply 600,000 tons of the estimated domestic consumption of 750,000 tons (milk equivalent).

The domestic demand for both red meat and dairy products is reported to increase by around 10% per annum. All of this incremental demand, as well as some import substitution, could be achieved by the development of a domestic industry.

The average size of milk plants is around 100 tons raw milk/day. Each such plant would require the establishment of 700 dairy farms with an average herd size of 10 cross-bred dairy cows. The forage requirement of such a dairy unit could be met by an average farm size of 40 to 50 rai under rainfed conditions in the Study Area. These units need to concentrate around milk collection centers of 10 tons/day.

Information on the profitability of milk processing and dairy farming is not available at this stage. Three major constraints limiting the growth of the dairy industry are 1) the underdeveloped red meat industry, 2) restrictive regulations on dairy plants, and 3) investment capital at the farm level.

The problems faced by red meat industry have an equally adverse effect on dairying. Dairy farms not only produce milk, but also produce calves for meat production. The calf sales constitute 40% of dairy farms' income in countries with developed livestock industries. Income from this is only 5% in Thailand, because there is no demand for calves from the meat industry which is almost totally lacking in the Study Area, and the Kingdom.

Second, the BOI requirements for promotional privileges for dairy plants are unnecessarily restrictive. The dairy plant is required to own, or have the right to use, at least 500 rai of land, have a minimum of 80 dairy cows, and stables, lodging, etc. None of this should be necessary for granting promotional privileges to new dairy plants. Excessive regulation may do no more than simply protect the oligopolistic position of publicly owned dairy plants in the region.

The last major constraint facing the industry is the need to establish the dairy plant and the supplying farm units simultaneously. The investment requirements of establishing sufficient dairy units to support a milk plant are quite substantial. At the same time, an efficient extension system for veterinary care, artificial insemination (AI), and forage production need to be introduced. This would require a large,

coordinated effort from many institutions and may be a good case for "Complete Cycle Project" concept recently introduced by the government (section 4.4.2).

3.2.2 Fruit and vegetable processing

As in Thailand, fruit and vegetable processing in the Study Area largely consists of pineapple canning. There has been a substantial expansion in tomato processing in the Northeast region in recent years, but this has occurred further north of the Study Area.

The fruit and vegetable processing factories that have been established in the region in recent years, and those which have received BOI incentives but have not started operations as yet, are based on a fairly standard product composition: baby corn, straw mushrooms, asparagus and bamboo shoots. All of the processed output is exported.

The list of additional fruits that can be grown in the region and are suitable for processing includes mango, papaya, longan, rambutan, and cashew nuts. The production of these commodities, however, is very small and all of the output is marketed as fresh. Processing enterprises can not compete as long as strong market demand for fresh produce exists. Because of the small volume of production (Table 8), the volume of second quality produce not suitable for marketing as fresh is not sufficient to sustain a processing industry. A further complication in fruits is the perennial nature of production. This makes the possible contractual arrangement between growers and processors even more complicated as discussed below.

Vegetables suitable for processing recently grown in the region include chillies, garlic, onion and tomatoes. There seems to be large room for expansion in vegetable processing if vegetables in which the region has a comparative advantage in production are well identified and a viable relationship between the farmers and processors can be developed.

The processors need a steady supply of raw materials of varieties suitable for processing at reasonable prices. For the farmer who grows this products, the processor is the monopsony buyer if the variety is sufficiently different from that for which a fresh market exists.

There have been both very successful examples and failures. Tomato paste processors have been successful in supporting farmers to grow tomatoes for processing which have substantially increased farm incomes. Kenaf and pineapple producers, on the other hand, have withheld produce from processors when they could receive higher prices in the outside markets, thereby forcing processing companies into bankruptcy. The key element of success is probably the identification and promotion of commodities in which the Study Area has a comparative advantage in primary production so that the processor can receive raw materials at competitive prices while the farmers also grow the commodity profitably.

For the short and medium term, the safe strategy is to build on the proven commodities: baby corn, straw mushrooms, bamboo shoots and asparagus. The production of the first can be increased immediately while the latter two have a gestation period of only two years.

Except for some pineapple, there is no fruit juice industry in Thailand. Aside from the limited availability of raw materials, the domestic demand has been also constrained by high levels of taxation of 20%. Under the new VAT system, fruit juice is recently reduced to 10%.

3.2.3 Grain milling and bakery products

At present, agro-industry in the Study Area is dominated by rice milling and cassava processing. There is substantial excess capacity in rice milling. There is some room for investment in rice milling to improve technical efficiency, particularly reduction of the proportion of broken rice. Some new investment may also occur to save energy in processing.

Aside from these special cases, it is unlikely that any new investment would occur in rice milling. On a single shift, eight hour basis, the existing milling capacity is four times the national paddy production.

A small part of the cassava output is presently processed into starch, with the bulk processed into tapioca pellets for export and sliced tapioca for the domestic feed milling industry. Roughly half of the domestic tapioca output is exported to EC under a quota system. The FOB prices of such exports have been around US$130/ton in recent years. The average FOB export price to other markets has been around US$50/ton.

The lucrative EC market is used by the government to force the exporters to export to other countries as well, thereby increasing total exports of Thailand. The quota allocation for exports to EC is partly based on the volume of the total exports of each company, past performance, and the stocks held by the exporter. The last is similar to the system used for rice export lisening and is basically a devise to force the exporters to purchase more of the primary commodity than they otherwise would.

The relatively high EC export price, and the high share of EC in total tapioca exports of Thailand (5.2 of the 9.0 million tons in 1990) also discourages further processing of tapioca for exports into such products as starch and modified starch. The latter requires twice as much fresh cassava as tapioca per unit of output. Even if the costs of further processing are disregarded, the export unit values of starch should be twice as those of tapioca if exporters were to be neutral between tapioca and starch exports. Over the last decade, the unit values of starch were only 60% higher than those of tapioca. This provides an incentive to export tapioca rather than further process it.

Around 10% of the cassava output is processed into starch and modified starch. Over half of the starch is exported to Japan and Hong Kong for the use in canning and paper industries. In both markets, Thailand's market share is close to 90% for cassava starch. The future growth of starch exports, therefore, depends on the price competitiveness of cassava starch compared with corn starch whose market is 10 times larger than that of cassava starch.

The increased use of cassava for starch and feed industries will become increasingly critical in the future when the EC tapioca quota is reduced or eliminated, as expected, and as a result of the ongoing GATT negotiations which will lead to major reductions in the internal EC grain and tapioca prices. The present acreage of cassava in the Study Area can be maintained if three measures are simultaneously taken: 1) growth

in the livestock (feed) industry and increasing utilization of tapioca in animal feed, 2) increasing share of starch in cassava product exports, and 3) improvements in yields to reduce raw materials costs while maintaining and possibly increasing the farm-level profitability of cassava production. The present average cassava yields are reported to be only a third of economically optimum yield levels. In addition, the starch content of cassava can be increased by up to 30% through variety improvement.

The nutritional value of tapioca is around 80% of that of maize for feed milling. The feed mills also prefer to use maize rather than tapioca because of the better color when maize is fed, particularly in egg production. For tapioca to become competitive with maize its price should be less than 80% of that of maize. Whether it could be produced competitively at that price largely would depend on growth in productivity.

3.2.4 Edible oil industry

Domestic production of liquid edible oil in Thailand meets the domestic demand. There is no margarine production. The growth in oil demand has been modest while there has been a growth of over 10% per annum in seed cake/paste demand over the last 10 years.

(a) National production and consumption

The major source of cake/paste in Thailand is soybeans. Soybean crushing capacity is one million ton in seven crushing plants. All of these, except two are located around Bangkok. One is located in Chiang Mai and another in Sukhothai. These two plants have 20,000 tons/year capacities.

Total production of soybean is around 400,000 tons in Thailand. The production has declined in recent years due to a fall in domestic prices. This fall, in turn, is due to change of policy since 1990. Until 1990, the imports were subject to matching domestic procurement requirements for import licences. This has been discontinued since 1990.

There still is some domestic protection for domestic soybean production. Soybean cake/paste is subject to a 6% import tax. An additional surcharge is levied to maintain domestic price stability at target levels. This has varied with the change in world prices, and has averaged around 20% CIF import value in recent years.

Thailand allows only oilseed cake/paste imports. Seed imports are not allowed as the domestic oil production is perceived to be in balance, and crushing of the oilseeds in the country would upset this balance by injecting additional oil as well as cake in the domestic market.

The sources of domestic oil supplies are as follows.

	%
Palm oil	65
Soybean oil	20
Rice bran oil	5
Others (peanut, sunflower, sesame, cashew nuts, etc.)	10

Slightly over half of the total oil (55%) is utilized in direct human consumption. The rest is used by industry for seasonings, and sauces production and canning.

(b) Existing processing capacity

The existing soybean crushing plants use combined mechanical pressing and solvent extraction technologies. As such they are suitable for combined processing of soybean with other oilseed sources. The most promising (significant) other oilseed is peanut. Roughly 80% of peanuts produced are used for direct human consumption. The quality of the remaining 20% used for processing is very poor, and are not handled property. As a result, the afflotoxin content tends to be high. This, however, can be practically controlled by better handling and increased production. A major growth in production of peanuts would increase the proportion of output processed, and thereby the average quality used for processing.

Another promising oilseed is castor bean and is already grown in Samut Prakarn. Sunflower is more tolerant in saline soils. The other major oil crop is corn.The oil content is low (2%), and a corn processing industry would need to develop a complete products line including starch, and corn syrup.

All of the present oil crushers are vertically integrated, including production of crude oils, refining, bottling and marketing. Each factory's product is marketed under its own brand name. This implies that new plants would also be integrated as there may not be a reliable market for crude oils.

Thailand's self-sufficiency in oil production also precludes refining plants which would be based on a mix of domestic and imported crude oils.

Two sources of edible oils in the region are soybeans and rice bran. There is no processing of other beans or nuts for oil in the region. There have been recent research efforts to grow sesame and sunflower in the region, but such efforts are concentrated in areas of relatively high elevation north of the Study Area.

Soybean production in the area was 16.1 thousand tons (average of 1988 - 1990). Cotton seed production was less than 4,000 tons during the same period (Table 3). This is too small a base for oil extraction. A single crushing plant of a relatively small size (100 tons of seed/day) would require production of over 10 times the present level. The development of downstream industries (oil refining and margarine production) would require even higher levels of oilseed output.

There is some rice bran as a basis of oil extraction. The Study Area produces close to 4 million tons of paddy, yielding around 400 thousand tons of rice bran which may be processed for crude oil production. The proportion of rice bran used for oil extraction is reported to be around a third, with most of the bran reportedly sold as pig feed without any processing. Nonetheless, there were five oil presses in the Study Area in 1990. The process technology used (hydraulic presses and solvent extraction) and their capacities is not known at this stage.

The Study Area will continue to rely on the rest of the country for protein ingredients of concentrate feed (particularly soybean meal/cake) without an oil seed crushing industry. The major oil seed in the Study Area is likely to be soyabean. The average yield in the Study Area is about the same as the national average which itself

is low: 214 kg/rai in 1990 compared with the world average of 270 kg/rai. One major bottleneck is reported to be the government monopoly on rhibozium and its severely limited supply.

Blending and packaging of liquid oil is, in contrast, well developed. There were 41 such plants in the Study Area in 1992 employing over 2,000 workers. No information is available on their capacities, capacity utilization and level of technology.

3.2.5 Animal feed industry

According to the information provided by the Ministry of Industry, there were 25 animal feed factories in the Study Area in 1992. All, except two, of these were located in Nakhon Ratchasima. All, except four, of these plants are simple mixers. They are mostly owned by the large farmers. Four produce complete feed, and each has an annual production capacity of 250,000 tons.

Traditionally, the industry supplied concentrates and pre-mixes to be mixed with coarse grains on the farm. The recent trend is towards production of pelletized complete feed. This is technologically more sophisticated, requiring equipment to handle vitamin, anti-biotic, mineral and special protein ingredients.

The shift to production of complete feed will create substantial growth opportunities for the development of feed industry. The volume of feed production would increase by up to four-fold, for example, by the simple shift from production of 25% concentrates to that of complete feed.

The bulk of the feed is consumed by broiler and pig farms. Based on a simple average of a representative ratio for the two, the feed ingredients required to produce 4.7 million tons of complete feed will be 1.2 million tons of cake/paste, 2 million tons of grain (mostly maize and sorghum), and 1 million ton of rice bran. Some of the grain, up to a third, could be replaced by tapioca pellets.

The Study Area would thus have sufficient production of all feed ingredients except cake/meal. Given Thailands' self-sufficiency in oil production, the cake production should be based on oil seeds with a high cake and low oil content. Soybean is ideal in that regard. Groundnut, sesame and corn also have low oil to cake ratios. Sunflower also seem very promising as it is better suited to saline soil.

3.2.6 Sugar industry

Sugarcane production in the region has been expanding in recent years. The sugar cane is seen as the most likely substitute crop for cassava if the area devoted to cassava is reduced by eliminating cassava from the relatively better soils.

The region has a fairly well developed industry to produce sugar-based products such as condiments, toffees and other sugar-based products for the regional market. There were 54 such plants in the region in 1992, employing an average of 8 workers each. They are also well spread throughout the Study Area.

(a) Trends in production

Traditionally sugarcane was grown in the Central region. This region accounted for 60% of area planted in early 1970's.This share has gradually declined and now stands at around 40%. The total area in the Central region has remained more or less constant at around 2 million rai over the last 20 years.

In the Northeast, in contrast, there has been a dramatic increase in area planted in sugarcane. This area was less than 100,000 rai in 1973/74. There was a slow growth until 1985/88, when around half a million rai was planted in cane. There has been a huge jump since then. The area in cane doubled between 1990/1992 increasing from 764,000 rai to 1.43 million rai in two years. The trend in growth of cane production is similar in the Northern region, which started from a similar base and had a similar area in cane production as the Northeast. Largely as a result of the growth in these two regions, the area planted in Thailand has increased steadily between 1973/74 and 1991/92.

The national cane production has increased even more rapidly than the area planted due to the simultaneous increase in yields. The national average of around 6 tons/rai cane yields of mid 1980's have approached 8 tons/rai over the last three production seasons.

The growth in sugarcane production in the Study Area largely parallels that of the Northern and Northeastern regions. The cane production in the Study Area was around 50,000 rai up to 1988. This increased to 149,000 rai in 1990. Based on comparative yields between the Study Area and the rest of the country, the cane production in the Study Area would be expected to have grown even more rapidly. The cane yields in the Study Area were above 8 tons/rai through the last five years compared with an average of around 7.5 tons/rai for the country. The constraint to the expansion of cane is probably the problematic location of the two factories in the Study Area and possibly their production technologies.

As of the end of 1992, the cane was processed in two sugar mills in the Study Area. These are located in Buri Ram and Mukdahan. Both plants are small by Thai standards. The plant in Mukdahan has a capacity of 2,000 tons/day and the one in Buri Ram 3,800 tons/day.

A new plant that has relocated to Nakhon Ratchasima and is expected to start operation at the end of 1992. It is one of the largest plants in Thailand with a capacity of 18,000 tons/day. Another plant is under construction in Nakhon Ratchasima and will have the same capacity. It is expected to start operations in the 1993/94 season.

The two plants already operating in the Study Area employed 1,200 workers. Over half of these were seasonal employees hired for the processing season. The plant in Mukdahan was supplied by 1,740 farmers while that of Buri Ram had only 113 farmer growers, indicating almost a plantation type of land ownership.

There appear to be two primary locational advantages of plants in the Study Area. The plants in the Central region are reported to face increasing problems in raw material supply as the farmers shift out of cane production. This shift is reported to occur as a result of the change in cropping patterns in the Central region in favor of horticulture and export oriented crops.

The second advantage of plants in the Northeast is the longer dry season. Sugar plants in the Central region operate for an average of 80 days a year. The plants in the Northeast, including the two in the Study Area operate for a period of over 150 days. The sugar content of cane in the Study Area is also higher than the national average.

Another advantage of all regions with dominant rainfed agriculture is the availability of seasonal labor. Over half of the workforce in processing plants is employed during the dry season. Regions with a peak of excess agricultural labor during the dry season would thus have a comparative advantage in labor supply. Employment in cane processing, in turn, would reduce the overall variability in seasonal labor demand.

(b) Prices and industrial organization

Thailand produced 4.8 million tons of sugar in 1991/92 production season. Of this 1.2 million tons is consumed domestically, the rest exported. The final consumption absorbs 75% of domestic consumption. About half of industrial demand is from beverage industries with the rest mainly used in fruit preserves and ice cream.

Of the total exports of 3.6 million tons, 800,000 tons are sold through long term contracts (Refereed to as Quota B, Quota A being sugar destined for domestic consumption). The rest is sold by the factories on the spot market (Quota C). Each manufacturer is allocated a proportional share of the three quotas.

Domestic ex-factory and retail prices of sugar are set by the government at 10 and 11 baht/kg. The international spot price at the same time was 4.5 baht/kg (US¢ 8.2/pound) for raw sugar. The domestic price is thus considerably higher than the international price. There is an elaborate system of controls and government interventions to segment the sugar market and insure that individual manufacturers do no divert sugar to the domestic market above the level set under Quota A.

Sugarcane growers and manufacturers have contracts based on profit sharing. Based on average prices under each quota and costs in primary production and processing, an indicative price is announced at the beginning of harvest season. In case the actual prices exceed the estimates, the difference is shared : 70% to the farmers, 30% to the manufacturers. In the reverse case, the difference is covered by the cane and sugar fund and the manufacturers are reimbursed.

The high domestic sugar prices discourage Thai exports of sugar based exports such as jams, sellies, and sugar confectioneries. The export of such products is small and not growing (around the sugar equivalent of 50,000 tons in 1991).

The exporters of sugar based products are partly compensated by being allowed to purchase sugar at 8.5 baht/kg. This, however, is resisted by the cane growers as it reduces the average price received by the sugar factories and therefore the estimated profits, of which the farmers receive 70% and processor 30%.Even at 8.5 baht/kg, the Thai sugar input is considerably more expensive than the comparable international price.[1] Some mechanism must be devised to insure that Thai

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1) For comparisons, the FOB spot price is the relevant one when the country is a net exporter. The costs of transport and insurance will be added to the spot price only if the country is net importer. The New York

manufacturers of sugar based products are provided with sugar at world prices when the commodity is exported.

3.3 Demand and Factors Affecting Supply

3.3.1 Demand for agro-industry products

The household expenditure data (Table 9) indicates that the growth in demand for agro-industry products will exceed the growth in per capita incomes for most products. Furthermore, the growth in overall demand will not constrain the growth of agro-industry production as the Study Area's share of most products is very small, and further growth can be achieved by increasing the Study Area's market share. The exceptional cases where the Study Area's market share in the country is significant is cassava products and some livestock products.

As a group, food consumption per capita has remained unchanged in Thailand between 1980 - 1990. The growth in the quantity of domestic food consumption has thus been the same as that of population. The volume of food production has grown by about 3.2% per annum with about 2% absorbed by population growth and changes in food composition, and the remaining 1.2% absorbed by the growth in exports.

During the same period, the expenditure on food has grown by about the same rate as that of incomes. This growth in expenditure is apparent from the income elasticities of demand given in Table 4. Despite constant levels of per capita food intake, the expenditure on food also grew by about 5% per annum between 1980 - 1990. Judging from the differential between the growth rates of primary production and agro-industries, most of the growth in food expenditure seems to be due to shift from consumption of primary products to products embodying an advanced level of processing.

Information on the relative weights of agro-industry products in food consumption is not available at this stage. Rough estimates of the magnitude of change, however, may be derived from the data given in Table 9. Considering the relative importance of rice products in total consumption, the income elasticity of demand for agro-industry products appear to be around 0.7. This is similar to the changes in consumption levels of agro-industry products in middle income countries.

The projected levels of per capita income in the region (around 10% per annum) would translate into agro-industry product demand growth of 7% per annum. Together with the impact of growth in population, the likely growth in demand is around 9% per annum. Aside from the income effect, the demand will also be effected by price changes. This, in turn, will depend upon the improvements in processing efficiency and distribution system of agro-industry products.

Data in Table 9 and discussions with industrialists indicate that above average rates of growth will be achieved in dairy products, and processed fruits and vegetables. Growth in poultry and meat products is likely to be around the average growth rates. Relatively low growth is expected in grain milling and sugar based products. The

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No.11, spot price of ¢8.2/pound is the relevant price for comparisons. The only adjustment needed is to add the processing cost from raw sugar to white sugar.

growth in feed industry depends on that of livestock and the extent to which the region will become a concentrate feed exporter to the rest of the country.

Available information on the changes in the actual production of specific commodities shows that the overall growth in agro-industries assumed in this report is not unreasonably high. Domestic consumption of beef, for example, has increased by 18.3% per annum between 1989-1997.[2] The Ministry of Agriculture estimates that the domestic milk demand will grow by 17% per annum between 1989-1997.

The assumed demand for feed derives from that of livestock. The demand for feed ingredients (particularly oil seeds) is similarly derived from that of feed. For the feed ingredients, a large part of the domestic demand is met by imports in the case of protein ingredients (cakes/meals). The demand, therefore, will not derive only from the growth of livestock production, but further opportunities are present for import substitution.

3.3.2 Factors affecting availability of primary products for processing

In general, the level of technology and marketing skills are well developed in Thai agro-industries. The major constraint faced by the industry is limited primary production. This is particularly true in the case of fruits, vegetables, oil crops and livestock products (Table 10).

Areas where sufficient raw materials are available and further processing would occur in response to the growth of domestic and export markets are bakery products, meat and dairy products, sugar based products, and some preserved fruits and vegetables. The growth of the last group, however, is likely to be limited due to year-around availability of fresh produce and strong consumer preferences.

The limited availability of primary products is due to both natural and institutional factors. Some of the institutional/policy factors relevant to each product group are discussed below. Three institutional factors appear to be of overriding importance and cut across all product groups. These are the development of efficient factor markets (particularly land), integration of primary producers with processors to encourage productivity and change the output composition to increase farm incomes and value added, and the impact of price controls.

(a) Land tenure

Security of land tenure is critical for encouraging farmers to increase investment in the farm holdings and improve productivity. This seems essential for livestock improvement and fruit production for processing. Security of tenure is also important for encouraging a more stable pattern of farm holdings with less seasonal outmigration and a more even pattern of labor utilization throughout the year. Unless this is done, the farmers will treat farm activities as a supplemental source of income with most of income derived from non-farm activities, even for those officially classified as farm population.

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2) Consultant Report prepared by Minster (1989).

Over 80% of the agricultural land appear to be owner operated, with an average farm holding size of 10 to 35 rai/family, if land titles such as Chanote Tidin, N.S. 3 and S.K. 1 are considered secure land titles. Yet, a common explanation for farmers' reluctance to invest in land improvements, perennial crops, farm structures and livestock genetic upgrading is cited to be the lack of land tenure security. The same factor is also often cited as the reason for lack of collateral for borrowing from BAAC.

Secure land titles will not only encourage investments. It will also lead to the development of an efficient land market. Farmers who own plots that are too small to secure a livelihood could sell them. It will also free them from the burden of returning to farming just to maintain their claim to ownership. Instead, they would hold permanent jobs in the non-agricultural sectors.

(b) Contract farming

Another common institutional factor hindering improved primary production for processing is noted to be absence of a viable relationship between farmers and processors. Quality specifications and prices of primary products create frictions in contract farming. It is also difficult to enforce contracts when the prices paid for the primary products differ from the parallel market prices: processors rejecting produce on the grounds of quality when the contract prices are above the parallel market prices, and farmers otherwise disposing of the product when they are low. As a result, neither the farmer is assured of a market when he produces varieties for processing, nor the processor of a steady supply of raw materials.

A programe that the government has recently introduced to resolve this issue is the Complete Cycle Project. Under these projects, the farmers and processors agree on prices and the processor guarantees purchases. The government agencies, in turn, provide the necessary inputs, particularly credit by BAAC to the participating farmers.

As formulated at present, these guidelines are very restrictive for processors while providing little apparent advantage. The processor guarantees purchase, has to provide a pre-specified number of extension staff, and post guarantee bonds. There appear to be no advantages for participating in such projects against all these commitments. As a result, there is little interest from the processors to participate in these projects.

Partly due to these restrictive regulations, the present interest in these projects have come primarily from input suppliers interested in selling inputs to farmers. The commodities chosen tend to be those requiring little or no processing.

These guidelines should be reviewed. One major direction of change would be to shift some of the burden of incentives to be provided to the farmers from processors to public agencies. BAAC should commit itself to providing credit to participating farmers; public agencies involved in input supply (irrigation water, seed and AI services) should similarly commit themselves to timely provision of these inputs.

Another change would be to reduce the level of integration required from these projects. The private processors participating in these projects not only purchase the output, but also supply the inputs. The farmers should be given the choice to procure the inputs wherever they may be available including the participating company. A similar freedom in choice of marketing outlet will also be desirable.

Both of these would introduce a market generated dynamism, will reduce the conflicts over prices, and will prevent transfer pricing practices by the processors.

The government may also explore alternative channels for supporting the participating farmers. Instead of exclusively relying on BAAC credit provision, for example, farmers could be financed through the agro-processors who would have access to alternative financial sources.

Another mechanism used by some agro-processors for insuring raw materials (as in the case of palm oil) has been to establish their own plantations or dairy herds. This model is not easy to implement in the Study Area due to the dominance of medium sized land holding pattern, would probably result in prohibitively high production costs, and would be socially undesirable. The main emphasis should be on farmers' participation in processing activities to the maximum extent technically feasible, i.e. contracting independent processes (dairy, layer, etc.) to independent farmers.

(c) Price controls

A list of commodities subject to government price controls, and information on mechanisms for implementation of price controls is not available at this stage. Price controls are reported to cover 22 commodities. Among the agro-industry products subject to price controls are milk, pork and sugar. For milk, both the procurement price from the farmers and retail prices are controlled by the government.

Although no formal price controls seem to be in place, the government also largely determines the prices of cassava and rice. For rice, the government undertakes price support procurement. Its major impact on rice prices, however, is probably through export quota allocation which, in turn, is related to the total procurement by the traders. This has the effect of forcing exporters to play a role in procurement to support prices received by farmers. The same system is also used in allocating EC tapioca export quotas.

A similar mechanism is used to protect the domestic oil processors. Feed mills are given import quotas for soybean meal/cake in proportion to their domestic procurement. This has the effect of forcing feed mills to procure the domestic supplies even when the domestic prices are above the border equivalents (CIF import price plus tariffs plus transport and trade margins).

There is also an elaborate system of quota holders for production of sugarcane. The prices in the domestic market, which absorbs about a third of the output, are kept at around double the world prices. The amount of sugar that each processing plant can sell at this lucrative market is related to the quantity of exports. The domestic consumers are thus subsidizing exports, and possibly sugarcane growers and processors.

(d) Regional comparative advantage in primary production

The largest cost component in agro-processing is that of primary products. This component may be as high as 70% for grain milling and animal feed industries. It is about half of the total cost or more for most other commodities. The price at which the primary commodity may be supplied, therefore, is a key element of the success of processing enterprises.

The price at which the farmer is willing to supply the processor with the primary commodity largely derives from the Study Area's suitability for growing the commodity and the farm practices. The commodity that is being promoted should provide an income incentive to the farmer. Otherwise, he will continue to grow the alternative crops.

One indication of the relative regional advantage in production of primary commodity is comparisons of the yields in the region with the rest of the country. Yields, however, may vary depending on input intensity, climatic and soil conditions and farm practices. Nonetheless, it is one indication of regional comparative advantage.

An even more reliable indicator of comparative advantage is gross margins per rai. For all primary commodities, with the possible exception of sugarcane, the market is national. The output price level, therefore, would be determined by national supply/demand conditions. With similar input and product prices, the gross margin indicates regional comparative advantage. The gross margins in the Study Area for different crops vary widely (Table 11).

Finally, one may compare the average costs of production in the region with the average price received by the farmers in the region. These figures are given in columns 2 and 4 of Table 11.

For crops, as expected, the highest gross margins are obtained in sugarcane and cassava. Cassava is highly profitable for the farmers to grow despite relatively low yields (about a-third of those achieved in Korea), and the fact that is planted mostly in poor soil. Profitability of sugarcane explains the recent expansion of its production in the Study Area. Other profitable crops are soyabean, groundnut and sesame. All three are potentially important crops for edible oil, and more importantly, protein ingredients for the feed industry.

Two other promising minor crops are babycorn and melons. The first is a key crop for exports (Table 6) and the latter appears to be in abundance throughout the Study Area, though it can not be processed.

Considerably higher returns (up to 20 times those of field crops) may be obtained for the farmers in fruit production. Products such as pomelo, lichee and asparagus are highly profitable. They are well suited for processing and will play and important role if farmers with relatively small plot sizes are encouraged. The constraint is the long gestation period (up to 8 years) before the farmers start to receive any income. The farmers will also not undertake such a long term investment unless there is absolute security of land ownership.

3.4 Local Resource Based and Footloose Industries

3.4.1 Gem cutting industry

As an important non agro-industry, jewelry has grown to gain substantial share in the manufacturing industry in both the national and the Study Area level at 6.1% and 5.9% respectively. At the sub-region level, the share of jewelry of the Ubon Ratchathani sub-region is high at 15.3% and which is followed by the Surin sub-region at 7%. The activity is mainly concentrating in gems stone cutting and polishing for final gem setting process in Bangkok. There are two locations, i.e. one

in Ubon Ratchathani and another in Si Sa Ket. According to the above NSO survey, value added ratio of this activity is extremely high at 94%. It is said that Khon Kaen has the largest operation of this activity in the Northeastern region. The second is the Mung Samsib in Ubon Ratchathani. Raw materials are imported from USA, Taiwan and Korea by jewellers in Bangkok and then sent to villagers. Investment required is small. This activity is considered a local technical resources based industry.

A problem of this industry is a kind of occupational sickness that damages the eye sights of workers. It is said that those workers normally have to stop engaging in this type of activities at the ages of mid-20's. Therefore improvement of working environment and practice to lessen the techno stress in the activity for protection of their eye sights is required at one side. Also broadening of their activities to making final products as ornaments to allow those retiring workers continue to work in the same trade of business may be required at another side. By doing so, the village may attract tourists who wish to buy those jewelry cheaper than in Bangkok.

3.4.2 Silk and handicraft industries

There is the Sericulture Research Center in Nakhon Ratchasima and has contributed in improving silk material production. Pak Thong Chai is the center of so called Thai silk and has succeeded in expanding both domestic and international markets. Surin province produces several kinds of silk textiles and also ornamental silverwares which based in the traditional Khamer culture and design.

Silk materials are locally produced and woven into textile with the designs such as "look kaeo" identical to Surin silk products. Silver materials as well as bead stone materials come from Bangkok and crafted into necklaces in this villages. About 300 persons participate in production activities as cottage industry except for two establishments that employ 50 workers and 75 workers respectively. Now the village itself is becoming one of tourist attractions of the province.

In Buri Ram there is a stone workshop engages in processing of local sand stones to be used for restoration of ruins in the areas. The skills of stone carving with the designs of the religious motives of Khamer have been kept by a few local people. Such replicas of the lintels of the Prasart Phanom Rung will be in great demand by art collects worldwide. Exotic stone statues and carved stones may find good market in the construction industry.

Agglomeration of silk industries in Pak Thong Chai has enhanced the structure of industry and enabled them to produce quality products that now enjoyed a high position in the world markets. However, their continued expansion may create problem of waste treatment particularly through dyeing process. Public assistance for establishment of a common waste water treatment would be one of the key issues the industry hopes for. Conservation and promotion of the stone carving skills is also important issue.

3.4.3 Concrete products

As discussed earlier, this is one of the most common industrial activities through almost every districts of the Study Area. Cements are mostly procured from Sara Buri but sand and gravels are locally produced. There have been constant demands from

construction of buildings and infrastructures. The industry is expected to continue growing.

3.4.4 Footloose industries

Footloose industries produce a variety of consumer products mainly for the competitive international mass markets. Availability of abundant labor, lower labor costs, political stability, necessary infrastructures and utilities, GSP quota, minimum government controls and maximum incentives are major factors for locational consideration. Typical products of the footloose industries are consumer electronics, watches, toys, garments, artificial flowers, shoes, bags, and sporting goods.

As mentioned earlier a several of these industries are already located in such remote places as Buri Ram and Surin and have generated substantial number of employment in each locality. In consideration of continued development and improvement of the interregional transport networks and industrial estates within the Study Area, these footloose industries will be further attracted to the region.

However there will be increasing competitions with neighboring countries, particularly with China and Vietnam for location of this type of activity. Further improvements on factors other than labor cost will be required.

3.5 Linkage Type Industries

In additional to the above footloose industries, there are some promising industries which have potential to become the leading industries of the Study Area in the long run. They are the fabricators of bus bodies and speciality trucks, manufacturers of precision metal components and manufacturers of precision dies and moulds for plastic and metal working industries. These industries require higher technologies and will help upgrade the general level of the country's industries. BOI recognizes the importance of this sector and is now placing a special emphases on their promotion in line with the new strategy called BUILD (BOI Unit of Industrial Linkage Development).

3.5.1 Engineering/metal working industries

Natural environment of the Study Area is quite suitable for this type of activity which requires various precision machine and tools. This is well proven by the successful operation of both the local and foreign investors in this activity in Nakhon Ratchasima. Since the Study Area has the problem in water supply except for some districts in the eastern part, those basic material industries such as iron and steel, chemicals, paper and pulp which require large amount of industrial water are considered not suitable for location. On the other hand, the engineering and metal working industries generally do not require large amount of water. Furthermore, as mentioned earlier the sub soil structure is solid enough to install precision metal working machinery without extra pilings required in the Central Plain of the country.

The Study Area has also substantial demands for agricultural machinery and transportation equipment. As it is already discussed in Section 3.2, there are a number of engine repair and reconditioning factories, car repair shops with lathe machines and or welding machines in addition to those new and modern machining factories in Nakhon Ratchasima which provide a broad base for industry to step up further.

Another potential is the activity of SRT in region. SRT started operation of the Northeastern line up to Korat in 1900 and since then the necessary facilities and personnels for repair and maintenance of their rolling stocks have been secured and trained. SRT has 5,612 rolling stocks as of September 1991 and the mechanical engineering department has 7,109 persons which constitutes about 27% of the total personnels of SRT. It is told that the annual budget of SRT for repair and maintenance is about 2.8 billion baht, 60% of which is the cost of materials and the company made a policy not to increase their personnels in view of current annual operating deficits of about 1 billion baht. SRT has the main workshop in Makkasan, Bangkok and the northeastern regional workshop in Korat.

With the resources of SRT it can help promote metal working industries in the country and can encourage the private sector to go into rolling stock manufacturing business as many opportunities exist in urban mass transit projects in Bangkok, expansion of the SRT lines and also export markets in the neighboring countries. The Makkasan workshop has 69 ha of land, but it is said that the half of the area will be used by proposed introduction of the urban mass transit system. Therefore if SRT makes a policy to relocate part of the facilities to Korat and allow them work with the private sector for establishment of rolling stock industry, the metal working industry in the Study Area will give substantial impacts on the industry scene of the Study Area.

Manufacturing of parts and components for transportation equipment will eventually induce the location of the assembly industries in the Study Area. Up until now there is no automobile test course in the country. Judging from the remarkable growth of the Thai automobile industry, it will soon need this facility to develop its own designed cars suitable for the country's topographical and climatical conditions. Since it is costly to own this kind of facility by single automobile company, it is suggested to own by the government or quasi public agency and allow the industry use it for their research purposes with reasonable fees.

Land cost is still cheap and there are many areas in the Study Area suitable to test performances of engine, part and components and chasis on various road conditions reflecting the typical profiles and designs of the countries' roads. Introduction of the facility to the Study Area will surely attract the location of the automobile industry.

CHAPTER 4

LOCATION OF INDUSTRY IN THE STUDY AREA

4.1 Locational Advantages of the Study Area

The Study Area possesses a number of advantages as a location for new enterprises as well as those relocating from BMA. Some of these are discussed below.

The Study Area has an abundance of relatively cheap, trainable and hard working workforce. There are about 6 million workers and majority of them engage in agriculture. A large portion of these workers has potential to be shifted into industrial activities by modernization and mechanization of agricultural sector. Furthermore about 100 thousands new workers are expected to participate in the market annually.

The land prices are still relatively low in the Study Area. In comparison with the Central region, there are still more lands not properly used even along the main highways which are located within and or near the urban areas. Also future agriculture crop diversification will change the current extensive land use pattern of rice farming into an intensive one of higher value added crops which will result in reduction of agricultural land use.

Currently the selling price of Nava Nakhon Industrial Estate of Pathum Thani is 3.5 to 4 million baht per rai, Well Grow Industrial Zone in Bang Pakong, Chachoengsao 2.9 million baht, while Suranaree Industrial Zone in Nakhon Ratchasima is 0.9 to 1 million baht.

Compared with alternative locations, construction costs in the Study Area are low. Soil structure is solid and does not require piling for normal factory buildings. This saves construction costs compared with those in the central plain areas. There is no flooding at most of areas in the Study Area. Comparing with the coastal zone, humidity does not contain salinity. It is a better environment for metal working industries.

The Study Area is easily accessible to the major markets in the BMA and neighboring Indochina countries. It will be served by roads, railways and airports as follows. The highway R-2 is being upgraded to eliminate the bottlenecks. The time distance to the BMA will be substantially shortened in the very near future. Moreover, construction of the outer ring road connecting Bang Pha-in with Bang Phli will soon start, and will divert traffic to the Eastern Seaboard bypassing the BMA and alleviate the present heavy traffic loads of R-1. The R-304 will be upgraded into a full 4 lanes road under the 7th Development Plan. Also another arterial road connecting the Study Area with the Eastern Seaboard is proposed under this study. Furthermore, the SRT Northeastern line will have direct link in 1995 with its Eastern line between Kaeng Khoi, Saraburi and Khlong Sip Kao, Chachoengsao. This line bypasses Bangkok and allows direct access to Laem Chabang Port from the Northeast by rail.

The above major improvement and development of the inter-regional access will definitely enhance the industrial location potential of the Study Area. The regional links include the following.