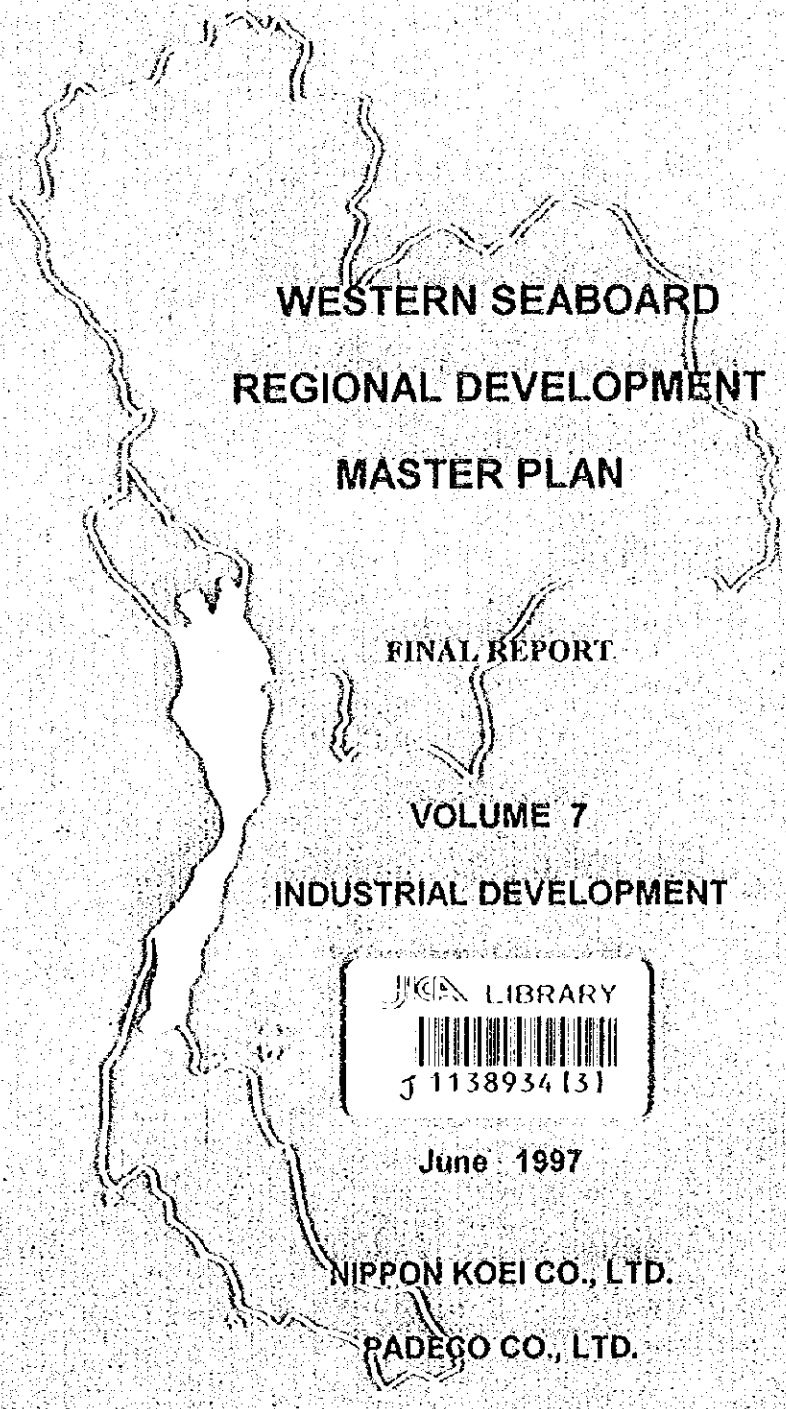
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

NATIONAL ECONOMIC AND
SOCIAL DEVELOPMENT BOARD (NESDB)
OF THE KINGDOM OF THAILAND



WESTERN SEABOARD REGIONAL DEVELOPMENT MASTER PLAN

FINAL REPORT

VOLUME 7

INDUSTRIAL DEVELOPMENT

June 1997

NIPPON KOEI CO., LTD.

PADECO CO., LTD.

WESTERN SEABOARD MASTER PLAN Volume 7 Industrial Development June 1997

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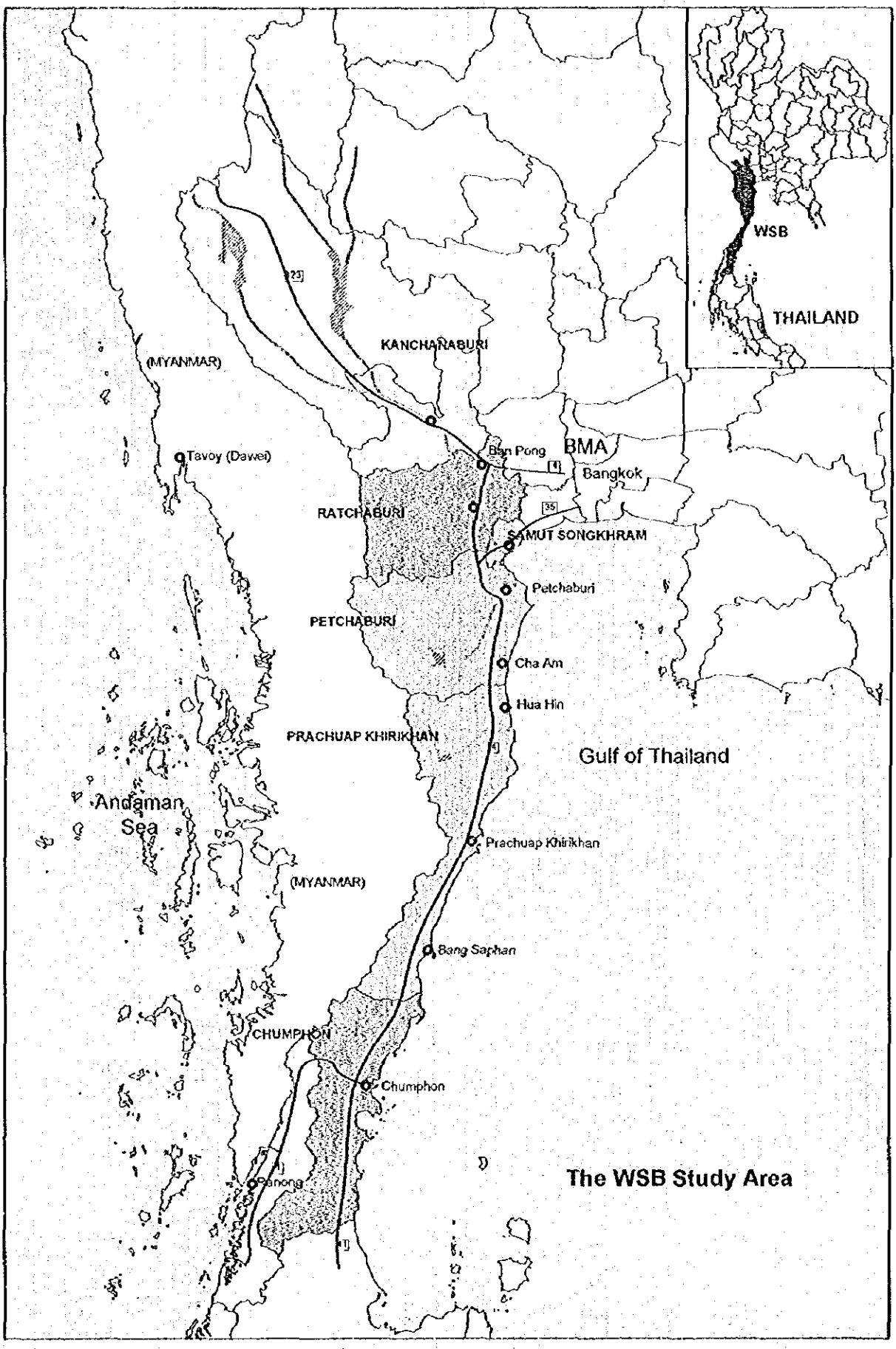
WSB
THAILAND
KANCHANABURI
(MYANMAR)
Tavoy (Dawei)
Ban Pong
BMA
Bangkok
RATCHABURI
SAMUT SONGKHRAM
Petchaburi
PETCHABURI
Cha Am
Hua Hin
PRACHUAP KHIRIKHAN
Gulf of Thailand
Andaman Sea
Prachuap Khirikhan
(MYANMAR)
Bang Saphan
CHUMPHON
Chumphon
Ranong
The WSB Study Area

VOLUME 7 INDUSTRIAL DEVELOPMENT

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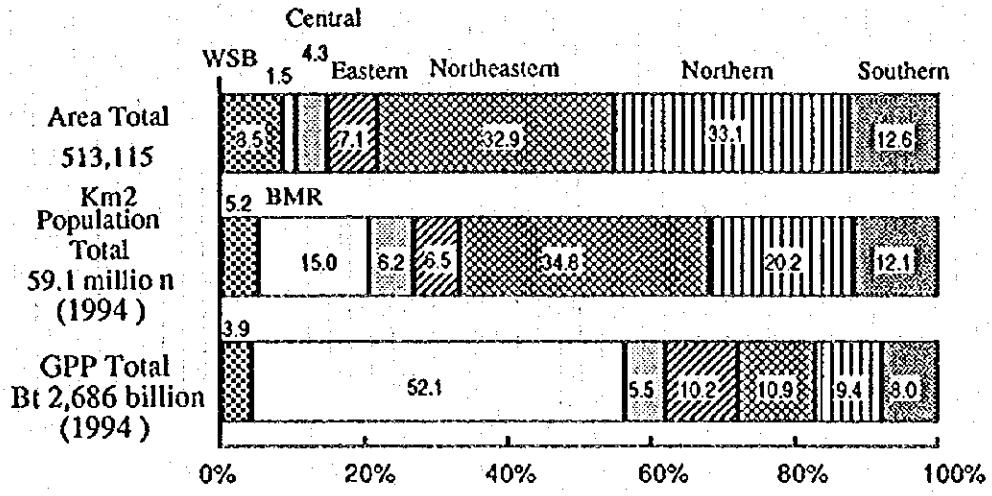
Chapter 1 Present Conditions for Industrial Development in the WSB Region

1.1 Overview

The WSB region is contributing 4 per cent to the Thai economy:

The Western Seaboard (WSB) region, comprising the six provinces of Kanchanaburi, Ratchaburi, Samut Songkhram, Petchaburi, Prachuap Khirikhan, and Chumphon, has an area of 43,698 km^2. The region's population totaled around 3.06 million and its gross provincial product (GPP: in constant 1988 prices) amounted to 106 billion Baht in 1994. WSB shares of the national total were 8.5 per cent, 5.2 per cent, and 3.9 per cent, respectively as shown in Figure 7.1.1.

Figure 7.1.1 Percent Shares by Region in Thailand



(1) Per Capita GPP

Per capita GPP of the WSB region is at a level of 76 per cent of the national average:

Per capita GPP of the region was 34,622 Baht, i.e., 76 per cent of the national average (45,452 Baht) in 1994, which ranked fourth among the country's seven regions. The per capita GPP of the Bangkok Metropolitan Region (BMR) was 158,017 Baht, or 3.48 times higher than the national average (Table 7.1.1).

Table 7.1.1 Socioeconomic Indicators by Region

(in constant 1988 prices)	Data Items				% Shares of Whole Kingdom			Difference GPP ('94)
	Area (Km2)	Population ('94:'000)	GPP ('94) (Bill. Baht)	GPP ('94) Per Capita (Baht)	Area	Popula-tion	GPP	Per Capita
Whole Kingdom (WK)	513,114.6	59,095	2,686.0	45,452	100.0%	100.0%	100.0%	1.00
WSB (6 Provinces)	43,697.7	3,062	106.0	34,622	8.5%	5.2%	3.9%	0.76
Kanchanaburi	19,483.2	737	24.2	32,838	3.8%	1.2%	0.9%	0.72
Ratchaburi	5,196.1	790	31.4	39,702	1.0%	1.3%	1.2%	0.87
Samut Songkhram	416.7	206	5.0	24,443	0.1%	0.3%	0.2%	0.54
Petchaburi	6,225.1	444	14.2	31,907	1.2%	0.8%	0.5%	0.70
Prachuap Khirikhan	6,367.6	456	18.1	39,643	1.2%	0.8%	0.7%	0.87
Chumphon	6,009.0	428	13.1	30,690	1.2%	0.7%	0.5%	0.68
BMR (6 Provinces)	7,758.1	8,851	1,398.6	158,017	1.5%	15.0%	52.1%	3.48
Bangkok	1,565.2	5,584	1,029.1	184,296	0.3%	9.4%	38.3%	4.05
Nakhon Pathom	2,168.3	719	44.5	61,807	0.4%	1.2%	1.7%	1.36
Nonthanburi	622.2	741	32.7	44,152	0.1%	1.3%	1.2%	0.97
Pathum Thani	1,525.9	511	93.8	183,467	0.3%	0.9%	3.5%	4.04
Samut Prakan	1,004.1	914	128.4	140,470	0.2%	1.5%	4.8%	3.09
Samut Sakhon	872.4	381	70.1	183,731	0.2%	0.6%	2.6%	4.04
Central (7 Provinces)	21,951.4	3,692	147.6	39,966	4.3%	6.2%	5.5%	0.88
Phra Nakhon Si Ayutthaya	2,556.6	699	40.4	57,725	0.5%	1.2%	1.5%	1.27
Lop Buri	6,199.7	738	18.3	24,846	1.2%	1.2%	0.7%	0.55
Saraburi	3,576.5	565	45.8	81,022	0.7%	1.0%	1.7%	1.78
Suphan Buri	5,358.0	835	21.9	26,213	1.0%	1.4%	0.8%	0.58
Eastern (8 Provinces)	36,502.5	3,860	274.0	70,980	7.1%	6.5%	10.2%	1.56
Chanthaburi	6,338.0	464	13.3	28,621	1.2%	0.8%	0.5%	0.63
Chachoengsao	5,351.0	605	35.5	58,659	1.0%	1.0%	1.3%	1.29
Chon Buri	4,363.0	962	137.8	143,169	0.9%	1.6%	5.1%	3.15
Trat	2,819.0	205	7.2	34,958	0.5%	0.3%	0.3%	0.77
Rayong	3,552.0	467	53.7	114,994	0.7%	0.8%	2.0%	2.53
Northeastern (19 Provinces)	168,854.3	20,542	293.5	14,290	32.9%	34.8%	10.9%	0.31
Khon Kaen	10,886.0	1,679	36.9	21,980	2.1%	2.8%	1.4%	0.48
Chaiyaphun	12,778.3	1,084	15.0	13,881	2.5%	1.8%	0.6%	0.31
Nakhon Ratchasima	20,494.0	2,464	46.5	18,867	4.0%	4.2%	1.7%	0.42
Buri Ram	10,321.9	1,445	17.5	12,117	2.0%	2.4%	0.7%	0.27
Roi Et	8,299.4	1,283	15.6	12,154	1.6%	2.2%	0.6%	0.27
Si Sa Ket	8,840.0	1,385	14.9	10,723	1.7%	2.3%	0.6%	0.24
Sakhon Nakhon	9,605.8	1,049	12.9	12,321	1.9%	1.8%	0.5%	0.27
Surin	8,124.0	1,330	16.0	11,999	1.6%	2.3%	0.6%	0.26
Udon Thani	11,730.3	1,442	19.9	13,819	2.3%	2.4%	0.7%	0.30
Ubon Ratchathani	15,744.9	1,680	22.2	13,210	3.1%	2.8%	0.8%	0.29
Northern (17 Provinces)	169,644.3	11,912	251.9	21,145	33.1%	20.2%	9.4%	0.47
Chiang Rai	11,678.4	1,252	19.6	15,665	2.3%	2.1%	0.7%	0.34
Chiang Mai	20,107.1	1,547	45.9	29,682	3.9%	2.6%	1.7%	0.65
Nakhon Sawan	9,597.7	1,117	25.8	23,138	1.9%	1.9%	1.0%	0.51
Phetchabun	12,668.4	1,042	15.8	15,149	2.5%	1.8%	0.6%	0.33
Lampang	12,534.0	804	21.2	26,402	2.4%	1.4%	0.8%	0.58
Southern (13 Provinces)	64,706.2	7,175	214.3	29,875	12.6%	12.1%	8.0%	0.66
Nakhon Si Thammarat	9,942.5	1,489	31.8	21,357	1.9%	2.5%	1.2%	0.47
Songhkla	7,393.9	1,144	42.6	37,267	1.4%	1.9%	1.6%	0.82
Surat Thani	12,891.5	815	27.5	33,719	2.5%	1.4%	1.0%	0.74

Note: Provinces listed in the Table are the main provinces in the regions excluding the WSB and BMA.

Source: Population (Office of Central Register, Local Administration Department-MOI)
Gross Provincial Product (NESDB)

Per capita GPP differs widely by province:

Per capita GPP varies greatly by province. It is high in the provinces of the BMR, especially in Bangkok, Samut Sakhon, and Pathum Thani, each with a per capita GPP of more than 180,000 Baht in 1994. Bangkok's per capita GPP (184,296 Baht) was the highest in Thailand, corresponding to around 18 times that of the lowest province of Si Sa Ket (10,723 Baht) in the Northeastern region. Provinces of the second ranking group with per capita GPP of 110,000-150,000 Baht, include Chon Buri and Rayong in the Eastern region or the ESB (Eastern Seaboard), and Samut Prakan in the BMR. Aggregated GPP of the top six provinces accounted for 56.3 per cent of the national total.

Per capita GPP of the WSB provinces ranked 16th-37th among Thailand's 76 provinces:

Of the six provinces in the WSB region, five were in the fourth group with a per capita GPP ranging from 30,000-45,000 Baht in 1994. Among the Kingdom's 76 provinces, Ratchaburi ranked 16th (39,702 Baht), followed by Prachuap Khirikhan (39,643 Baht), Kanchanaburi (32,838 Baht, 22nd), Petchaburi (31,907 Baht), and Chumphon (30,690 Baht, 25th). Samut Songkhram ranked 37th (24,443 Baht), the lowest in the WSB region. (Figure 7.1.2)

(2) High-Growth Provinces

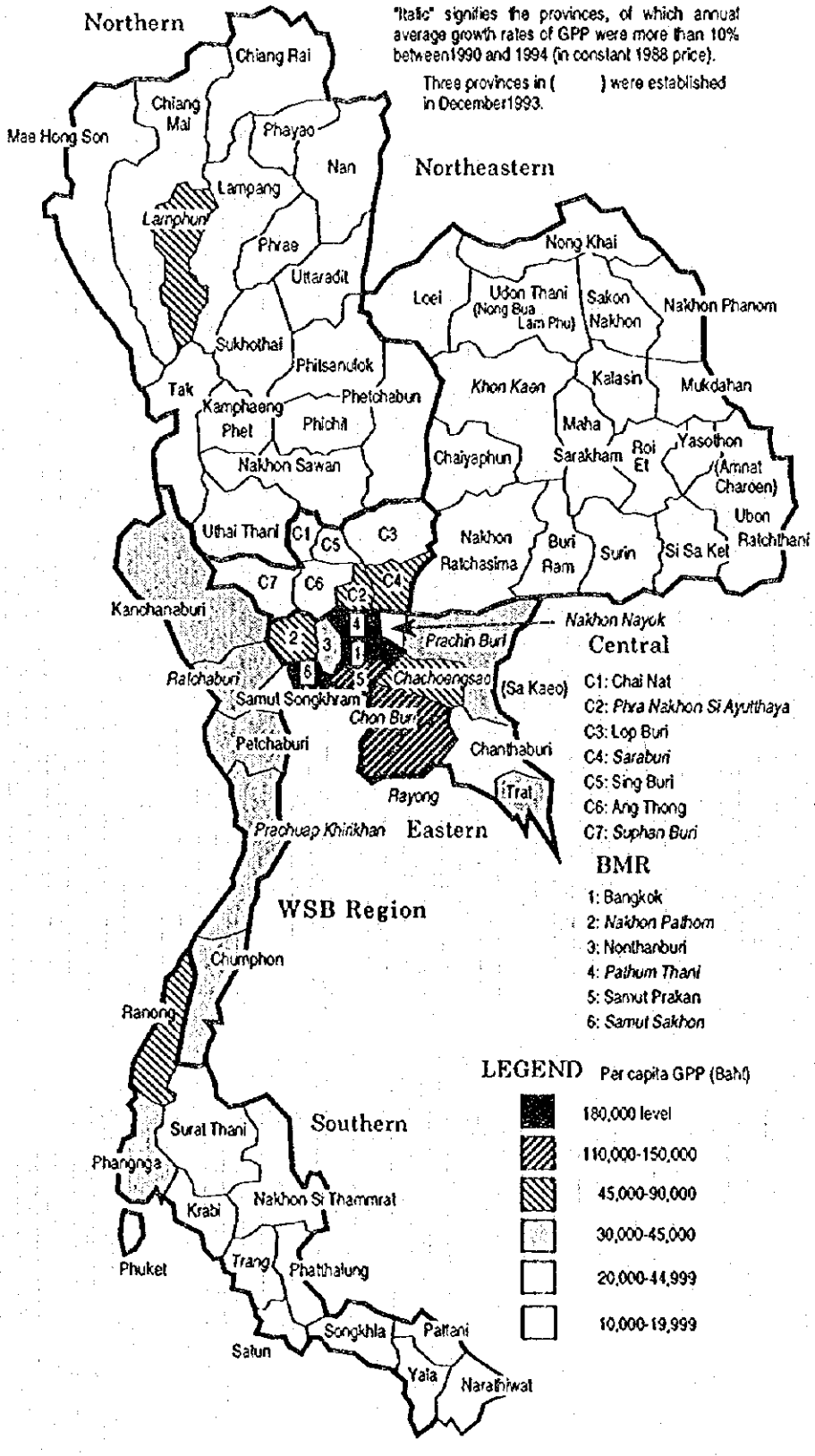
Higher growth provinces are mostly situated around Bangkok:

Thailand's total GPP increased from 1,946 billion Baht in 1990 to 2,686 billion Baht in 1994 (in constant 1988 prices), implying an average annual growth rate of 8.4 per cent. By province, Samut Sakhon in the BMR ranked top (29.9 per cent) followed by Lamphun (27.4 per cent) in the Northern region, Ayutthaya (26.1 per cent) in the Central, and Nakhon Pathom (21.4 per cent) and Pathum Thani (19.1 per cent), both in the BMR. These high-growth provinces are mostly situated around Bangkok. An exception is Lamphun, where a large industrial estate including an export processing zone (EPZ) was developed.

High-growth provinces are concentrated in the ESB:

These are 11 provinces having an average GPP growth rate ranging from 10.2 per cent per annum (Trang in the Southern region and Suphan Buri in the Central region) to 14.8 per cent per annum (Nakhon Nayok in the ESB) as shown in Figure 7.1.1. Of the seven provinces of the ESB, however, five including Nakhon Nayok province, are classified as high-growth provinces. The high growth of the ESB is attributable to industrial estate development by the Industrial Estate Authority of Thailand (IEAT). Rayong is well known for the development of petrochemical complexes at Map Ta Phut, while Laem Chabang Industrial Estate has been developed in Chon Buri. Supported by the relevant improvement in

Figure 7.1.2 Per Capita GPP by Province in 1994



infrastructure, many private industrial estates have been developed in the ESB. Such developments have absorbed huge investments and have been promoted as an expansion of Bangkok's economic area.

Ratchaburi and Prachuap Khirikhan are high-growth provinces in the WSB region:
Between 1990 and 1994, the GPP of Ratchaburi increased at an annual average rate of 13.0 per cent, ranking eighth among 73 provinces in 1990, while Prachuap Khirikhan's GPP increased by 10.5 per cent per annum, which was ranked 14th. In this period, a large textile mill in Ratchaburi and a steel complex in Prachuap Khirikhan started operation.

(3) Industrial Structure

The WSB's industrial structure has been agriculture-oriented:
Of the total GPP of the WSB region, agriculture accounted for 20.1 per cent, which was 8.6 percentage points higher than the national average in 1994. On the other hand, industry (including mining and quarrying, manufacturing, construction, electricity, and water supply) accounted for 37.4 per cent, 3.7 percentage points lower than the national average. The service sector's share was 42.6 per cent, which was also lower than the national average of 47.5 per cent. Consequently, the WSB industrial structure is relatively agriculture-oriented. (Table 7.1.2)

The share of agriculture in the WSB region as a proportion of the national total was 6.9 per cent, 3 percentage points higher than that of the total GPP in 1994. By sector, forestry accounted for 24.3 per cent of the national GPP and was mostly concentrated in Kanchanaburi. (Table 7.1.3)

Manufacturing was less developed in the WSB:
Manufacturing in the WSB region accounted for 27.0 per cent of the total GPP, 3.4 percentage points lower than the national average, while the share of other sectors was almost the same as the national average. (Table 7.1.2)

The WSB's growth rate was relatively higher in fisheries and manufacturing:
The Thai economy has rapidly grown through industrial development, particularly manufacturing, which increased at an annual average growth rate of 10.4 per cent between 1990 and 1994, while the rates for the agriculture and service sectors remained at 4.0 per cent and 7.8 per cent, respectively. (Table 7.1.3) Manufacturing industry also increased rapidly in the WSB region, with a growth rate of 19.3 per cent in 1990-1994, almost double the national average. By province, Ratchaburi, Prachuap Khirikhan, and Chumphon showed

the highest manufacturing growth in the region, with their growth rates at 27.2 per cent, 26.8 per cent, and 31.6 per cent, respectively. During this period, some crude palm oil refineries started operation in Chumphon.

Table 7.1.2 Industrial Structure of the WSB Region in 1994

GPP: Billion Baht (in constant1988 prices)	Whole King-dom	WSB Total	Kancha-naburi	Ratcha-buri	Samut Song-khram	Petcha-buri	Prachuap Khiri-khan	Chum-phon
G P P Total	2,686.0	106.03	24.20	31.37	5.04	14.18	18.09	13.15
AGRICULTURE	308.3	21.27	4.75	4.05	0.83	1.97	3.84	5.81
Crops	183.5	12.07	3.11	2.47	0.16	1.31	2.03	2.98
Livestock	32.8	2.17	0.40	0.90	0.06	0.22	0.32	0.28
Fisheries	42.2	3.81	0.05	0.05	0.39	0.29	1.12	1.91
Forestry	3.4	0.83	0.82		0.01		0.00	0.00
Agricultural services	9.2	0.38	0.17	0.11	0.00	0.05	0.02	0.03
Simple agri. processing products	37.3	2.01	0.20	0.52	0.22	0.10	0.36	0.61
INDUSTRY	1,100.8	39.60	7.49	16.52	1.21	4.54	7.76	2.08
Mining and quarrying	43.6	1.47	0.53	0.36	0.04	0.34	0.13	0.06
Manufacturing	815.9	28.66	4.56	14.13	0.77	2.27	5.83	1.10
Construction	172.8	6.73	1.78	1.08	0.28	1.57	1.36	0.66
Electricity and water supply	68.5	2.73	0.62	0.95	0.13	0.35	0.44	0.25
SERVICES	1,276.9	45.16	11.96	10.80	3.00	7.67	6.49	5.25
Transportation and communication	208.7	6.53	2.67	1.00	0.39	1.44	0.54	0.49
Wholesale and retail trade	439.5	17.23	4.90	4.13	1.16	2.78	2.49	1.78
Banking,insurance and real estate	214.5	5.36	0.80	1.40	0.43	0.76	1.07	0.89
Ownership of dwellings	73.7	4.18	1.08	1.03	0.26	0.66	0.69	0.47
Public administration and defence	69.7	3.94	1.00	0.94	0.21	0.79	0.47	0.53
Services	270.8	7.92	1.51	2.30	0.56	1.23	1.23	1.10
Percent Shares	Whole King-dom	WSB Total	Kancha-naburi	Ratcha-buri	Samut Song-khram	Petcha-buri	Prachuap Khiri-khan	Chum-phon
G P P Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
AGRICULTURE	11.5	20.1	19.6	12.9	16.5	13.9	21.2	44.2
Crops	6.8	11.4	12.9	7.9	3.1	9.3	11.3	22.7
Livestock	1.2	2.0	1.7	2.9	1.1	1.5	1.7	2.1
Fisheries	1.6	3.6	0.2	0.2	7.7	2.0	6.2	14.5
Forestry	0.1	0.8	3.4		0.2		0.0	0.0
Agricultural services	0.3	0.4	0.7	0.4	0.0	0.3	0.1	0.2
Simple agri. processing products	1.4	1.9	0.8	1.6	4.3	0.7	2.0	4.7
INDUSTRY	41.0	37.3	30.9	52.7	24.0	32.0	42.9	15.8
Mining and quarrying	1.6	1.4	2.2	1.2	0.8	2.4	0.7	0.5
Manufacturing	30.4	27.0	18.8	45.0	15.2	16.0	32.3	8.4
Construction	6.4	6.4	7.4	3.4	5.6	11.1	7.5	5.0
Electricity and water supply	2.6	2.6	2.6	3.0	2.5	2.5	2.4	1.9
SERVICES	47.5	42.6	49.4	34.4	59.5	54.1	35.9	40.0
Transportation and communication	7.8	6.2	11.0	3.2	7.7	10.2	3.0	3.7
Wholesale and retail trade	16.4	16.3	20.3	13.2	23.0	19.6	13.8	13.5
Banking,insurance and real estate	8.0	5.1	3.3	4.5	8.5	5.4	5.9	6.8
Ownership of dwellings	2.7	3.9	4.4	3.3	5.1	4.7	3.8	3.6
Public administration and defence	2.6	3.7	4.1	3.0	4.1	5.6	2.6	4.0
Services	10.1	7.5	6.2	7.3	11.1	8.7	6.8	8.4

Source: NESDB

Table 7.1.3 WSB's Regional Shares of the Kingdom Total GPP and Growth Rate by Sector

GPP Percent Shares of the Kingdom Total	Whole King-dom	WSB Total	Kancha-naburi	Ratcha-buri	Samut Song-khram	Petcha-buri	Prachuap Khiri-khan	Chum-phon
G P P Total	100.0	3.9	0.9	1.2	0.2	0.5	0.7	0.5
AGRICULTURE	100.0	6.9	1.5	1.3	0.3	0.6	1.2	1.9
Crops	100.0	6.6	1.7	1.3	0.1	0.7	1.1	1.6
Livestock	100.0	6.6	1.2	2.7	0.2	0.7	1.0	0.8
Fisheries	100.0	9.0	0.1	0.1	0.9	0.7	2.6	4.5
Forestry	100.0	24.3	23.9		0.3		0.0	0.0
Agricultural services	100.0	4.1	1.9	1.2	0.0	0.5	0.2	0.3
Simple agri. processing products	100.0	5.4	0.5	1.4	0.6	0.3	1.0	1.6
INDUSTRY	100.0	3.6	0.7	1.5	0.1	0.4	0.7	0.2
Mining and quarrying	100.0	3.4	1.2	0.8	0.1	0.8	0.3	0.1
Manufacturing	100.0	3.5	0.6	1.7	0.1	0.3	0.7	0.1
Construction	100.0	3.9	1.0	0.6	0.2	0.9	0.8	0.4
Electricity and water supply	100.0	4.0	0.9	1.4	0.2	0.5	0.6	0.4
SERVICES	100.0	3.5	0.9	0.8	0.2	0.6	0.5	0.4
Transportation and communication	100.0	3.1	1.3	0.5	0.2	0.7	0.3	0.2
Wholesale and retail trade	100.0	3.9	1.1	0.9	0.3	0.6	0.6	0.4
Banking,insurance and real estate	100.0	2.5	0.4	0.7	0.2	0.4	0.5	0.4
Ownership of dwellings	100.0	5.7	1.5	1.4	0.4	0.9	0.9	0.6
Public administration and defence	100.0	5.7	1.4	1.3	0.3	1.1	0.7	0.8
Services	100.0	2.9	0.6	0.8	0.2	0.5	0.5	0.4
Annual Average Growth Rate (1990-1994)	Whole King-dom	WSB Total	Kancha-naburi	Ratcha-buri	Samut Song-khram	Petcha-buri	Prachuap Khiri-khan	Chum-phon
G P P Total	8.4%	7.7%	2.1%	13.0%	6.2%	5.7%	10.5%	7.3%
AGRICULTURE	4.0%	1.8%	-1.7%	3.2%	2.2%	2.1%	2.3%	3.7%
Crops	3.3%	-0.2%	1.4%	2.4%	-6.0%	2.8%	-3.0%	-2.3%
Livestock	3.0%	1.0%	-3.3%	2.9%	19.7%	-5.9%	-0.7%	9.9%
Fisheries	8.9%	13.6%	12.0%	0.2%	6.8%	11.7%	18.0%	13.7%
Forestry	-14.1%	-12.4%	-10.6%	-100.0%	-40.5%	-100.0%		-55.4%
Agricultural services	-1.1%	-2.1%	-1.1%	-2.8%	-9.9%	-1.5%	-17.4%	11.7%
Simple agri.processing products	7.7%	8.9%	2.2%	11.5%	10.9%	-1.0%	7.0%	12.5%
INDUSTRY	10.6%	15.2%	2.1%	23.8%	14.3%	8.7%	21.1%	20.1%
Mining and quarrying	8.9%	1.9%	-1.2%	4.0%	7.9%	2.5%	20.4%	-9.3%
Manufacturing	10.8%	19.3%	0.4%	27.2%	16.1%	16.7%	26.8%	31.6%
Construction	10.3%	7.4%	6.4%	12.0%	17.5%	2.5%	7.0%	15.4%
Electricity and water supply	10.0%	9.3%	8.1%	10.1%	2.9%	5.3%	14.8%	11.4%
SERVICES	7.8%	5.4%	3.8%	5.7%	4.7%	5.1%	6.5%	7.7%
Transportation and communication	9.2%	5.3%	0.6%	11.9%	10.7%	5.5%	13.9%	10.7%
Wholesale and retail trade	6.7%	6.8%	7.4%	7.0%	4.3%	6.4%	6.7%	7.0%
Banking,insurance and real estate	18.7%	14.2%	13.0%	13.8%	14.7%	10.7%	9.0%	30.4%
Ownership of dwellings	5.0%	4.9%	7.0%	3.7%	3.7%	4.7%	3.9%	5.9%
Public administration and defence	3.2%	3.4%	1.9%	3.6%	1.4%	3.8%	4.6%	5.2%
Services	4.0%	-0.4%	-3.7%	-0.2%	-1.4%	0.2%	4.0%	-0.4%

Source: NESDB

Fisheries have also been active in the WSB region, especially in Prachuap Khirikhan and Chumphon. Their average growth rates between 1990 and 1994 were 18.0 per cent and 13.7 per cent per annum, respectively.

(4) Level of Industrialization

Per capita gross provincial manufacturing product (GPMP) represents degrees of industrialization. Per capita GPMP in the WSB region was 9,360 Baht in 1994 (in constant 1988 prices) corresponding to a level of 68 per cent of the national average (13,806 Baht). By province, Ratchaburi had the highest GPMP (17,884 Baht), or 38 per cent higher than that of the national average. On the other hand, Chumphon had the lowest GPMP (2,574 Baht), only 19 per cent of the national average. (Table 7.1.4)

Per capita gross provincial agricultural product (GPAP) represents degrees of agglomeration of agriculture. In the WSB region, per capita GPAP in Chumphon was the highest (13,517 Baht), or 160 per cent higher than the national average.

In an ideal scenario, growth of the economy would entail hand-in-hand progress of agriculture and manufacturing, a sort of "agro-industrialization." Good examples are Samut Sakhon in the BMR and Rayong in the ESB, where per capita GPAP and per capita GPMP are equally high, indicating that these are relatively rich provinces in Thailand.

Figure 7.1.3 shows the spatial distribution of per capita GPMP by province in 1994. The developed provinces with per capita GPMP of more than 24,000 Baht are concentrated mostly in the BMR and ESB. Degrees of industrialization in provinces generally reflect their distance from Bangkok, resource endowment, progress of industrial estate development, and quality of infrastructure. As noted before, Lamphun in the Northern region is an exception because it developed an EPZ with good access to Chiang Mai International Airport. A new trend of GPMP growth is observed in "border provinces," namely Nakhon Phanom and Nong Khai in the Northeastern region. The "Friendship Bridge" between Nong Khai and Thanaleng in Lao PDR was opened in April 1994. GPMP has also been increased significantly in Phayao and Chiang Mai of the Northern region, which may reflect the positive impact of economic transactions with Myanmar. The WSB's provinces have common borders with Myanmar, but no positive impact has been yet observed on their manufacturing development.

(6) Summary of Current Situation

As a whole, the WSB region contributes about four per cent to the Thai economy. The region's per capita GPP is 76 per cent of the national average, with its six provinces ranked 16th to 37th among the country's 76 provinces. The region could be called a "middle class" economy in Thailand.

The industrial structure of the WSB region has been agriculture-oriented. However, Ratchaburi and Prachuap Khirikhan have been industrialized mainly because of large investments in a textile mill and a steel mill complex, respectively. In contrast, Chumphon remains an agricultural center of the region with crude palm oil refineries located in the province. Fisheries are also active in Chumphon and Prachuap Khirikhan.

In addition, there are many attractive tourism spots in the WSB, with each of the six provinces having its unique character. These attributes of the province have been taken into account in industrial development planning for the region.

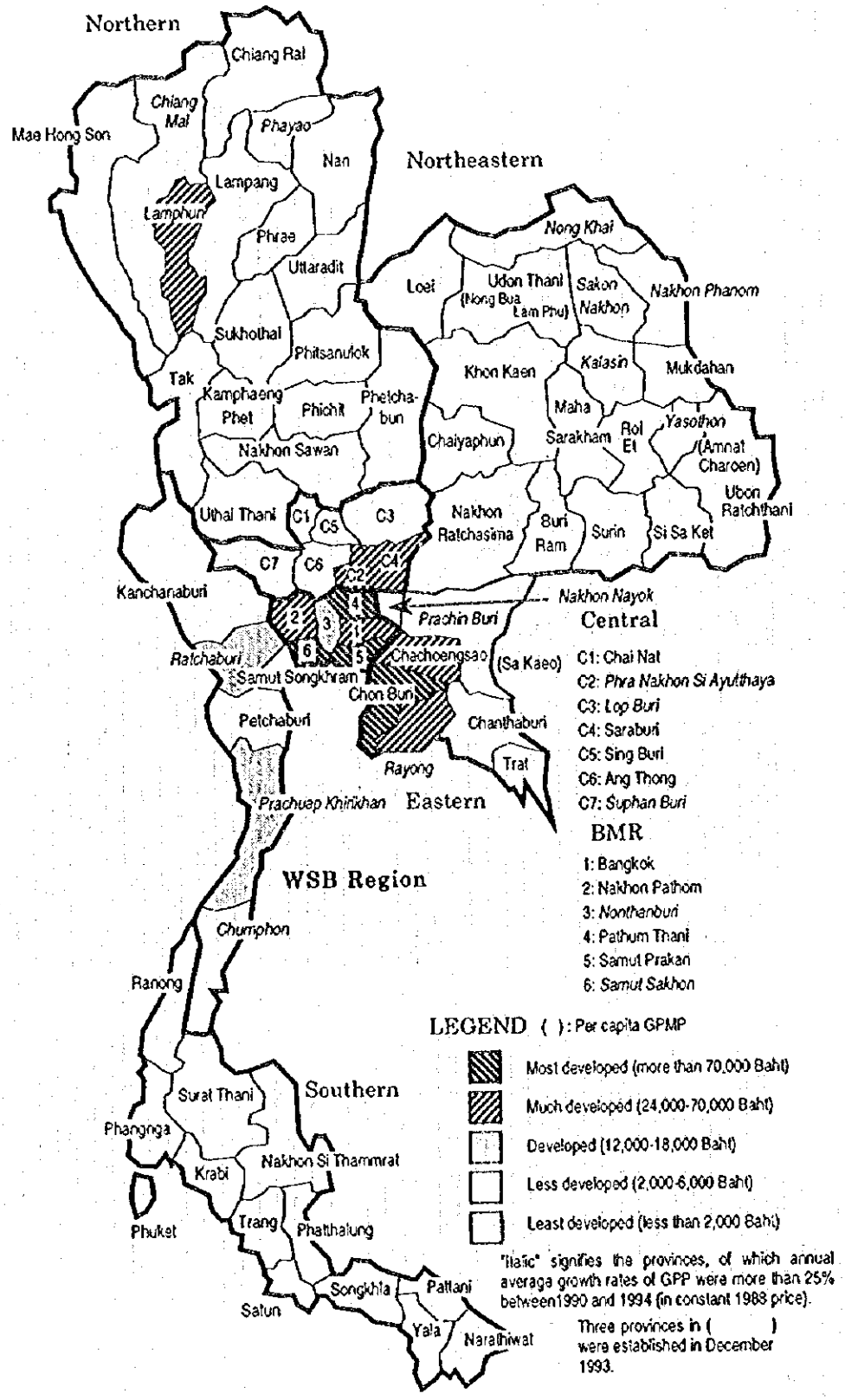
Table 7.1.4 Indicators on Industrialization by Region and Province

	Annual Average Growth Rate (1990-1994)				Per Capita (1994)		Difference	
	Population	GPP Total	GPAP (Agriculture)	GPMP (Manufacturing)	GPAP (Baht)	GPMP (Baht)	GPAP	GPMP
Whole Kingdom	1.22%	8.4%	4.0%	10.8%	5,217	13,806	1.00	1.00
WSB (6 Provinces)	1.59%	7.7%	1.8%	19.3%	6,944	9,360	1.33	0.68
Kanchanaburi	1.38%	2.1%	-1.7%	0.4%	6,452	6,182	1.24	0.45
Ratchaburi	2.35%	13.0%	3.2%	27.2%	5,131	17,884	0.98	1.30
Samut Songkhram	-0.03%	6.2%	2.2%	16.1%	4,023	3,713	0.77	0.27
Petchaburi	0.95%	5.7%	2.1%	16.7%	4,437	5,119	0.85	0.37
Prachuap Khirikhan	1.80%	10.5%	2.3%	26.8%	8,423	12,786	1.61	0.93
Chumphon	1.87%	7.3%	3.7%	31.6%	13,571	2,574	2.60	0.19
BMR (6 Provinces)	0.90%	8.6%	9.4%	7.3%	3,486	61,279	0.67	4.44
Bangkok	0.17%	7.7%	6.7%	4.5%	1,010	54,298	0.19	3.93
Nakhon Pathom	2.28%	21.4%	5.4%	42.2%	6,639	33,514	1.27	2.43
Nonthanburi	2.58%	-0.5%	9.2%	-13.8%	1,865	12,967	0.36	0.94
Pathum Thani	3.10%	19.1%	0.5%	21.6%	4,115	136,520	0.79	9.89
Samut Prakan	1.70%	2.4%	13.3%	-0.1%	9,030	94,925	1.73	6.88
Samut Sakhon	1.58%	29.9%	13.4%	42.2%	22,817	128,107	4.37	9.28
Central (7 Provinces)	0.20%	13.1%	8.8%	28.4%	4,912	15,535	0.94	1.13
Phra Nakhon Si Ayutthaya	0.51%	26.1%	4.5%	58.8%	3,463	35,892	0.66	2.60
Lop Buri	-0.31%	7.7%	3.2%	30.1%	5,139	2,659	0.99	0.19
Saraburi	1.37%	12.3%	2.3%	14.9%	3,712	40,391	0.71	2.93
Suphan Buri	0.20%	10.2%	7.3%	34.5%	6,268	5,857	1.20	0.42
Eastern (8 Provinces)	1.13%	11.2%	4.7%	20.0%	7,561	29,047	1.45	2.10
Chanthaburi	1.39%	8.5%	4.5%	14.1%	7,107	4,036	1.36	0.29
Chachoengsao	0.95%	11.1%	3.5%	19.5%	7,887	30,511	1.51	2.21
Chon Buri	1.39%	10.6%	0.1%	18.4%	6,112	78,881	1.17	5.71
Trat	0.99%	7.1%	0.9%	8.9%	8,494	2,832	1.63	0.21
Rayong	0.74%	13.5%	7.3%	34.4%	15,386	25,044	2.95	1.81
Northeastern (19 Provinces)	0.89%	6.4%	0.5%	12.2%	3,360	1,409	0.64	0.10
Khon Kaen	-0.04%	11.1%	-1.2%	-12.4%	2,614	4,964	0.50	0.36
Chaiyaphun	0.56%	4.8%	4.9%	-42.0%	4,264	1,776	0.82	0.13
Nakhon Phanom	1.83%	6.7%	2.9%	163.8%	3,586	316	0.69	0.02
Nakhon Ratchasima	0.82%	7.9%	3.6%	-15.9%	4,123	2,943	0.79	0.21
Buri Ram	0.06%	3.3%	0.7%	-28.5%	3,314	1,066	0.64	0.08
Roi Et	1.08%	4.8%	-0.9%	1.1%	3,211	605	0.62	0.04
Loei	2.87%	5.6%	-2.4%	13.6%	4,820	877	0.92	0.06
Si Sa Ket	0.90%	3.8%	-1.0%	25.5%	3,140	275	0.60	0.02
Sakhon Nakhon	1.87%	5.2%	-2.4%	12.8%	2,957	734	0.57	0.05
Surin	0.80%	6.0%	4.4%	34.7%	3,343	501	0.64	0.04
Udon Thani	1.20%	6.3%	0.1%	0.4%	3,274	847	0.63	0.06
Ubon Ratchathani	1.25%	7.9%	1.3%	7.1%	2,982	1,156	0.57	0.08
Northern (17 Provinces)	2.01%	6.6%	3.2%	22.3%	4,507	2,931	0.86	0.21
Chiang Rai	4.75%	5.1%	-2.8%	8.4%	3,149	628	0.60	0.05
Chiang Mai	2.97%	5.8%	-1.1%	24.9%	3,463	5,763	0.66	0.42
Nakhon Sawan	0.66%	7.0%	3.7%	17.4%	5,471	5,173	1.05	0.37
PheTchabun	2.19%	5.4%	3.5%	12.2%	5,842	474	1.12	0.03
Lampang	0.99%	5.6%	-1.3%	7.2%	2,429	906	0.47	0.07
Southern (13 Provinces)	1.67%	6.7%	7.3%	6.5%	12,047	1,631	2.31	0.12
Nakhon Si Thammrat	1.07%	6.2%	6.0%	14.8%	6,613	1,854	1.27	0.13
Songhkla	1.22%	7.8%	10.4%	8.5%	14,169	1,832	2.72	0.13
Surat Thani	2.51%	7.2%	6.7%	1.4%	14,728	2,733	2.82	0.20

Note: Number of provinces totals 76. Provinces listed in the Table are the main provinces in the regions excluding the WSB and BMR.

Source: Population (Office of Central Register, Local Administration Department-MOI)
Gross Provincial Product (NESDB)

Figure 7.1.3 Level of Industrialization by Province in 1994
(per Capita Gross Provincial Manufacturing Product [GPMP])



1.2 *Existing Industries and Investment Trends*

(1) Structure of Manufacturing Industry

The manufacturing GDP or gross provincial manufacturing product (GPMP) of the WSB region amounted to 28.4 billion Baht (in constant 1988 prices), which was produced by 234,794 workers in 1994. The WSB's GPMP, which accounted for 3.5 per cent of the national total manufacturing GDP/GPMP, increased at an annual average rate of 15.5 per cent from 1989 to 1994, or 3.8 percentage points higher than that of the national average. By sector, the growth rate was higher in textiles, paper and paper products, rubber and plastic products, non-metallic mineral products including cement, fabricated metal products, and other manufacturing industries. In addition, the region has a new sector, i.e., a basic metal industry that produces steel products and will form a steel mill complex. (Table 7.1.5)

Table 7.1.5 GPMP in the WSB Region and Thailand in 1994

TSIC (Thai Standard Industrial Classification) Unit: million Baht (in constant 1988 prices)	1994 GDP/GPMP WSB GPMP	WSB Workers	Whole Kingdom	GDP:1989-1994 Annual Average Growth Rate WSB	W. King	GDP % Shares to Total (1) WSB	(2) W. King	(3) (1)-(2)
Total	28,425	234,794	816,619	15.5%	11.8%	100.0	100.0	0.0
311-4 Food, Beverage and Tobacco	12,457	152,692	140,129	6.9%	7.0%	43.8	17.2	26.7
321 Textiles	3,598	11,491	68,353	25.4%	6.0%	12.7	8.4	4.3
322 Wearing Apparel	5	278	73,206	8.2%	8.4%	0.0	9.0	-8.9
323-4 Leather, Leather Products and Footwear	419	555	31,303	13.6%	13.5%	0.3	3.8	-3.5
331-2 Wood, Wood Products and Furniture	81	10,301	23,069	2.6%	3.9%	1.5	2.8	-1.4
341 Paper and Paper Products	5,409	2,412	8,829	35.7%	10.6%	19.0	1.1	17.9
342 Printing and Publishing	24	593	19,441	11.3%	8.5%	0.1	2.4	-2.3
351-2 Chemical Products	70	1,172	55,701	-8.9%	12.8%	0.2	6.8	-6.6
353-4 Petroleum Products			12,972		17.0%	0.0	1.6	-1.6
355-6 Rubber and Plastic Products	772	9,594	24,441	37.1%	14.1%	2.7	3.0	-0.3
361-9 Non-Metallic Mineral Products	2,398	14,116	49,229	24.4%	13.9%	8.4	6.0	2.4
371-2 Basic Metal Products	242	729	13,767	-	12.7%	0.9	1.7	-0.8
381 Fabricated Metal Products	124	2,577	21,535	25.3%	11.8%	0.4	2.6	-2.2
382-5 Machinery and Equipment	185	9,314	84,531	17.5%	13.1%	0.7	10.4	-9.7
390 Other Manufacturing Industries	2,642	18,970	68,790	23.5%	16.4%	9.3	8.4	0.9

Note: Number of workers by subsector was estimated by the Study Team based on labor productivity in the Industrial Survey (NSO).
Source: NESDB

By category of GPMP: food processing, paper and non-metallic products are outstanding:
The manufacturing of food and beverages (tobacco is not produced in the region) accounted for 43.8 per cent of the total GPMP in the WSB region, 26.7 percentage points higher than the national average. Textiles, paper and paper products, and non-metallic products in the region also had larger shares than those of the national average.

(2) Major Subsectors

The official statistics such as the Industrial Survey by the National Statistical Office (NSO) and the Industrial Statistics compiled by the Ministry of Industry (MOI) do not cover all manufacturing establishments and their activities. According to MOI statistics, there were 4,105 registered manufacturing establishments in the WSB region employing 75,025 workers in 1994 as shown in Table 7.1.6. These establishments belong to the so-called modern sector.

Table 7.1.6 Structure of Manufacturing in the WSB Region (1994: Modern Sector)

		Data Items		Percent Shares		Increase rate 91/92-94	
		No. of Establi-shments	No. of Workers	No. of Establi-shments	No. of Workers	No. of Establi-shments	No. of Workers
2901	Stone Quarrying, etc.	280	2,902	-	-	1.24	1.20
4102	Gas	1	7	-	-		
	Manufacturing Total	4,105	75,025	100.0%	100.0%	1.00	1.09
311-4	Food, Beverage and Tobacco	1,716	37,913	41.8%	50.5%	0.94	0.99
321	Textiles	94	5,831	2.3%	7.8%	1.24	1.57
322	Wearing Apparel	4	278	0.1%	0.4%	1.33	1.26
323	Leather and Leather Products	6	155	0.1%	0.2%	3.00	1.82
324	Footwear						
331	Wood and Wood/Cork Products	301	3,878	7.3%	5.2%	1.06	1.08
332	Furniture, Fixtures and Floorings	56	964	1.4%	1.3%	1.10	1.21
341	Paper and Paper Products	18	1,512	0.4%	2.0%	1.20	0.88
342	Printing and Publishing	29	92	0.7%	0.1%	0.66	0.51
351	Industrial Chemicals	18	1,015	0.4%	1.4%	1.38	3.28
352	Other Chemical Products	10	73	0.2%	0.1%	1.25	1.55
353	Petroleum Refineries						
354	Other Petroleum and Coal Products	3	84	0.1%	0.1%		
355	Rubber Products	67	608	1.6%	0.8%	0.68	0.96
356	Plastic Products	25	693	0.6%	0.9%	2.27	1.56
361	Pottery	67	2,430	1.6%	3.2%	1.06	1.05
362	Glass and Glass Products						
369	Other Non-Metallic Mineral Products	372	4,025	9.1%	5.4%	1.18	1.57
371	Iron and Steel Basic Industries	10	729	0.2%	1.0%	0.26	1.21
372	Non-Ferrous Metal Basic Industries						
381	Fabricated Metal Products	215	1,977	5.2%	2.6%	1.28	2.25
382	General Machinery	359	2,444	8.7%	3.3%	0.98	1.22
383	Other Electrical/Electronic Products	31	989	0.8%	1.3%	0.84	1.99
384	Transport Equipment	608	5,871	14.8%	7.8%	0.98	1.01
385	Precision Instruments	1	10	0.0%	0.0%	1.00	0.77
390	Other Manufacturing Industries	95	3,454	2.3%	4.6%	1.12	0.91

Source: Industrial Statistics (Office of Industrial Economics-MoI)

Workers in the "modern sector" accounted for 32.0 per cent of total manufacturing workers (modern: 75,035 workers, total: 234,794 workers). The non-modern sector may be mostly household/cottage manufacturing, covering food processing, textiles, wood products, and

other manufacturing industries.

The major subsectors in the WSB are agro-industries and resource-based industries such as cement, and bus body assembly:

Canned/processed fruit and vegetables had the largest number of workers with 18,106, while the number of establishments in this subsector totaled 68. Other subsectors with more than 1,000 workers include sugar refining, textiles including spinning and weaving, grain mills, other manufacturing, saw mills, pottery, and motor vehicles mainly comprising bus body assembly and repair shops as shown in Figure 7.1.4. These subsectors were mostly concentrated in Ratchaburi, with 26,969 workers or 36.0 per cent of the region's total employment as shown in Tables 7.1.7 and 7.1.8.

Kanchanaburi was second in the number of workers (13,958), with major subsectors including sugar refining, grain mills, saw mills, and canned/processed fruit and vegetables. Fruit and vegetable processing was also a major subsector in Prachuap Khirikhan along with ship building and repair.

The major subsectors in Chumphon were canned/processed fruit and vegetables, canned/processed fish, vegetable oil (crude palm oil), saw mills, and other manufacturing industries.

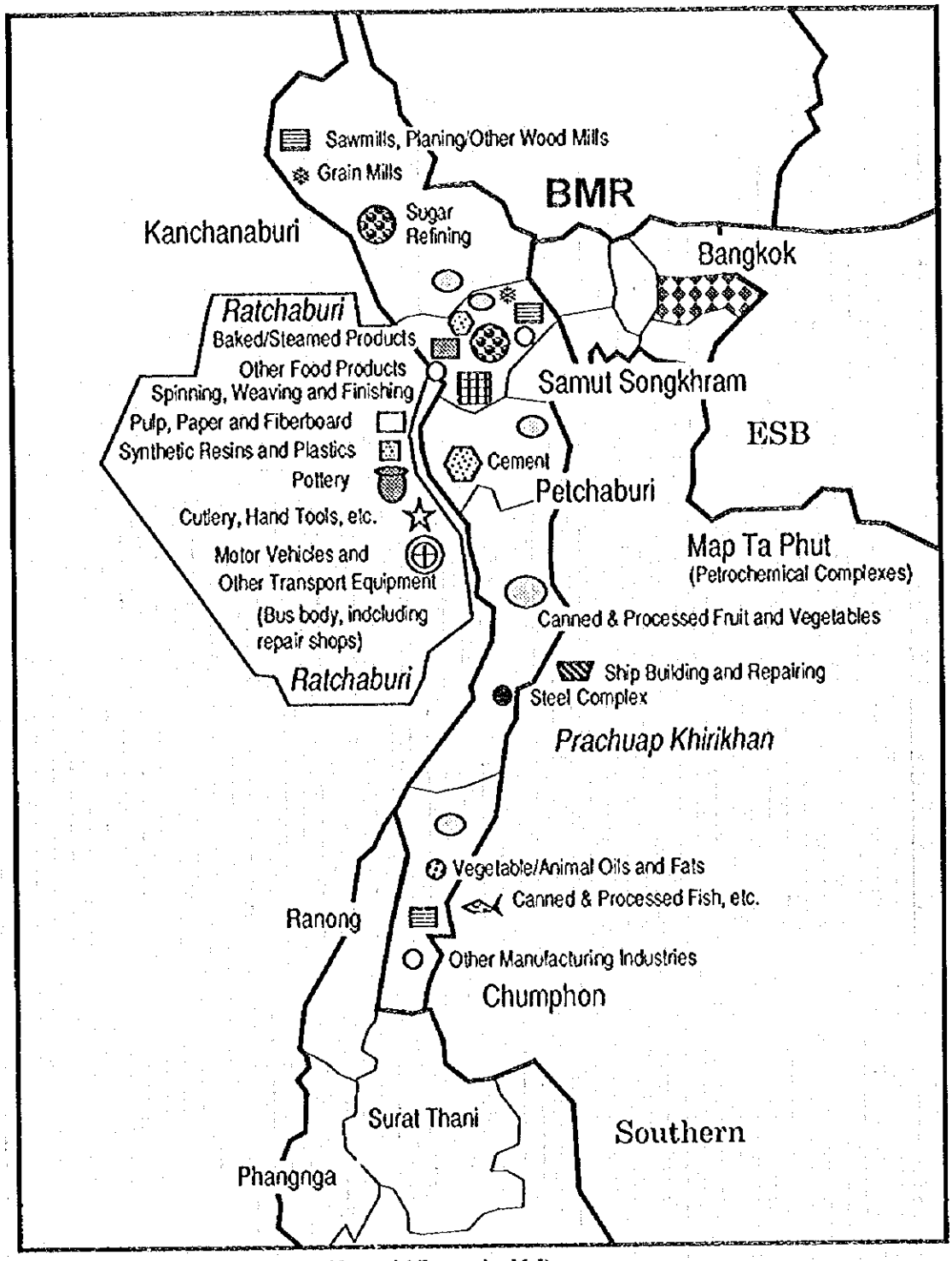
Petchaburi had only one major subsector, canned/processed fruit and vegetables. Cement manufacturing in Petchaburi, with less than 1,000 persons, however, is also important as resource-based industry, like pottery in Ratchaburi.

Samut Songkhram had no major subsector having more than 1,000 workers, and the province represents the smallest agglomeration of manufacturing in the WSB region.

Industrial agglomeration in the WSB region is characterized by lack of footloose and labor-intensive subsectors:

Industrialization in Thailand started from import substitution and then proceeded to the promotion of export industry, which has led the Thai economy with high growth together with competitive agro-products. Import substitution took place in consumer goods such as medicine, durable consumer goods such as radio, TV, and electrical appliances, and industrial products mainly consisting of textiles, plastics, and steel products as shown in Figure 7.1.5.

Figure 7.1.4 Major Manufacturing Industries in the WSB's Provinces
(Number of workers more than 1,000 in 1994 excluding cement and steel complex.)



Source: Industrial Statistics (Office of Industrial Economics-MoI)
Note:Names of major industries are specified just only for their main location.

Table 7.1.7 Top 30 Manufacturing Subsectors in the WSB Region (1994)
(Number of Establishments)

Rank	TISC	INDUSTRY TYPE	WSB TOTAL	Accum.	Rate	Kancha-naburi	Ratcha-buri	St. Song-khram	Petcha-buri	Pr. Khiri-khan	Chum-phon
		INDUSTRY TOTAL	4,386			1,093	1,411	181	605	469	629
			100.0%			24.9%	32.2%	4.1%	13.8%	10.7%	14.3%
		Mining Total	281			143	58		28	10	42
			100.0%			50.9%	20.6%		10.0%	3.6%	14.9%
	2901	Stone Quarrying, etc.	280			143	57		28	10	42
			100.0%			51.1%	20.4%		10.0%	3.6%	15.0%
	4102	Gas	1				1				
			100.0%				100.0%				
				Accum.							
			4,105		Rate	950	1,353	181	577	459	587
Rank		Manufacturing Industries Total	100.0%		100.0%	23.1%	33.0%	4.4%	14.1%	11.2%	14.3%
1	3116	Grain Mills	1,179		28.7%	(34.0)	(28.2)	0.1	18.2	5.6	13.9
2	3849	Other Transport Equipment	373		37.8%	(35.9)	(23.3)	1.9	15.0	11.5	12.3
3	3699	Concrete Products, etc.	272		44.4%	18.8	17.6	4.0	17.3	(22.8)	(19.5)
4	3311	Sawmills & Other Wood Mills	260		50.8%	15.8	(33.1)	13.1	13.1	14.2	10.8
5	3821	Engines & Turbins	243		56.7%	17.3	(41.6)	10.3	8.6	7.8	14.4
6	3843	Motor Vehicles	165		60.7%	18.2	(62.4)	1.8	10.3	5.5	1.8
7	3121	Other Food Products	164		64.7%	5.5	(31.1)	15.9	12.2	17.1	18.3
8	3811	Cutlery, Hand Tools, etc.	127		67.8%	16.5	(32.3)	1.6	8.7	13.4	(27.6)
9	3117	Baked & Steamed Products	112		70.5%	5.4	(41.1)	0.9	(28.6)	4.5	(19.6)
10	3909	Other Manufacturing Industries	92		72.8%	5.4	(23.9)	7.6	17.4	(22.8)	(22.8)
11	3813	Structural Metal Products	83		74.8%	(24.1)	(32.5)	2.4	15.7	15.7	9.6
12	3822	Agricultural Machinery & Equip.	69		76.5%	(40.6)	(33.3)		11.6	11.6	2.9
13	3113	Canned & Processed Fruit and Veg.	68		78.1%	11.8	(22.1)	7.4	(23.5)	(30.9)	4.4
14	3610	Pottery & China	67		79.8%		(100.0)				
15	3122	Prepared Animal Feeds	67		81.4%	(28.4)	(20.9)	7.5	7.5	14.9	(20.9)
16	3211	Spinning, Weaving and Finishing	57		82.8%	5.3	(89.5)		1.8	1.8	1.8
17	3551	Tyre & Tube	56		84.1%	(44.6)	12.5		7.1	17.9	17.9
18	3320	Furniture, Fixtures and Floorings	56		85.5%	(25.0)	(19.6)	7.1	12.5	12.5	(23.2)
19	3841	Ship Building & Repairing	54		86.8%		3.7	(31.5)	14.8	(29.6)	20.4
20	3691	Structural Clay Products	53		88.1%	18.9	(49.1)		(20.8)	7.5	3.8
21	3692	Cement, Lime and Plaster	47		89.3%	4.3	(83.0)		4.3		8.5
22	3824	Special Industrial Machinery & Equip.	39		90.2%	17.9	(43.6)	(20.5)	10.3	2.6	5.1
23	3114	Canned & Processed Fish, etc.	38		91.1%	2.6	7.9	15.8		(31.6)	(42.1)
24	3219	Other Textiles	32		91.9%			3.1		(71.9)	(25.0)
25	3420	Printing & Publishing	29		92.6%	6.9	(58.6)		(20.7)	13.8	
26	3115	Vegetable & Animal Oils and Fats	26		93.3%		3.8	7.7		(19.2)	(69.2)
27	3560	Plastic Products	25		93.9%	(20.0)	(48.0)	4.0	8.0		(20.0)
28	3118	Sugar Refining	23		94.4%	(56.5)	(21.7)	8.7	8.7	4.3	
29	3319	Other Wood & Cork Products	22		95.0%	9.1	(77.3)	4.5	4.5	4.5	
30	3831	Electrical Industrial Machinery	20		95.4%	(40.0)	15.0		(25.0)	10.0	10.0

Note: ( ) Subsector in province, percent share of which is around more than 20% to the regional total.

Source: Industrial Statistics (Office of Industrial Economics, MoI)

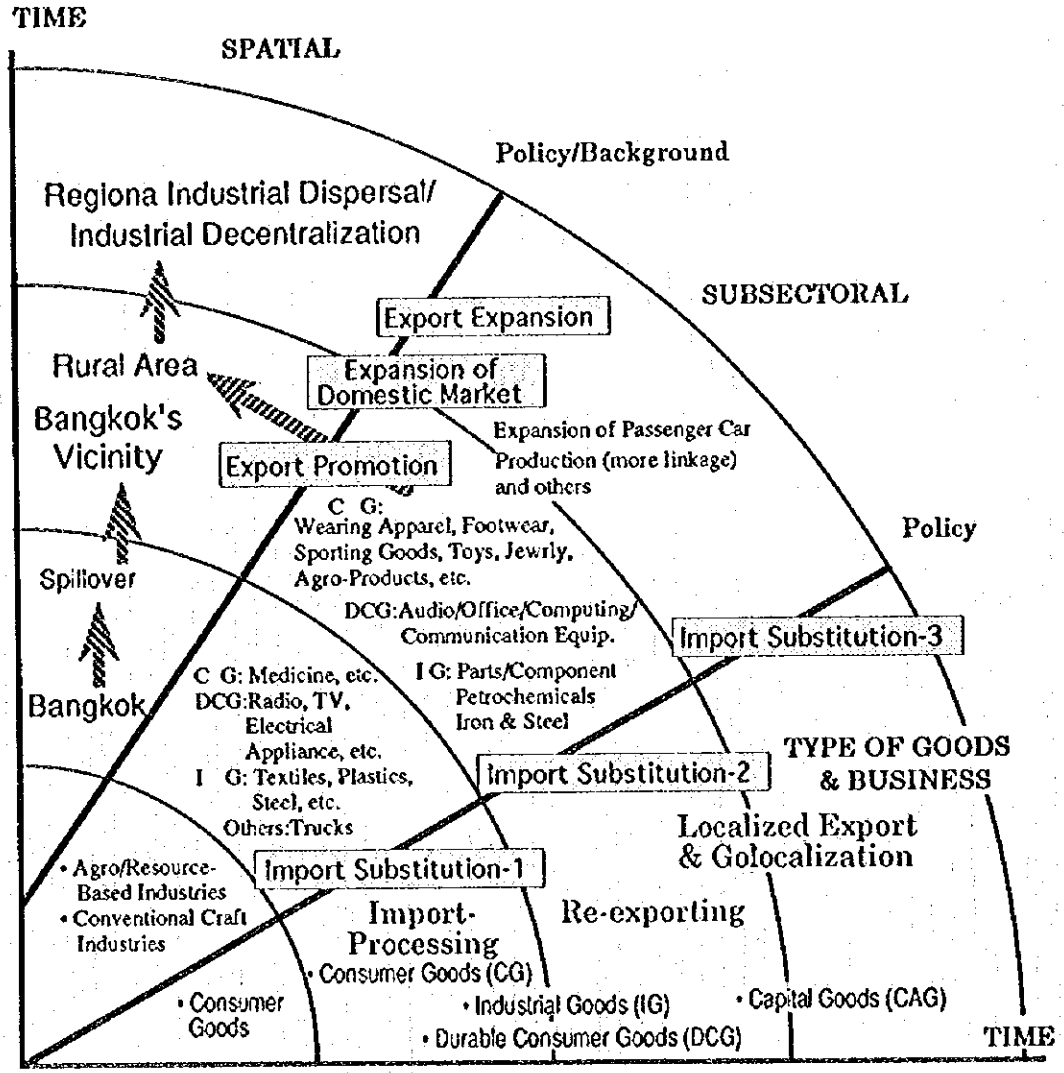
Table 7.1.8 Top 30 Manufacturing Subsectors in the WSB Region (1994)
(Number of Workers)

TISC	WSB TOTAL		Kancha-naburi	Ratcha-buri	St. Song-khram	Petcha-buri	Prachup Khiri-khan	Chum-phoorn
INDUSTRY TOTAL	77,934		15,004	28,108	2,868	8,031	13,758	10,165
	100.0%		19.3%	36.1%	3.7%	10.3%	17.7%	13.1%
Mining Total	2,909		1,046	1,139		213	117	394
	100.0%		36.0%	39.2%		7.3%	4.0%	13.5%
2901 Stone Quarrying, etc.	2,902		1,046	1,132		213	117	394
			36.0%	39.0%		7.3%	4.0%	13.6%
4102 Gas	7			7				
	100.0%			100.0%				
		Accum.						
	75,025	Rate	13,958	26,969	2,868	7,818	13,641	9,771
Rank Manufacturing Industries Total	100.0%	100.0%	18.6%	36.0%	3.8%	10.4%	18.2%	13.0%
1 3113 Canned & Processed Fruit and Veg.	18,106	24.1%	15.8	6.2	0.7	18.0	(42.8)	16.5
2 3118 Sugar Refining	6,121	32.3%	(62.6)	(34.8)	0.3	0.1	2.2	
3 3211 Spinning, Weaving and Finishing	4,990	38.9%	1.6	(95.5)		1.4	1.2	0.3
4 3116 Grain Mills	3,885	44.1%	(32.5)	(44.9)	0.1	12.5	4.1	5.9
5 3909 Other Manufacturing Industries	3,101	48.3%	2.6	(19.9)	3.0	10.8	15.6	(48.0)
6 3311 Sawmills & Other Wood Mills	3,006	52.3%	(19.7)	(29.4)	12.5	7.1	12.4	19.0
7 3610 Pottery & China	2,430	55.5%		(100.0)				
8 3843 Motor Vehicles	2,234	58.5%	5.0	(84.4)	1.0	8.0	1.2	0.4
9 3849 Other Transport Equipment	2,198	61.4%	(32.5)	(28.0)	2.5	13.4	7.5	16.1
10 3121 Other Food Products	2,114	64.2%	2.9	(50.3)	17.9	6.5	11.8	10.6
11 3699 Concrete Products, etc.	2,005	66.9%	18.8	(19.8)	4.6	15.5	18.9	(22.4)
12 3114 Canned & Processed Fish, etc.	1,922	69.5%	0.2	12.4	16.9		18.5	(52.1)
13 3117 Baked & Steamed Products	1,868	71.9%	6.5	(69.3)	0.4	15.9	2.2	5.7
14 3122 Prepared Animal Feeds	1,526	74.0%	14.0	17.2	(20.6)	2.0	(26.3)	(19.9)
15 3692 Cement, Lime and Plaster	1,524	76.0%	1.3	29.3		(67.3)		2.1
16 3841 Ship Building & Repairing	1,254	77.7%		0.5	10.8	3.1	(76.5)	9.1
17 3411 Pulp, Paper and Fiberboard	1,235	79.3%	(39.6)	(60.4)				
18 3811 Cutlery, Hand Tools, etc.	1,097	80.8%	9.9	(48.1)	0.7	15.5	13.9	11.8
19 3821 Engines & Turbins	1,020	82.2%	14.3	(46.2)	8.7	8.2	8.2	14.3
20 3320 Furniture, Fixtures and Floorings	964	83.4%	(26.5)	13.5	6.7	(28.7)	8.1	16.5
21 3560 Plastic Products	693	84.4%	16.5	24.1	(38.0)	15.2		6.3
22 3824 Special Industrial Machin. & Equip.	660	85.2%	(28.2)	(42.7)	12.1	13.9	0.8	2.3
23 3513 Synthetic Resins and Plastics	600	86.0%		(100.0)				
24 3115 Vegetable & Animal Oils and Fats	595	86.8%		0.7	2.5		11.1	(85.7)
25 3219 Other Textiles	565	87.6%			1.2		(78.1)	(20.7)
26 3813 Structural Metal Products	555	88.3%	17.1	(34.6)	14.8	9.7	9.7	14.1
27 3131 Spirits	513	89.0%	(70.2)	(29.8)				
28 3822 Agricultural Machinery & Equip.	497	89.7%	(24.7)	(58.4)		8.0	6.8	2.0
29 3691 Structural Clay Products	496	90.3%	(19.8)	(52.8)		16.7	8.1	2.6
30 3312 Wooden & Cane Containers	490	91.0%	(82.4)	13.9		2.7		1.0

Note: ( ) Subsector in province, percent share of which is around more than 20% to the regional total.

Source: Industrial Statistics (Office of Industrial Economics, MoI)

Figure 7.1.5 Process and Pattern of Industrialization in Thailand



Import substitution has progressed largely by investment in parts/components, mainly for electronic products and motor vehicles, petrochemicals, and steel mills.

Export promotion has been successful and conducive to a huge influx of investments in labor-intensive subsectors such as wearing apparel, footwear, leather goods, sporting goods, toys, and electronic parts/components. These are footloose industries that could locate in remote areas such as the Northern and Northeastern region. However, their agglomeration is small in the WSB region, which may be attributable to the following:

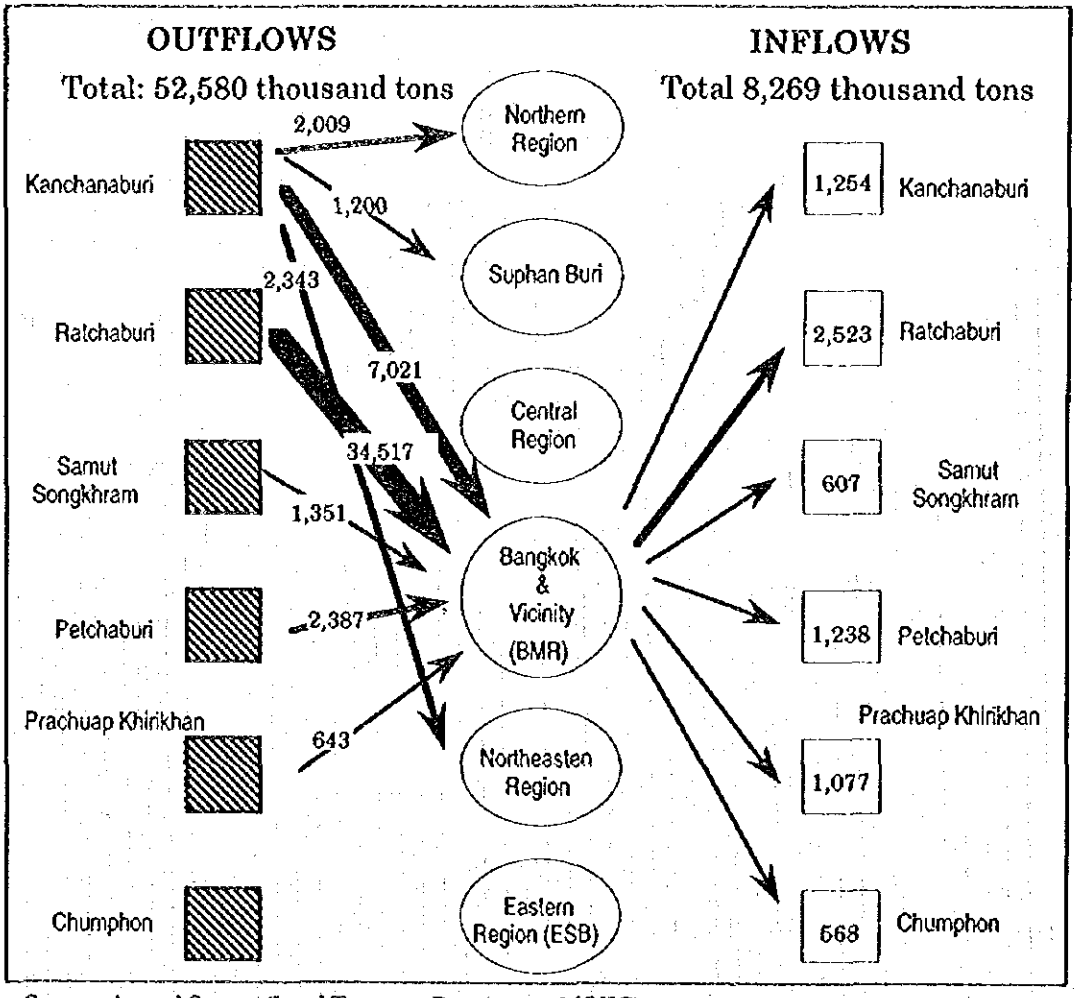
- Since the major industries in the WSB such as canned/processed fruit and fish are labor-intensive, there were few potential workers to attract footloose and labor-intensive industries from outside the region.
- Transport constraints caused by the geographical shape of the WSB region (long and slender) make it difficult for residents in one province to commute to other provinces.
- There is no industrial estate operating in the region, which implies that less information is available on the region and therefore investors do not know the region well; in other words, the psychological distance of the region is far from investors.

(3) Regional Linkages

Province-to-province flows are small and there are virtually no linkages within the region:
According to the annual survey by the Land Transport Department, province-to-province flows of road freight were quite limited in 1994, the latest year for which data are available. The largest flow was only 71,170 tons/year from Kanchanaburi to Samut Songkhram.

Interregional flows are linked to the BMR but Kanchanaburi had a link to other regions:
Figure 7.1.6 (showing linkages of 500,000 tons per year or more) illustrates regional linkages based on road freight in 1994. Ratchaburi was the main origin of road freight with 34.5 million tons to the BMR, of which 88 per cent was construction materials including cement. Petchaburi is a cement-producing province and its road freight included 3.5 million tons to the BMR. Kanchanaburi had the second largest outflow with 12.3 million tons, while its destinations were relatively diversified, including 7 million (76 per cent construction materials) to the BMR, 2.3 million (around 100 per cent agricultural products including sugar cane) to the Northeastern region, 2.0 million tons to the Northern region (again mainly agricultural products), and 1.2 million tons to Suphan Buri (90 per cent agricultural products).

Figure 7.1.6 Regional Linkages: Road Freight in 1994
(Schematic Showing Movements of 500,000 Tons per Year or More



Source: Annual Survey (Land Transport Department-MOTC)

In terms of inflows, the main origin to the WSB region is the BMR with 8.26 million tons in 1994, including 3.52 million tons to Ratchaburi, 1.25 million tons to Kanchanaburi, 1.24 million tons to Petchaburi, and 1.08 tons to Prachuap Khirikhan. These flows are mainly composed of a mix of agricultural commodities, minerals, equipment, and manufactured goods.

Interindustry linkages within the WSB region are limited:

It is quite natural that construction materials and agricultural products are dominant in road freight because they are bulky and are the main products of the WSB region. On the other hand, the small volumes of road freight between WSB provinces likely demonstrates limited interindustry linkages within the WSB region for the following reasons:

- Agro-processing industry is highly active in the region, but it is mostly complete within each province (an exception is crude palm oil).

- Major subsectors other than agro-industry are resource-based industries such as pottery and cement.
- Transport equipment such as bus body assembly and repair shops has formed industrial cluster within each province.
- There is little agglomeration of other machinery/equipment industries that require regional linkages.
- Finally, the location of some provinces in this long and slender region with little domestic hinterland may hamper transactions among them. In this context, exports are of strategic importance for the WSB region.

(4) Exports

Thailand's exports increased rapidly during the latter half of 1980s, with agricultural products as the major export product. In 1994, however, agricultural products accounted for 16.6 per cent of total exports, while manufactured goods including agro-industrial goods were dominant representing 81.3 per cent of total exports. Thailand is an agro-industrial export country as shown in Table 7.1.9.

Table 7.1.9 Top 20 Export Industries in Thailand (1994)

EXPORT (US$ million)		Amount	% Shares		Growth Rate(91-94/year)	Exports minus Imports
RANK	TISC TOTAL	38,821	100.0	Accum. %	18.00	-7,805
1	3832 Radio, TV and Communications Equipment	5,620	14.5	14.5%	25.30	-888
2	3825 Office & Computing Machinery	3,952	10.2	24.7%	26.51	1,653
3	3114 Canned & Processed Fish, etc.	3,736	9.6	34.3%	13.61	3,138
4	3220 Wearing Apparel	3,018	7.8	42.1%	9.27	2,976
5	3829 Other Machinery & Equipment	1,434	3.7	45.7%	23.95	-1,853
6	3213 Knitting	1,355	3.5	49.2%	1.52	1,152
7	3113 Canned & Processed Fruit and Vegitables	1,296	3.3	52.6%	-6.17	1,261
8	3211 Spinning, Weaving and Finishing	1,295	3.3	55.9%	13.19	293
9	3901 Jewelry & Related Articles	1,209	3.1	59.0%	5.86	1,065
10	3831 Electrical Industrial Machinery	1,022	2.6	61.7%	60.32	-1,112
11	3909 Other Manufacturing Industries	946	2.4	64.1%	9.27	227
12	3559 Rubber Products including Footwear	890	2.3	66.4%	38.92	666
13	3839 Other Electrical & Electronic Products	874	2.3	68.6%	26.97	-79
14	3903 Sporting & Athletic Goods	823	2.1	70.8%	15.87	774
15	3560 Plastic Products	721	1.9	72.6%	38.23	104
16	3320 Furniture, Fixtures and Floorings	668	1.7	74.3%	19.65	648
17	3850 Precision Instruments	645	1.7	76.0%	43.56	-389
18	3513 Synthetic Resins & Plastics	549	1.4	77.4%	20.34	-1,015
19	3233 Products of Leather & the like	532	1.4	78.8%	12.36	517
20	3843 Motor Vehicles	531	1.4	80.2%	55.58	-3,761

Source: Customs Department-MOF

The aggregated value of these top 20 export industries amounted to US$25,496 million, or 80.2 per cent of the nation's total exports. Canned/processed fruit and fish, the major subsectors in the WSB region, ranked 7th and 3rd, respectively. Meanwhile, it is notable that horizontal trade stood out among manufactured goods, especially machinery/equipment including their parts/components. This finding indicates globalized production of goods through division of work between Thailand and foreign countries, a tendency that will expand the optimum distribution of resources based on regional comparative advantage and disadvantage.

Based on the Industrial Questionnaire Survey (IQS/ST) conducted by the Study Team in the WSB region, export subsectors in the region have been identified and tabulated in Table 7.1.10:

Table 7.1.10 Number of Factories by Destination of Products (Output Value Basis)

	No. of Respon-dents	100% domestic	Export Subtotal	Some for export	More than 50% export	100% for export	No Answer
Total	135	82	49	22	14	13	4
Sugar Refining	8		8	1	7		
Canned/Processed Fruit and Vegetables	21	7	14	3	3	8	
Canned /Processed Fish, etc.	10	4	6	2	1	3	
Palm Oil Refining	6	6					
Wood/Coconut Furniture	15	13	1			1	1
Pottery/Ceramics	13	5	8	6	2		
Motor Vehicle Industry	10	8					2
Ship Building & Repairing	8	6	1	1			1
Other Machinery and Equip.	14	13	1	1			
Other Manufacturing	30	20	10	8	1	1	

Source: Industrial Questionnaire Survey by the Study Team (IQS/ST)

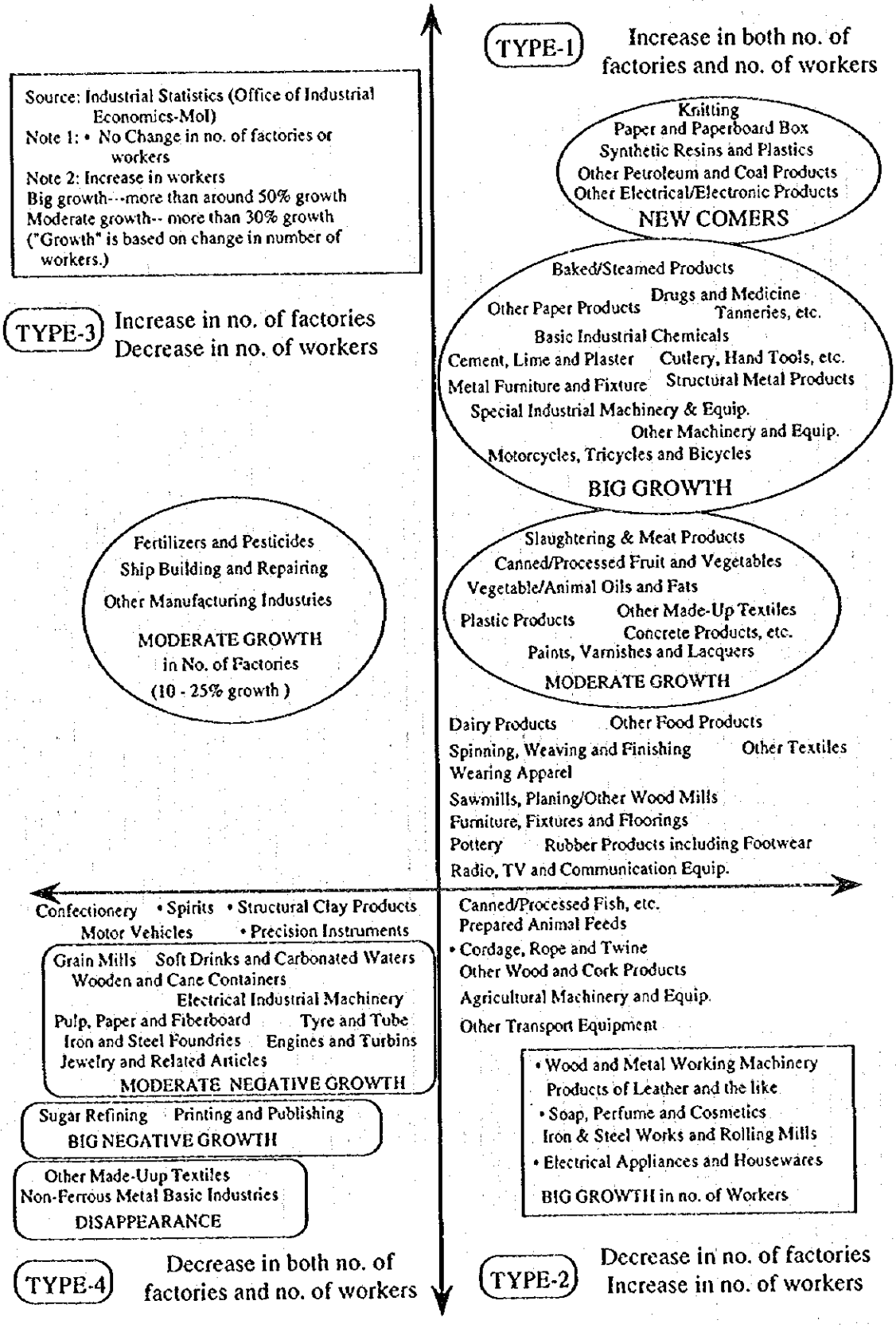
Refined sugar produced in the WSB region is at least partly exported, while canned/processed fruit and vegetables are mainly exported. Canned/processed fish is also one of the major export industries in the region. On the other hand, palm oil refining (crude oil) and the motor vehicle industry (mainly bus body assembly) are domestic market-oriented.

(5) Investment Trends/Structural Changes

The WSB has many "growth subsectors" with small negative growth subsectors:

Manufacturing subsectors can be categorized into the following four types based on increases or decreases in the number of factories and workers as illustrated in Figure 7.1.7:

Figure 7.1.7 Recent Trends of Manufacturing Subsectors in the WSB Region (1991/1992 [Chumphon] - 1994)



Type 1 - **Growth subsector** (increasing in both number of factories and number of workers)
This type includes paper products, cutlery, structural metal products, and new industries such as knitting, synthetic resin, and other electrical/electronic products. Canned/processed fruit and vegetables, one of the major subsectors in the WSB region, is positioned in the "moderate growth" group.

Type 2 - **Restructuring subsector** (decreasing in number of factories and increasing in number of workers)
This type is sensitive to the economies of scale for efficient production, though there are some cases that a large factory is newly located and small factories stopped operation or changed their product line. In the WSB region, leather goods, soap and cosmetics, steel rolling work, and electrical appliances were grouped into this type.

Type 3 - **Small-scale subsector** (increasing in number of factories and decreasing in number of workers)
This type is relatively insensitive to economies of scale and includes fertilizers/pesticides (maybe just mixing), ship building and repair, and other manufacturing industries.

Type 4 - **Sunset or severe restructuring subsector** (decreasing in both number of factories and number of workers)
This type faces severe competition or severe business circumstances, such as limited demand and low price of product. Sugar refining is a typical industry in this group as is printing.

As seen above, new trends are observed. Labor-intensive subsectors such as knitting and electrical/electronic products were located newly in the WSB region between 1991/92 and 1994. Industrial chemicals increased both in terms of number of factories and number of workers. A steel complex initially producing cold roll and galvanized steel started operations in 1991.

(6) BOI-Approved Projects

The Board of Investment (BOI) has played an important role in promotion of export industries and foreign direct investment (FDI) through granting privileges/incentives to investors. BOI changed its policy/incentive structure early in 1993 in order to channel more investment into provincial areas distant from the BMR. The major revision is to give more attractive incentives for Zones 2 and 3. In terms of corporate income tax holidays, investors in Zone 3 can enjoy an eight-year exemption, while investors in industrial estates or promoted industrial zones in Zone 2 receive a seven-year exemption for projects.

As shown in Table 7.1.11, the WSB region had 294 approved projects (5.0 per cent of national total) with an aggregated investment of 71.3 billion Baht (3.4 per cent of the national total) in 1989-95. The share of investments in the WSB region was relatively small.

Table 7.1.11 BOI Approved Projects (1989-September 1995)

	1989	1990	1991	1992	1993	1994	95sep.	Total
No. of Projects								
Whole Kingdom	1,100	906	594	369	849	1,173	862	5,853
WSB Total	70	38	36	18	40	57	35	294
WSB/WK	6.4%	4.2%	6.1%	4.9%	4.7%	4.9%	4.1%	5.0%
Investments (million Baht)								
Whole Kingdom	286,054	474,846	277,107	275,390	176,353	251,219	353,852	2,094,821
WSB Total	18,004	10,748	15,975	5,092	6,625	10,650	4,247	71,341
WSB/WK	6.3%	2.3%	5.8%	1.8%	3.8%	4.2%	1.2%	3.4%

Note: Projects include not only manufacturing projects but also those in other all sectors.
Source: Board of Investment (BOI)

Compared with investments in other regions, BOI-approved projects in the WSB region were less active. As shown in Table 7.1.12, BOI projects have become more common in Zone 3 and much less common in Zone 1, a switch that is most likely attributable to the revision of BOI incentive structure in 1993. The 2,293 approved projects in Zone 3 involved a total investment of 634.7 billion Baht in 1993-95, which was 11 percentage points higher by number of projects and 18.4 percentage points higher for investment than in the previous three-year period (i.e., 1989-92).

Of the six provinces of the WSB region, Kanchanaburi, Ratchaburi, and Samut Songkhram are in Zone 2 while the other three provinces are in Zone 3. This zoning by BOI appears to have affected investment in the region. In the WSB's six provinces, BOI-approved projects increased only in Petchaburi (Zone 3) from 1993 to September 1995. Also consider the case of Rayong in the ESB, which is still in Zone 3. In Rayong, there are many industrial estates including Map Ta Phut where petrochemical complexes have been developed. Supported by its favorable zoning, the ESB has benefitted from huge investments accounting for 55.2 per cent of the national total.

Meanwhile, revision of the BOI incentive structure in 1993 has had some effects on the regional distribution of investment. The BMR's share decreased radically after the revision. Except for the BMR, as shown in Table 7.1.12, the WSB region is the sole region whose share of BOI-approved projects decreased in number and amount of investment (-0.9 per cent and -1.0 per cent, respectively) after the revision.

Table 7.1.12 BOI Approved Projects by Region (1989-September 1995)

	No. of Projects			Percent Shares			
	Total	(A) 89-92	(B) 93-95sep.	Total	(A) 89-92	(B) 93-95sep.	(B-A) (%)
Whole Kingdom (WK)	5,853	2,969	2,884	100.0%	100.0%	100.0%	
WSB	294	162	132	5.0%	5.5%	4.6%	-0.9
Kanchanaburi	49	31	18	0.8%	1.0%	0.6%	-0.4
Ratchaburi	69	49	20	1.2%	1.7%	0.7%	-1.0
Samut Songkhram	17	12	5	0.3%	0.4%	0.2%	-0.2
Phetchaburi	66	16	50	1.1%	0.5%	1.7%	1.2
Prachuap Khirikhan	52	29	23	0.9%	1.0%	0.8%	-0.2
Chumphon	41	25	16	0.7%	0.8%	0.6%	-0.3
BMR	1,834	1,248	586	31.3%	42.0%	20.3%	-21.7
Central	590	282	308	10.1%	9.5%	10.7%	1.2
Eastern	1,527	696	831	26.1%	23.4%	28.8%	5.4
Northeastern	586	198	388	10.0%	6.7%	13.5%	6.8
Northern	555	230	325	9.5%	7.7%	11.3%	3.5
Southern	525	216	309	9.0%	7.3%	10.7%	3.4
not specified	12	7	5	0.2%	0.2%	0.2%	-0.1
ZONE 1	1,834	1,248	586	31.3%	42.0%	20.3%	-21.7
ZONE 2	1,373	808	565	23.5%	27.2%	19.6%	-7.6
ZONE 3	4,007	1,714	2,293	68.5%	57.7%	79.5%	21.8
	Investments (million Baht)			Percent Shares			
	Total	(A) 89-92	(B) 93-95sep.	Total	(A) 89-92	(B) 93-95sep.	(B-A) (%)
Whole Kingdom (WK)	2,094,821	1,313,397	781,424	100.0%	100.0%	100.0%	
WSB	71,341	49,819	21,522	3.4%	3.8%	2.8%	-1.0
Kanchanaburi	15,584	13,213	2,371	0.7%	1.0%	0.3%	-0.7
Ratchaburi	17,315	15,096	2,219	0.8%	1.1%	0.3%	-0.9
Samut Songkhram	4,165	3,757	408	0.2%	0.3%	0.1%	-0.2
Phetchaburi	14,178	3,025	11,153	0.7%	0.2%	1.4%	1.2
Prachuap Khirikhan	14,100	10,142	3,958	0.7%	0.8%	0.5%	-0.3
Chumphon	5,999	4,586	1,413	0.3%	0.3%	0.2%	-0.2
BMR	777,309	630,982	146,327	37.1%	48.0%	18.7%	-29.3
Central	137,051	69,546	67,505	6.5%	5.3%	8.6%	3.3
Eastern	877,928	446,675	431,253	41.9%	34.0%	55.2%	21.2
Northeastern	88,194	41,899	46,295	4.2%	3.2%	5.9%	2.7
Northern	70,584	37,177	33,407	3.4%	2.8%	4.3%	1.4
Southern	69,657	34,893	34,764	3.3%	2.7%	4.4%	1.8
not specified	2,757	2,406	351	0.1%	0.2%	0.0%	-0.1
ZONE 1	777,309	630,982	146,327	37.1%	48.0%	18.7%	-29.3
ZONE 2	428,577	257,050	171,527	20.5%	19.6%	22.0%	2.4
ZONE 3	1,314,755	680,009	634,746	62.8%	51.8%	81.2%	29.5

Note: Zone 1 = BMR
Zone 2 = WSB (Kanchanaburi, Ratchaburi, Samut Songkhram), Central (Ang Thong, Ayuttaya, Saraburi)
Eastern (Nakhon Nayok, Chachoengsao, Chon Buri)
Source: Board of Investment (BOI)

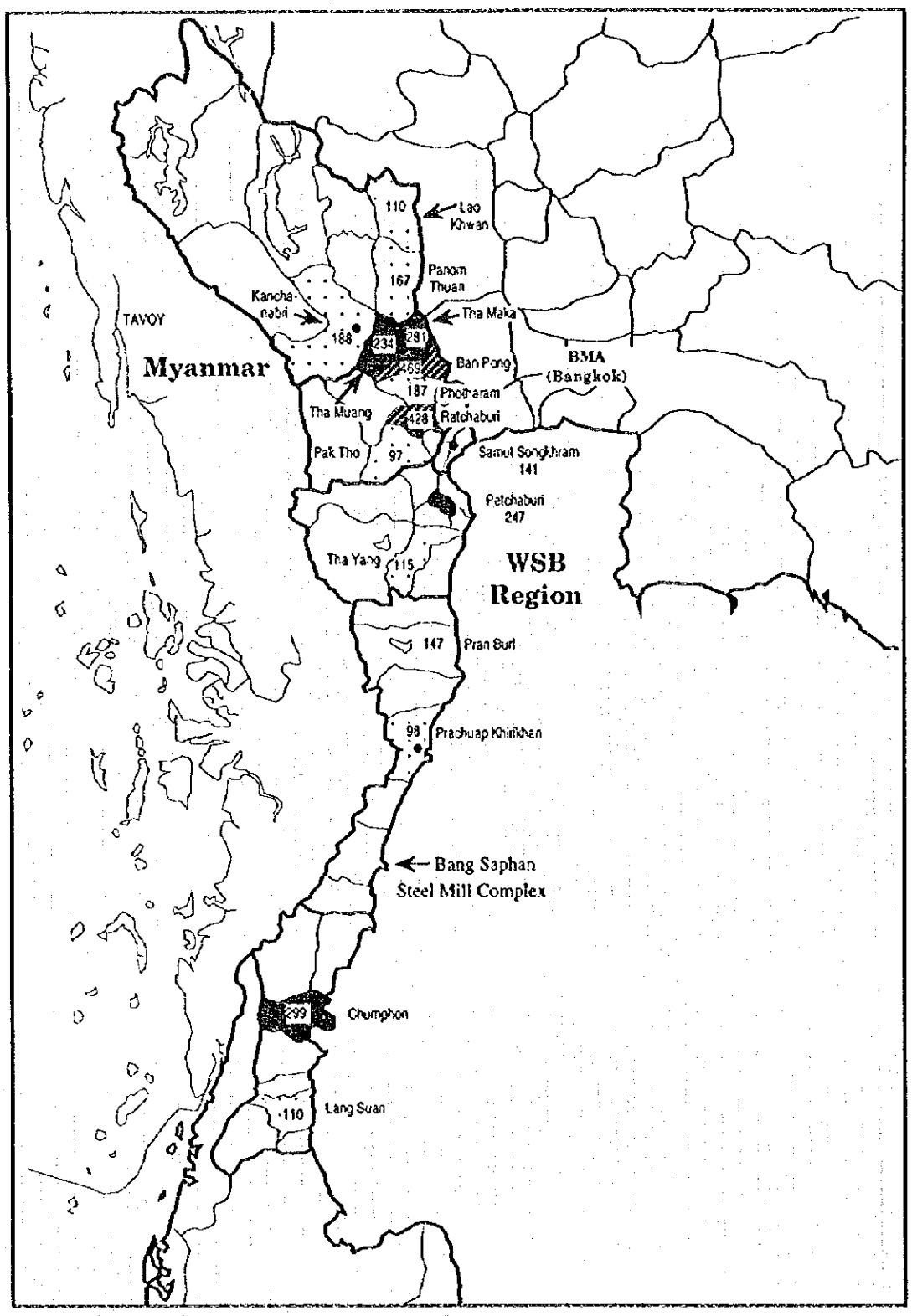
(7) Spatial Distribution of Industrial Establishments

In general, industrial activities are closely related to urban functions. In other words, industrialization promotes urbanization and the latter supports the former. This generalization is true in the WSB region, where 4,389 industrial establishments classified into "the modern sector" are registered, mostly concentrated in urban areas as shown in Figure 7.1.8.

Ban Pong in Ratchaburi province had 469 establishments in 1994, which was the largest center among 49 amphoes in the region, followed by Ratchaburi (428), Chumphon (299), Tha Maka (281) in Kanchanaburi province, Petchaburi (247), and Tha Muang (234). These amphoes could be called "urban cores" in the region.

There is no industrial estate (IE) operating in the WSB region. Recently, however, three IE projects have been planned as mentioned in the next Section.

Figure 7.1.8 Spatial Distribution of Industrial Establishments by Amphoe in 1994 (Amphoes with around more than 100 establishments)



Source: Industrial Statistics (Office of Industrial Economics-MoI)

1.3 *Industrial Resources and Infrastructure Development*

Industrial resources and infrastructure are essential for industrial development. They involve many factors for industrial location, operation, management, and marketing, namely; indigenous agricultural and mineral resources as raw materials for manufacturing, land development, labor supply, utilities (electricity and water), and conditions for transport and communications. Educational/training facilities are also essential together with other "infrastructure software/soft-infarastructuure," i.e., functions regarding research and development (R&D), urban/business activities, and amenity/quality of life.

(1) Industrial Resources

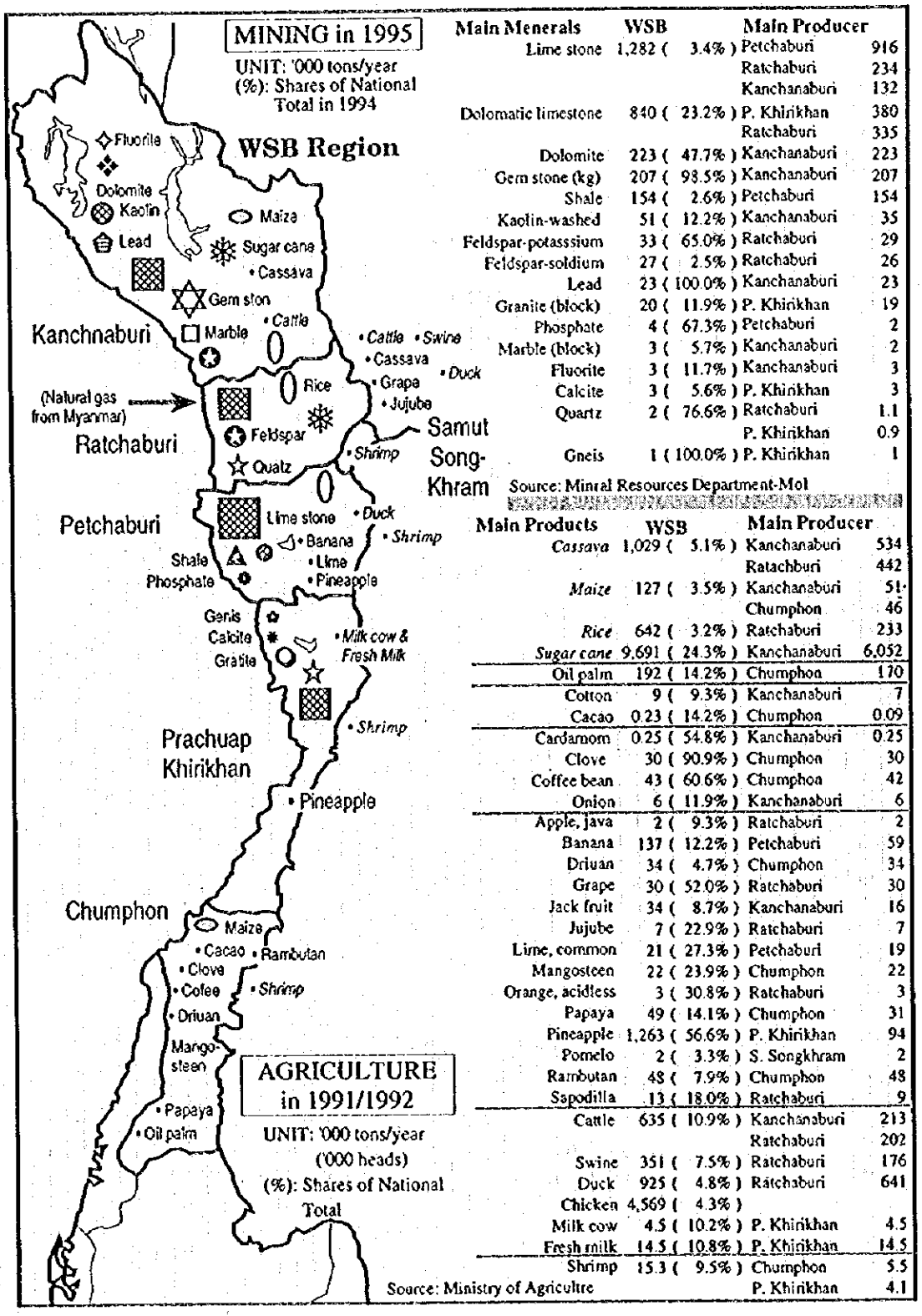
The WSB region is a sort of "agro-industrial" area:

The WSB region is a long and slender area, ranging for about 450 km north to south. Its climate is tropical in the northern/upper part and tropical monsoon with heavy rainfall in the southern/lower part. Precipitation ranges from 1,100 mm/year in Ratchaburi to 1,700 mm/year in Chumphon. The western part of the region is mountainous. Reflecting these features, agricultural products in the region are diversified. The valleys are suitable for cultivating upland crops such as sugar cane, cassava, and maize, all of which are the main products of Kanchanaburi. The Mae Klong river basin in the east is fertile and suitable for lowland crops including paddy. Fruit production is active in Ratchaburi for grapes, Petchaburi for bananas, lime, and pineapple, Prachuap Khirikhan for pineapples, and Chumphon for durians, mangosteens, and rambutans. Chumphon is also the main production center of coffee and cloves in Thailand. Vegetables are widely produced throughout the WSB. (Figure 7.1.9)

Livestock farming is also promoted in the region. Chicken breeding is popular throughout the six provinces. Kanchanaburi and Ratchaburi are cattle breeding centers, while Prachuap Khirikhan is a dairy center. Shrimp is one of the main products in Chumphon, Prachuap Khirikhan, and Samut Songkhram.

Forestry resources are concentrated in Kanchanaburi, which has a total of 7 million rai of forest areas. The WSB region has more than fifteen national forest conservation zones, six national parks, and three wild animal conservation zones. As a consequence of these protections, the availability of forest resources in the region is limited.

Figure 7.1.9 Mining and Agriculture in the WSB Region



Main Menerals	WSB		Main Producer	
Lime stone	1,282	(3.4%)	Petchaburi	916
			Ratchaburi	234
			Kanchanaburi	132
Dolomatic limestone	840	(23.2%)	P. Khirikhan	380
			Ratchaburi	335
Dolomite	223	(47.7%)	Kanchanaburi	223
Gem stone (kg)	207	(98.5%)	Kanchanaburi	207
Shale	154	(2.6%)	Petchaburi	154
Kaolin-washed	51	(12.2%)	Kanchanaburi	35
Feldspar-potasssium	33	(65.0%)	Ratchaburi	29
Feldspar-soldium	27	(2.5%)	Ratchaburi	26
Lead	23	(100.0%)	Kanchanaburi	23
Granite (block)	20	(11.9%)	P. Khirikhan	19
Phosphate	4	(67.3%)	Petchaburi	2
Marble (block)	3	(5.7%)	Kanchanaburi	2
Fluorite	3	(11.7%)	Kanchanaburi	3
Calcite	3	(5.6%)	P. Khirikhan	3
Quartz	2	(76.6%)	Ratchaburi	1.1
			P. Khirikhan	0.9
Gneis	1	(100.0%)	P. Khirikhan	1

Source: Mineral Resources Department-MoI

Main Products	WSB		Main Producer	
Cassava	1,029	(5.1%)	Kanchanaburi	534
			Ratachburi	442
Maize	127	(3.5%)	Kanchanaburi	51
			Chumphon	46
Rice	642	(3.2%)	Ratchaburi	233
Sugar cane	9,691	(24.3%)	Kanchanaburi	6,052
Oil palm	192	(14.2%)	Chumphon	170
Cotton	9	(9.3%)	Kanchanaburi	7
Cacao	0.23	(14.2%)	Chumphon	0.09
Cardamom	0.25	(54.8%)	Kanchanaburi	0.25
Clove	30	(90.9%)	Chumphon	30
Coffee bean	43	(60.6%)	Chumphon	42
Onion	6	(11.9%)	Kanchanaburi	6
Apple, Java	2	(9.3%)	Ratchaburi	2
Banana	137	(12.2%)	Petchaburi	59
Driuan	34	(4.7%)	Chumphon	34
Grape	30	(52.0%)	Ratchaburi	30
Jack fruit	34	(8.7%)	Kanchanaburi	16
Jujube	7	(22.9%)	Ratchaburi	7
Lime, common	21	(27.3%)	Petchaburi	19
Mangosteen	22	(23.9%)	Chumphon	22
Orange, acidless	3	(30.8%)	Ratchaburi	3
Papaya	49	(14.1%)	Chumphon	31
Pineapple	1,263	(56.6%)	P. Khirikhan	94
Pomelo	2	(3.3%)	S. Songkhram	2
Rambutan	48	(7.9%)	Chumphon	48
Sapoditla	13	(18.0%)	Ratchaburi	9
Cattle	635	(10.9%)	Kanchanaburi	213
			Ratchaburi	202
Swine	351	(7.5%)	Ratchaburi	176
Duck	925	(4.8%)	Ratchaburi	641
Chicken	4,569	(4.3%)		
Milk cow	4.5	(10.2%)	P. Khirikhan	4.5
Fresh milk	14.5	(10.8%)	P. Khirikhan	14.5
Shrimp	15.3	(9.5%)	Chumphon	5.5
			P. Khirikhan	4.1

Source: Ministry of Agriculture

Mineral resources are mostly used for local manufacturing:

Limestone mined in Petchaburi is mostly used for cement manufacturing. Ratchaburi and Kanchanaburi are also limestone producers. Dolomite and kaolin mined in Kanchanaburi are used for pottery in Ratchaburi, which is also a main producer of feldspar used for pottery manufacturing. Kanchanaburi is the main producer of gemstones including blue sapphire, which accounted for 98.5 per cent of the national total, while quartz is mined in Ratchaburi and Prachuap Khirikhan, representing 76.6 per cent of the national total. (Figure 7.1.9)

Mineral production typically fluctuates based on changing demand patterns, the exhaustion of resources, and changes in prices. In the WSB region, the production of limestone, as well as kaolin and feldspar, more than doubled from 1991 to 1995. Dolomite limestone was newly produced and granite production increased in 1995 at a level of more than twenty times of 1991. On the other hand, the production of such minerals as gemstones, fluorite, tin concentrates, shale, and lead decreased.

Minerals mined in the WSB region are mostly used for local manufacturing but some portions have been exported. Dolomite, ilmenite, lead, and quartz are the main minerals exported from the region.

Natural gas from Myanmar is a new resource in the WSB region:

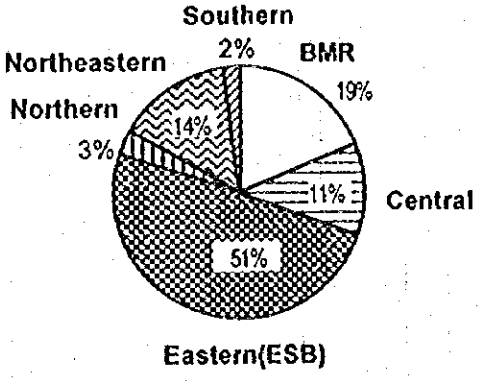
The Petroleum Authority of Thailand (PTT) will import natural gas from Myanmar. PTT has already contracted to import 525 million cubic feet per day (MMCFD) of natural gas produced from Yadana Gas Field for 30 years from 1998. Yadana Gas Field can export an additional 475 MMCFD (totaling up to 1,000 MMCFD). PTT also agreed to import 200 MMCFD of Yatagon gas from 1999. The imported gas is to be used mainly for power generation plants in Ratchaburi but some portion could be provided as raw material for manufacturing.

(2) Infrastructure Hardware

Three industrial estates are planned in the WSB region:

Industrial estate (IE) development is effective for regional dispersal/decentralization of industries since intensive pinpoint-investment in land and related infrastructure can create good production spaces in rural areas. However, IE development in Thailand has been heavily concentrated in the ESB as shown in Figure 7.1.10.

Figure 7.1.10 Area and Shares of Industrial Estates by Region and by Developer as of July 1995



Region	Total (rai)	IEAT	Joint with IEAT	Private
Total	114,611	16,872	51,381	40,584
BMR	21,961	2,087	9,760	10,214
Central	13,144		9,744	3,400
Eastern (ESB)	57,149	9,556	28,142	13,577
Northern	3,530	2,980		550
Northeastern	16,578		3,735	12,843
Southern	2,249	2,249		
Total	100.0%	100.0%	100.0%	100.0%
BMR	19.2%	12.4%	19.0%	25.2%
Central	11.5%		19.0%	8.4%
Eastern (ESB)	49.9%	56.6%	54.8%	33.5%
Northern	3.1%	17.7%		1.4%
Northeastern	14.5%		7.3%	31.6%
Southern	2.0%	13.3%		

Source: Industrial Authority of Thailand (IEAT)

Lack of IEs in the WSB region to date may have caused negative effects on industrialization. However, three IEs are planned in the WSB, namely Kanchanaburi IE (681 rai/109 ha), Mahachay IE (1,300 rai/208 ha) in Ratchaburi, and Khao Yoi IE (final 1500 rai/240 ha) in Petchaburi. Kanchanaburi IE and Mahachay IE are under construction. The developers of these IEs are private companies.

BOI revised its incentive system in early 1993 and a seven-year exemption from corporate income tax is granted for projects in IEs or promoted industrial zones in Zone 2. IE development in Kanchanaburi and Ratchaburi, which are designated as Zone 2, may be a response to this incentive.

There are two additional proposals for IE development. One is to develop an IE in Prachuap Khirikhan in line with the formation of the steel complex there and the other is planned in Chumphon.

Water is abundant in the Upper WSB but limited in the Central WSB:

The Upper WSB region has Srinakarindra and Khao Laem reservoirs constructed on the Mae Klong river (30,840 km^2 in catchment area) for hydropower, flood control, irrigation, and other purposes. Water is abundant in the Upper WSB.

River basins located in the Central WSB are small, and available water resources are quite

limited. In the Petchaburi river basin (5,600 km^2 in catchment area), Kang Kra Chan reservoir (640 million m^3 in storage capacity) has been constructed for irrigation, hydropower, water supply, and flood control. However, water is insufficient to meet the requirements in the province.

The Lower WSB is endowed with more than 1,700 mm/year of rainfall but river basins are relatively small. In order to meet water requirements, the development of Tha Sae Dam and reservoir (194 million m^3 in storage capacity) in Chumphon has been studied. The water developed will be provided for irrigation, as well as for industrial use in the Bang Saphan area.

The WSB region is a national center of electricity supply:

Electric power in the WSB region is interconnected to the national grid through 230 KV and/or 115 KV transmission lines. Four major power stations are located in the WSB region: Srinakarindra Dam, Tha Thung Na Dam, and Khao Laem Dam in Kanchanaburi, and Kaeng Krachan Dam in Petchaburi. They have eleven power plant units with a total maximum generating capacity of 1,036 MW.

Between 1992 and 2009, the Electricity Generating Authority of Thailand (EGAT) plans to set up another 14 power plants with a total capacity of 11,700 MW. An independent power producer (IPP) in Ratchaburi will utilize natural gas from Myanmar for a power plant of 1,800 MW. An IPP in Prachuap Khirikhan province will utilize imported coal as fuel. EGAT also has a plan to construct a 500 KV transmission line to integrate the independent power producers (IPPs) in Ratchaburi and in Prachuap Khirikhan by 2001. These expansion plans will substantially strengthen the WSB power network. Further, the WSB region can be positioned as a national center of electricity supply in Thailand.

The WSB region has multi-modal transport access:

All transport means (road, rail, ship/waterway, and air) are available for access to and from the WSB region. There are two main interregional highways: Route 4 runs from Bangkok through Ratchaburi, Petchaburi, Prachuap Khirikhan, and other provinces in the Southern region, while Route 35 runs from Bangkok through Samut Sakhon and Samut Songkhram and connects with Route 4. Route 4 has been improved up to Pranburi in Prachuap Khirikhan province as a dual two-lane road, and it is scheduled to be improved as far south as Chumphon by 1997.

South-bound trains starting at Bangkok/Thonburi pass through the provinces in the region. From Nong Pla Duk Junction in Ratchaburi, one railway line passes through Ratchaburi,

Petchaburi, Prachuap Khirikhan, Chumphon, and other provinces in the Southern region, Malaysia, and finally reaches Singapore, while another goes west to Kanchanaburi. There is also the Wong Wien Yai-Mae Klong railway line that runs from Wong Wien Yai to Samut Songkhram.

There is a long coastal area in the WSB region. There are coastal ports at Samut Songkhram, Ban Laem-Petchaburi, Prachuap Khirikhan, and Chumphon, which are used for fishing, oil transport and other purposes. An oil terminal to supply fuels to power plants in Ratchaburi is to be constructed in Petchaburi with a total storage capacity of 300,000 barrels (around 49,000 kiloliters). The most important port in the region is Prachuap port, a deep-sea port recently developed at Bang Saphan. The port primarily serves the steel complex at the site. The port is also servicable for general cargo. An estimated total of 2.3 million tons were handled at the port in 1995, including 500,000 tons of non-steel cargo. The Mae Khlong river and its canals provide the region with an inland waterway system serving Samut Songkhram, Ratchaburi, and Kanchanaburi.

The WSB region has an airport at Hua Hin (with a 1,200 m long runway served by one daily round trip to and from Bangkok), a new privately operated airport outside of Ratchaburi, and a new airport to be opened in 1997 at Pathiu, north of Chumphon (with a 2,100 m long runway). The economic impacts of Pathiu airport on the development of Chumphon province and the Bang Saphan industrial complex will be substantial.

(3) Infrastructure Software

Skill development is relatively well facilitated in the WSB region:

Each province in the WSB region has vocational and technical schools, providing skilled and semi-skilled workers for local industries. The Western Region Skill Development Institute is located in Ratchaburi and provides training for over 3,000 workers in more than ten skill types. There are two more skill development centers planned, one in Bang Saphan district by the Department of Vocational Education (DOVE) and the other in Prachuap Khirikhan district by the Department of Skill Development (DOSD).

The five provinces other than Chumphon in the region are under the administration of regional offices of the Government. The Western Industrial Promotion Center of MOI in Suphan Buri provides in-house training by dispatching trainers.

Higher education is expected to be improved:

The Rajabhat Institute-Petchaburi has been serving as a teachers' college and is being

developed as a national and regional education center. In addition, there are international educational facilities including Stamford Institute, which is located at Hua Hin in Prachuap Khirikhan. Further, Chumphon campus of the King Mongkut's Institute of Technology has been recently opened with a faculty of agriculture at the initial stage.

Public R&D facilities are still less developed:

The Research and Development Center for Environmental Conservation is located in Ratchaburi and provides services related to industrial waste management. However, there is no other public institute providing R&D and testing services in the WSB region, as almost all such institutes are concentrated in the BMR.

Urban and business functions are yet undeveloped:

Urban centers have been developed mainly in the provincial capitals. Most of the provincial capitals have populations ranging from 30,000 to 40,000 persons, except for Chumphon, which has a municipal population of around 100,000. Given such limited urbanization and inter- and intra-regional exchanges, there is no convention nor trading center in the WSB region, though first-class resort hotels are available at Hua Hin-Prachuap Khirikhan and Cha-Am-Petchaburi. Functions concerning business activities have been almost solely concentrated in the BMR.

However, the Industrial Finance Corporation of Thailand (IFCT) established a regional office in Ratchaburi province. IFCT loans have been allocated intensively to export oriented projects, energy saving projects, industrial development in provincial/rural areas, and projects utilizing local resources and raw materials. The IFCT branch will contribute to consolidation of the WSB manufacturers' financial foundation for their further development.

The WSB region has many natural amenities but few urban amenities:

There are many scenic spots, cultural/historic sites, and tourism resorts in the region. The region will be one of the excursion centers of Thailand. However, permanent living conditions with adequate urban amenities are more crucial for industrial development. Manufacturing industries should be technology-intensive for survival in the future and industrial employees including engineers and R&D staff members will require better amenities for their refreshment. Unfortunately, such urban amenities are not yet available in the WSB region. It is expected that industrial development in the region will be synchronized with core urban development to satisfy human needs for quality of life.

Chapter 2 Constraints and Potentials of the WSB Region for Industrial Development

In order to efficiently and reasonably proceed with industrial development in the WSB region, it is helpful not only to recognize constraints on development and mitigate them as much as possible, but also to identify the development potentials of the region and utilize them to the fullest extent.

2.1 Constraints

Table 7.2.1 summarizes main constraints of the region for industrial development, principally based on analyses in Chapter 1. Note, however, that since the six provinces of the region have unique characters and therefore dealing with them on the same basis as one region is not always adequate.

Table 7.2.1 Main Constraints on Industrial Development in the WSB Region

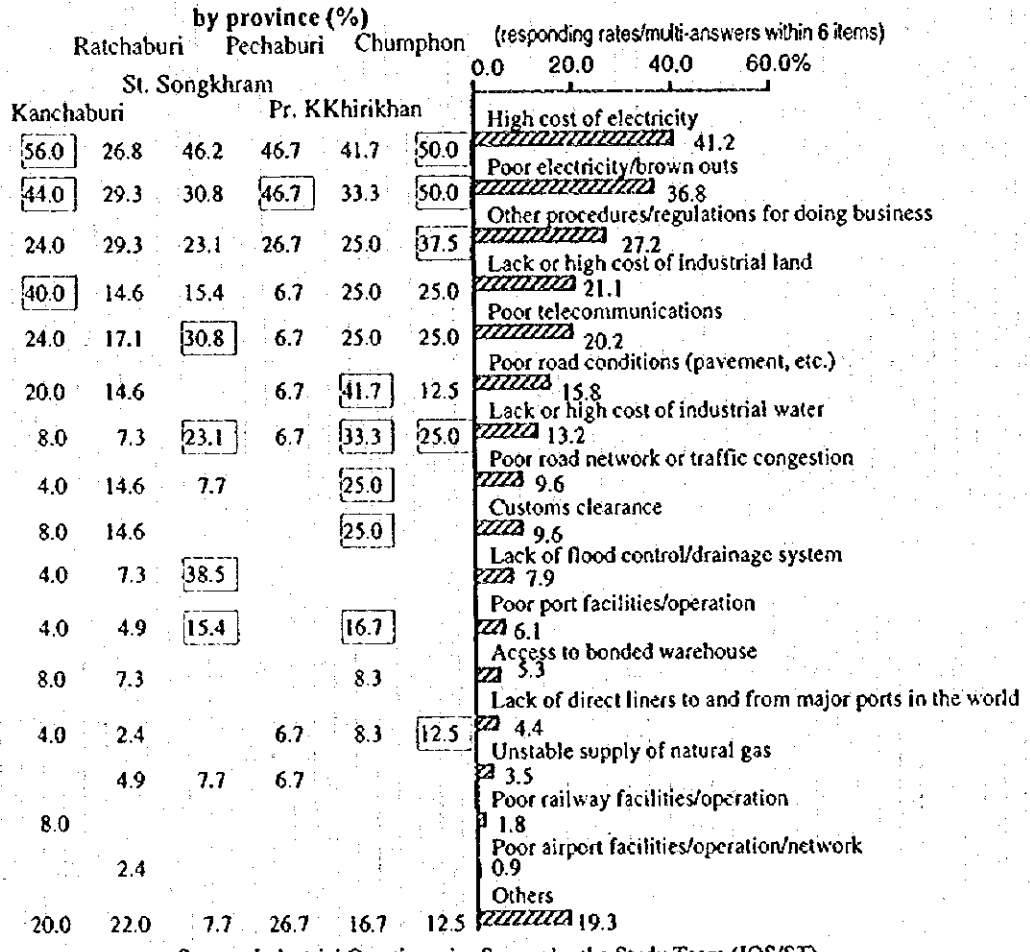
	Upper WSB	Central WSB	Lower WSB
	Samut Songkhram Kanchanaburi Ratchaburi	Petchaburi Prachuap Khirikhan (Upper part)	Prachuap Khirikhan (Bang Saphan, etc) Chumphon
Physical Constraints			
1. Land (long and slender)	• limited (mountainous)	• limited (mountainous)	
2. Water Resources		• limited	• limited
3. Mineral Resources	• limited	• relatively limited	• limited
4. Accessibility by Road		• limited	
Socioeconomic Constraints			
1. Hinterland/Market		• limited	
2. Labor Supply	• limited	• limited	• limited
3. Agglomeration of Existing Industries	• relatively limited	• limited	• limited
4. Public R&D Institute	• limited	• limited	• limited
5. Urban Functions	• limited	• limited	• limited
6. Linkages with Other Region		• limited	
Institutional Constraints			
1. BOI Incentives	• limited (Zone 2)		
2. Competence of Local Administrations	• limited	• limited	• limited

Among these constraints, ones regarding physical conditions of the WSB region, especially resource constraints, are in general not easy to address. The institutional constraints are issues to be discussed by taking the regional balance and decentralization policies in Thailand into consideration.

Constraints pointed out by existing manufacturers in the WSB region

The existing manufacturers in the WSB region recognize serious constraints on their production activities. In the Industrial Questionnaire Survey carried out by the Study Team (IQS/ST), they pointed out that constraints were very critical regarding electricity supply/cost, regulations, land supply, and telecommunications, as shown in Figure 7.2.1. "Poor electricity/brown out" was reported as a hindrance to industrial production, which might result in losses. Procedures or regulations were recognized as a soft infrastructural constraint along with customs clearance, although it was hoped that they would not constrain business activities as much in the future.

Figure 7.2.1 The Most Critical Infrastructure-Related Constraints for Existing Manufacturers

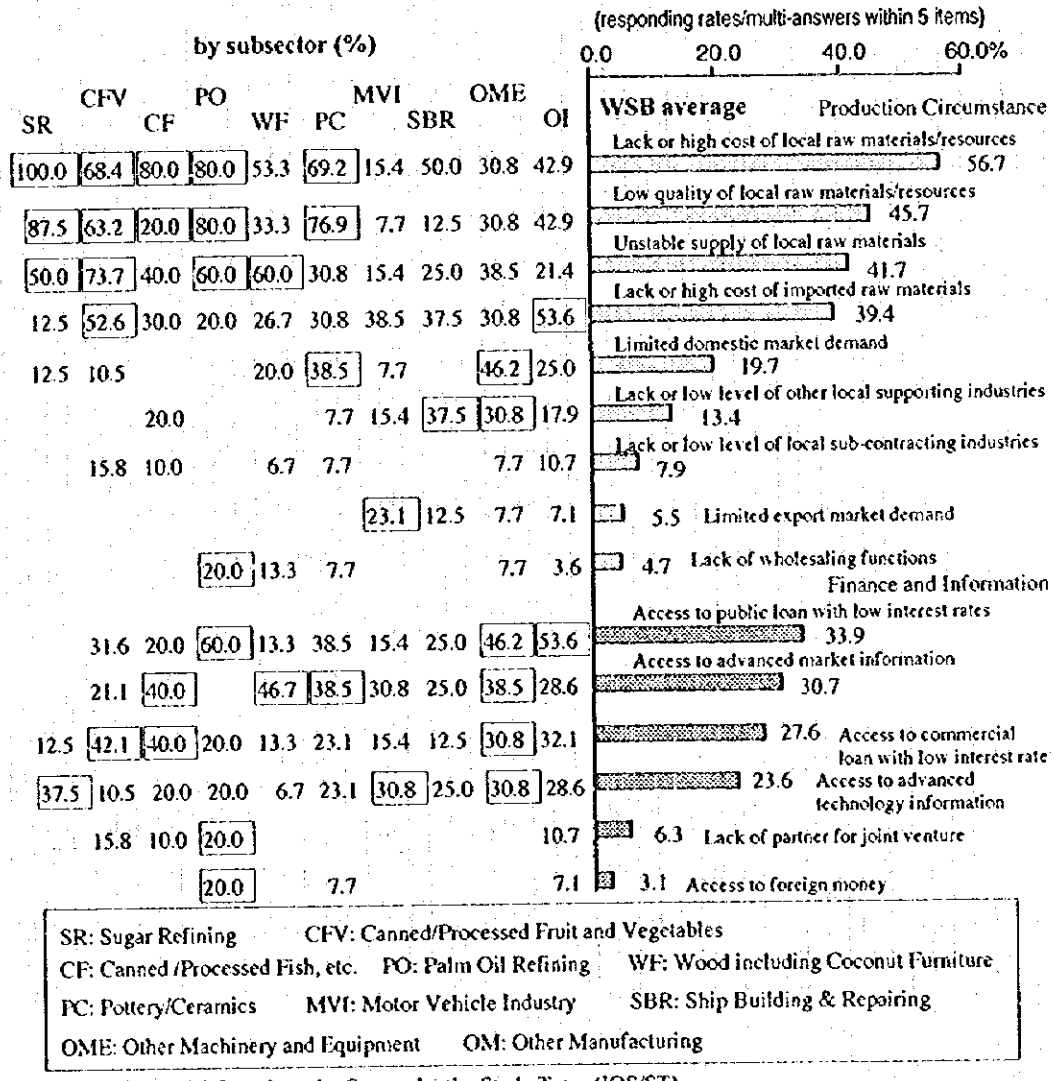


Source: Industrial Questionnaire Survey by the Study Team (IQS/ST)

The "lack or high cost of industrial land" is a critical constraint for existing manufacturers in Kanchanaburi, while "road conditions" is a severe constraint in Prachuap Khirikhan. "Lack or high cost of industrial water" is relatively critical in Samut Songkhram, Prachuap Khirikhan, and Chumphon, probably reflecting local site conditions as well as limited water resources in these provinces.

Figure 7.2.2 shows constraints on production circumstances, finance, and information indicated by IQS/ST. Constraints on supply conditions of local raw materials are very critical, which may be closely related to the local resource-based nature of existing manufacturing industries.

Figure 7.2.2 The Most Critical External Constraints for Existing Manufacturers

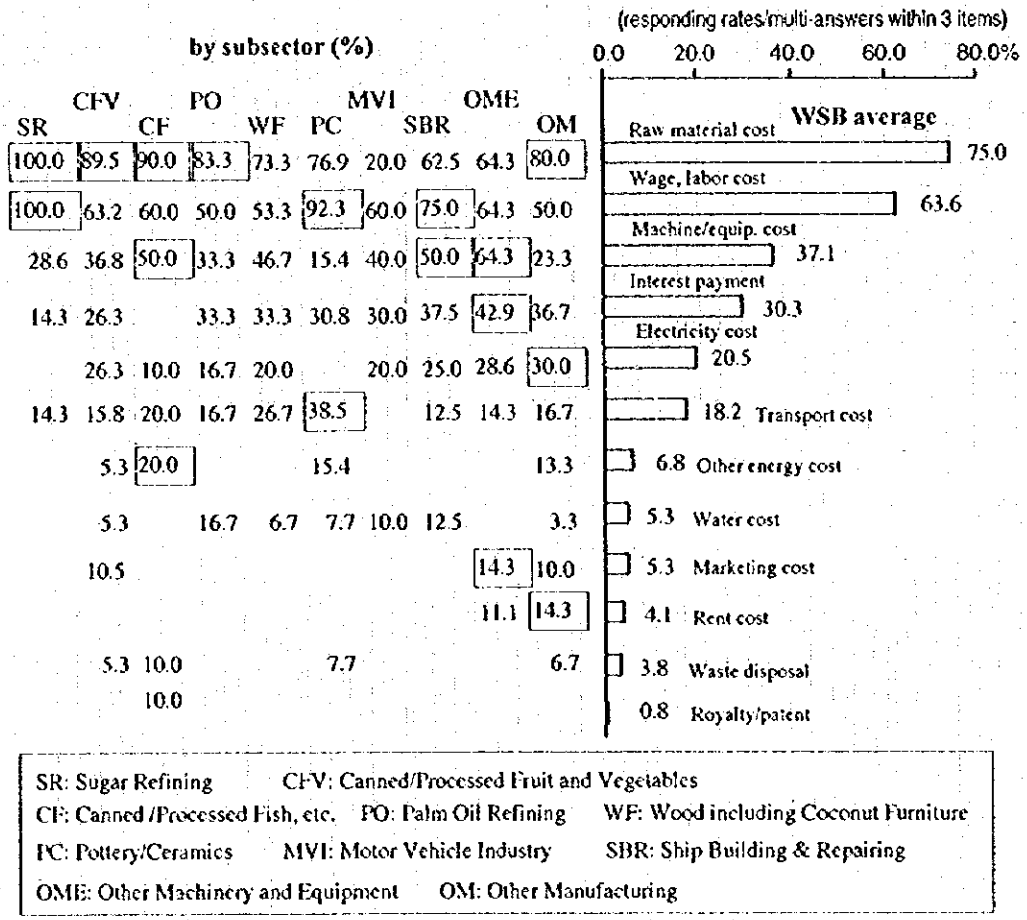


Source: Industrial Questionnaire Survey by the Study Team (IQS/ST)

On the other hand, the "lack or high cost of imported raw materials" is critical for the canned/processed fruit and vegetables industry, which probably uses imported cans, and for other industries.

In the meantime, the cost of raw materials is one of the most important factors determining the profitability of many industries, excluding the demand for their products. The importance of this factor for existing manufacturers in the WSB region is shown in Figure 7.2.3, indicating that many pointed out that supply conditions of local raw materials was a severe constraint on their production. Wage/labor costs are more critical for existing WSB industries such as sugar refining and pottery/ceramics, while machine/equipment cost is more critical for industries such as canned/processed fish and other machinery/equipment; both are critical for ship building and repair.

Figure 7.2.3 The Most Important Factors in Determining Profitability of Existing Manufacturers



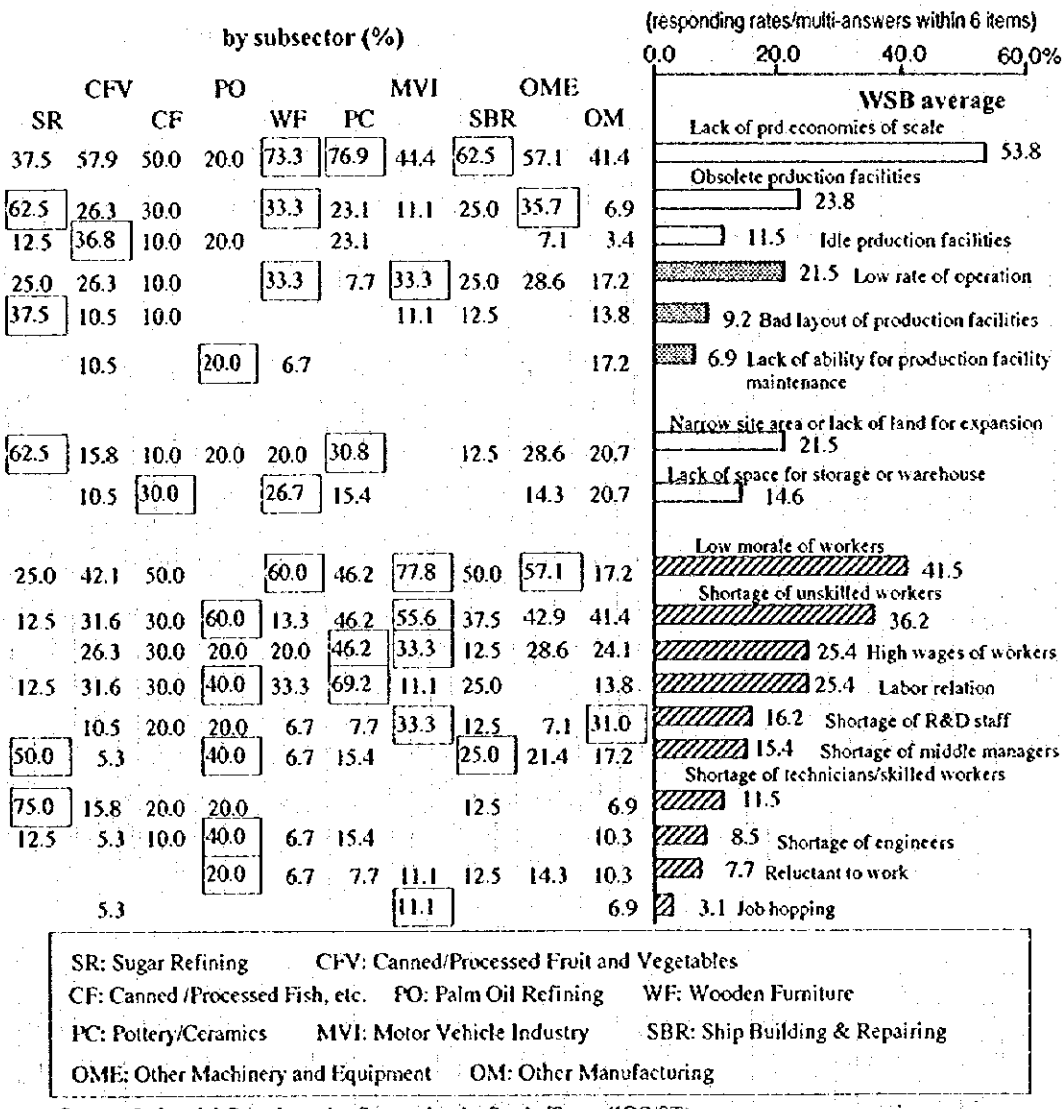
SR: Sugar Refining CFV: Canned/Processed Fruit and Vegetables
CF: Canned /Processed Fish, etc. PO: Palm Oil Refining WF: Wood including Coconut Furniture
PC: Pottery/Ceramics MVI: Motor Vehicle Industry SBR: Ship Building & Repairing
OME: Other Machinery and Equipment OM: Other Manufacturing

Source: Industrial Questionnaire Survey by the Study Team (IQS/ST)

Internal problems recognized by existing WSB manufacturers

Existing WSB manufacturers not only face external constraints but also have internal problems as shown in Figure 7.2.4.

Figure 7.2.4 The Most Critical Internal Problems for Existing Manufacturers



Source: Industrial Questionnaire Survey by the Study Team (IQS/ST)

The "lack of production scale merit or economies of scale" is recognized by many WSB manufacturers as their most critical problem, especially by small-scale industries such as wooden furniture, the motor vehicle industry (centering on bus body assembly), and other machinery and equipment. These factories' average employment size ranges from 25 to 48 persons, as shown in Table 7.2.2. "Obsolete production facilities" is one of the most critical

internal problems for sugar refining, while "idle production facilities" is critical for canned/processed fruit and vegetables, probably because their production is seasonal.

Table 7.2.2 **Employment Size and Composition of Existing Manufacturing Factories (by IQS/ST)**

	Workers per Factory	Composition of Workers including Management									
		Manage-ment	Middle Manag.	Sales staff	Engin-eer	Techni-cian	Desi-gner	Skilled worker	Semi-skilled	Un-skilled	Other
Total	283	1.1%	2.6%	1.1%	0.5%	3.1%	0.2%	12.0%	11.9%	63.5%	4.1%
Sugar Refining	484	1.6%	6.5%	0.6%	1.0%	5.8%	0.2%	29.1%	26.6%	27.2%	1.3%
Canned/Processed Fruit and Veg	554	1.1%	2.3%	1.0%	0.4%	2.7%	0.1%	8.0%	11.1%	67.6%	5.8%
Canned /Processed Fish, etc.	1,319	0.4%	0.9%	0.1%	0.1%	0.2%	0.0%	3.7%	2.0%	92.7%	
Palm Oil Refining	107	1.6%	5.6%	2.3%	0.7%	6.6%	0.5%	24.6%	4.0%	51.2%	2.8%
Wood/Coconut Furniture	48	2.5%	2.9%	2.1%	0.4%	1.2%	1.0%	16.7%	31.9%	40.1%	1.2%
Pottery/Ceramics	171	1.3%	1.6%	2.3%	0.3%	0.3%	0.6%	9.6%	10.9%	71.7%	1.4%
Motor Vehicle Industry	25	4.0%	3.1%	0.4%		8.0%		43.4%	31.4%	9.7%	
Ship Building & Repairing	30	2.5%	4.5%	1.7%	0.4%	2.1%	2.5%	29.8%	18.6%	33.9%	4.1%
Other Machinery and Equip.	26	6.3%	3.0%	3.9%	1.8%	4.5%	0.9%	40.5%	31.5%	4.5%	3.3%
Other Manufacturing	191	1.7%	3.9%	3.0%	1.3%	9.0%	0.4%	20.6%	20.6%	26.3%	13.4%

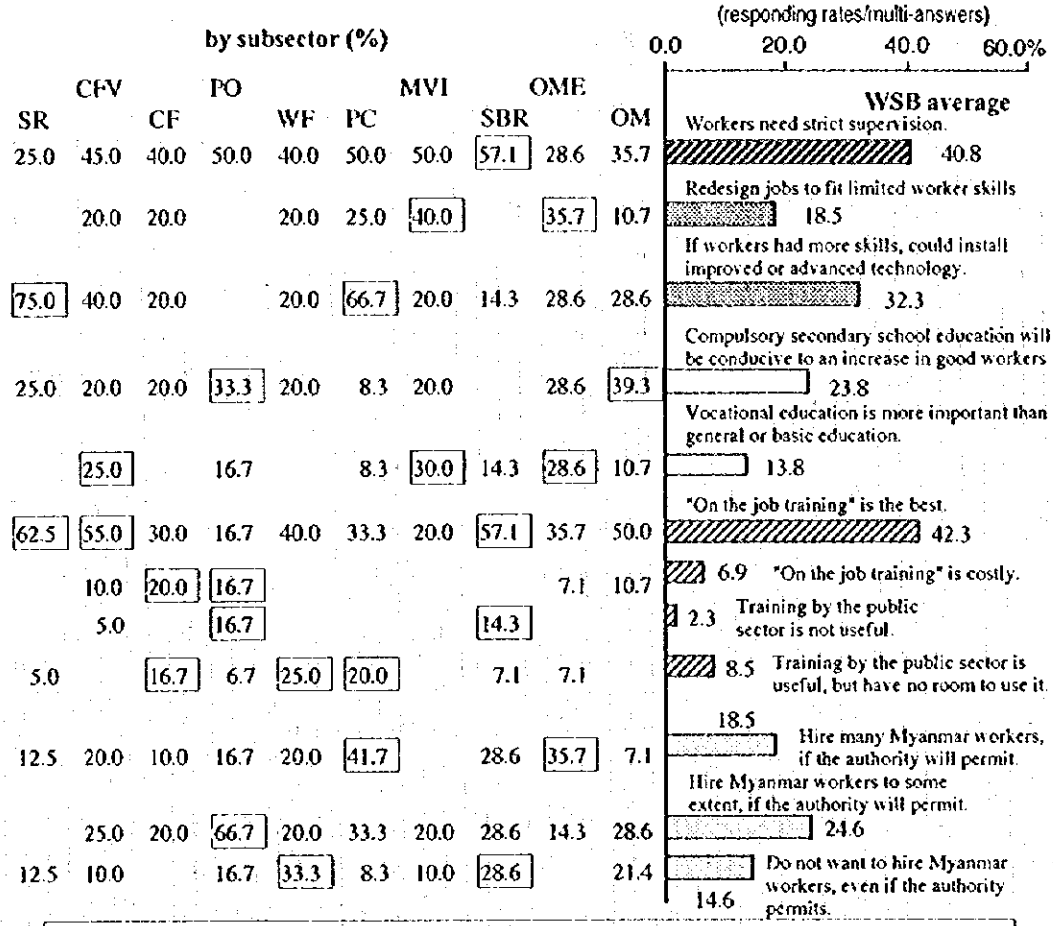
Source: Industrial Questionnaire Survey by Study Team (IQS/ST)

Among their internal problems, many WSB manufacturers recognize "low morale of workers" and "shortage of unskilled workers" as the most critical problems. The latter problem seems to have a close relationship to a heavy dependence on unskilled workers. For example, workers in canned/processed fish and pottery/ceramics industries are mostly unskilled, accounting for 92.7 per cent and 71.1 per cent of the total, respectively. The shortage of technicians/skilled workers is also critical, especially for sugar refining. In relation to these, a high wage structure is a severe problem for manufacturers in the pottery/ceramics and motor vehicle industries.

Of a total 135 respondents, 68 manufacturers carry on research and development (R&D) activities centering on the development of product and production technology. However, it should be noted that 16.2 per cent of the respondents or 20 manufacturers recognize the shortage of R&D staff to be one of their most critical internal problems; this shortage of highly qualified staff, including engineers, is a critical problem throughout the country.

Management of WSB manufacturers recognize the main issues facing them. In terms of the manpower situation, they have a cause for anxiety since their workers need strict supervision, as shown in Figure 7.2.5.

Figure 7.2.5 Perception of Existing Manufacturers regarding Manpower Situation



Source: Industrial Questionnaire Survey by the Study Team (IQS/ST)

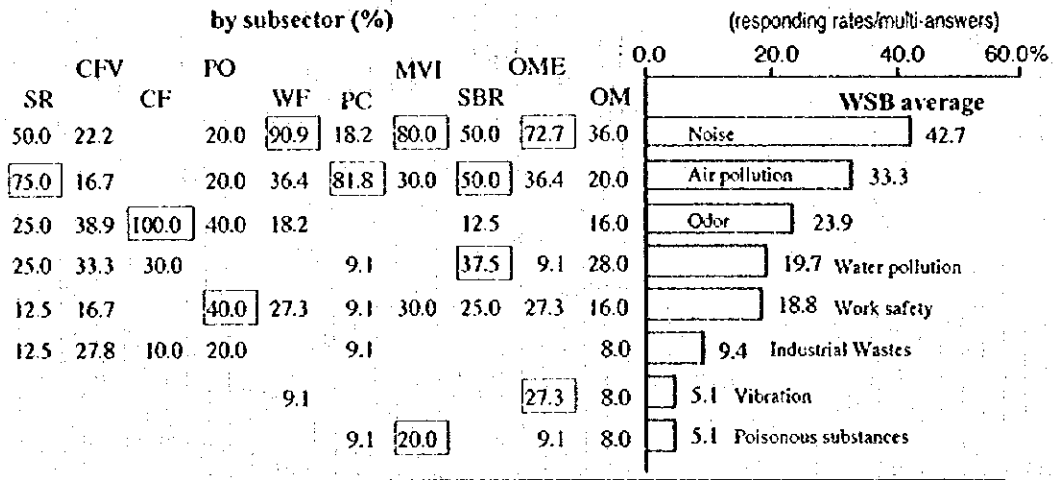
Most manufacturers engaging in sugar refining and pottery/ceramics production could install improved or advanced technology if their workers had more advanced skills. "On the job training" is carried out in many factories in the WSB region, and many manufacturers appraise such training as the most effective. It is worth noting in this context that the Industrial Promotion Center of MoI in Suphan Buri dispatches trainers to factories.

The shortage of unskilled workers, which is one of the most critical internal problems for WSB manufacturers, has been conducive to an increase in workers from Myanmar. According to the IQS/ST, 43.1 per cent of the respondents or 56 manufacturers in the WSB region would hire Myanmar workers if the authorities would permit, while the number of Myanmar workers to be hired depends on individual manufacturer.

Environmental problems

Environmental problems caused or accompanied by factory production are both internal and external issues. WSB manufacturers perceive well their environmental problems, as shown in Figure 7.2.6.

Figure 7.2.6 Critical Environmental Problems relating to Production Activities by Existing Manufacturers



Source: Industrial Questionnaire Survey by the Study Team (IQS/ST)

Noise problems are critical for wood and metal processing industries such as manufacturers of wooden furniture, motor vehicles, and other machinery and equipment, while air pollution is critical for fuel-intensive industries such as sugar refining and pottery/ceramics. All the respondents from the canned/processed fish industry recognizes odor as a critical environmental problem. Work safety was considered to be critical, mainly by the manufacturers of palm oil, wooden furniture, and motor vehicles.

2.2 *Potentials and Regional Comparative Advantages*

Despite the constraints as noted in the previous section, the WSB region has significant potentials and regional comparative advantages for industrial development, as summarized in Table 7.2.3.

Table 7.2.3 Potentials and Regional Comparative Advantages of the WSB Region

✣ Regional Comparative Advantages of the WSB Region	Upper WSB Samut Songkhram Kanchanaburi Ratchaburi	Central WSB Petchaburi Prachuap Khirikhan (Upper part)	Lower WSB Prachuap Khirikhan (Bang Saphan, etc) Chumphon
✣ 1. Long Coastal Line	• available	• available	• available
✣ 2. Proximity to Bangkok (by road)	• one day trip area	• one day trip area (some part)	
✣ 3. Access to Myanmar	• one day trip area	• one day trip area	• one day trip area
4. Access to Malaysia, etc.			• relatively near
✣ 5. Access to the World	• land-bridge	• deep-sea port (Prachuap at Bang Saphan)	• seaport • airport (Pathiu: planned)
✣ 6. Land Availability	• 2 industrial estates (Kancha. & Racha.) • Abandoned shrimp field (Songkhram)	• 2 industrial estates (Petcha. &Khirikhan) [proposed])	• 1 industrial estate [proposed]
✣ 7. Land Price	• relatively cheap (Songkhram)	• relatively cheap	• cheap
✣ 8. Agricultural Resoruces	• relatively abundant	• relatively abundant	• relatively abundant
✣ 9. Fishery Resources	• relatively abundant	• fisheries base	• fisheries base
✣ 10. Natural Gas from Myanmar	• pipelined to Ratchaburi		
✣ 11. Water Resources	• relatively abundant		
✣ 12. Electricity Supply	• national center	• national center	• national center
✣ 13. Agglomeration of Existing Industries	• industrial cluster (bus body assembly) (pottery) • quality enterprises	• industrial cluster (canned fruit) • quality enterprises	• industrial cluster (canned fish) (ship bld. & repair.) • steel mill complex • quality enterprises
14. R&D of Manufacturing	• carried on by at least 68 manufacturers		
15. Skill Development	• Western Skill Development Institue (Ratchaburi)	• Skill Development Centers (DOVE,DOSD) (planned)	
16. Education	• Mahidole Univ.	• Rajabhat Institute • international university (Stam Ford, etc.)	• Chumphon Campus of the King Mongkut's Institute of Technology
✣ 17. Natural Attractions/Amenity		• Cha Am, Hua Hin	
18. Industrial Association (CC/FTI)	• active	• active	• active
- Board of Trade (BoT)	• BoT (Ratchaburi)		
19. BOI Incentives	(Zone 2)	• Zone 3	• Zone 3

Note: CC=Chamber of Commerce, FTI=Federation of Thai Industries

The WSB's long coastline is a basic, geographical advantage for this seaboard region. It provides beautiful beaches such as those of Cha Am and Hua Hin and also a deep-sea seaport, Prachuap port at Bang Saphan, with the potential of receiving oceangoing ships with a capacity of up to 200,000 deadweight tons (DWT). Indeed, the port is one of the

most significant comparative advantages of the region, as there is a plan to handle not only cargoes related to the nearby steel complex but also general cargo. A total of 28 manufacturers in the WSB region expressed their interest in using the port, as shown in Table 7.2.4, which reports results of the Industrial Questionnaire Survey by the Study Team (IQS/ST).

Table 7.2.4 Demand for Using Prachuap Port as a General Cargo Port

	Repondents	Use or not		If use, for what?		
	Total	NO	YES	Export	Import	Domestic
Total	124	96	28	23	8	11
Sugar Refining	8	7	1	1		
Canned/Processed Fruit and Vegetables	19	10	9	9	1	
Canned /Processed Fish, etc.	8	6	2	2	1	1
Palm Oil Refining	6	5	1	1		
Wood/Coconut Furniture	15	14	1	1	1	1
Pottery/Ceramics	12	9	3	3	1	2
Motor Vehicle Industry	8	7	1			1
Ship Building & Repairing	6	4	2			2
Other Machinery and Equip.	14	12	2	1	1	2
Other Manufacturing	28	22	6	5	3	2

Source: Industrial Questionnaire Survey by the Study Team (IQS/ST)

The WSB region will become a global gateway for Thailand by mobilizing Prachuap port, the new airport planned at Pathiu north of Chumphon and better access conditions to Myanmar, Malaysia, other South and Southeast Asian countries, and the rest of the world.

Proximity to Bangkok, with it possible to reach Bangkok from all points in the entire region within one day or less, is a comparative advantage for receiving industrial spillover from the Bangkok Metropolitan Region (BMR). In addition, land prices in the WSB region are still cheaper than in the BMR. For example, the price of land in Kao Yoi industrial estate (IE) in Petchaburi, 120 km from Bangkok, is about one million Baht/rai, cheaper than in the ESB, where prices are as follows:

- 1.5 million Baht/rai in Prachin Buri IE, 170 km from Bangkok
- 1.0-1.4 million Baht/rai in TPI IE in Rayong, 180 km from Bangkok
- 2.7 million Baht/rai in Eastern IE in Rayong, 190 km from Bangkok

The maximum land prices officially appraised by the Land Department (1992-95) could explain the WSB's comparative advantage in this regard. The following land price index has been computed by setting land prices in Bangkok equal to 100, for purposes of comparison:

WSB provinces		Other Provinces
60% level		Songkhla (Southern region)
40% level		Chiang Mai (Northern region)
24% level		Samut Prakan (BMR)
20% level	Petchaburi	Khon Kaen, Nakhon Ratchasima, Udon Thani (Northeastern region)
16% level		Surat Thani (Southern region)
14% level		Chonburi (ESB), Suphan Buri (Central region)
12% level	Prachuap Khirikhan	Rayong (ESB)
10% level	Kanchanaburi, Chumphon	Chiang Rai (Northern region)
8% level	Ratchaburi	Sukhothai (Northern region)
6% level	Samut Songkhram	Trat (ESB)

The relatively cheap land in the WSB region would appear to assure the region's continuing competitiveness, even if it prices increase to some extent in accordance with progress of the region's development. Industrial estates in the region with relatively low land prices will trigger an influx of sizable investments. In addition, a total of 80,000 rai of abandoned shrimp fields in Samut Songkhram could provide new space for various economic activities, if necessary infrastructure is developed.

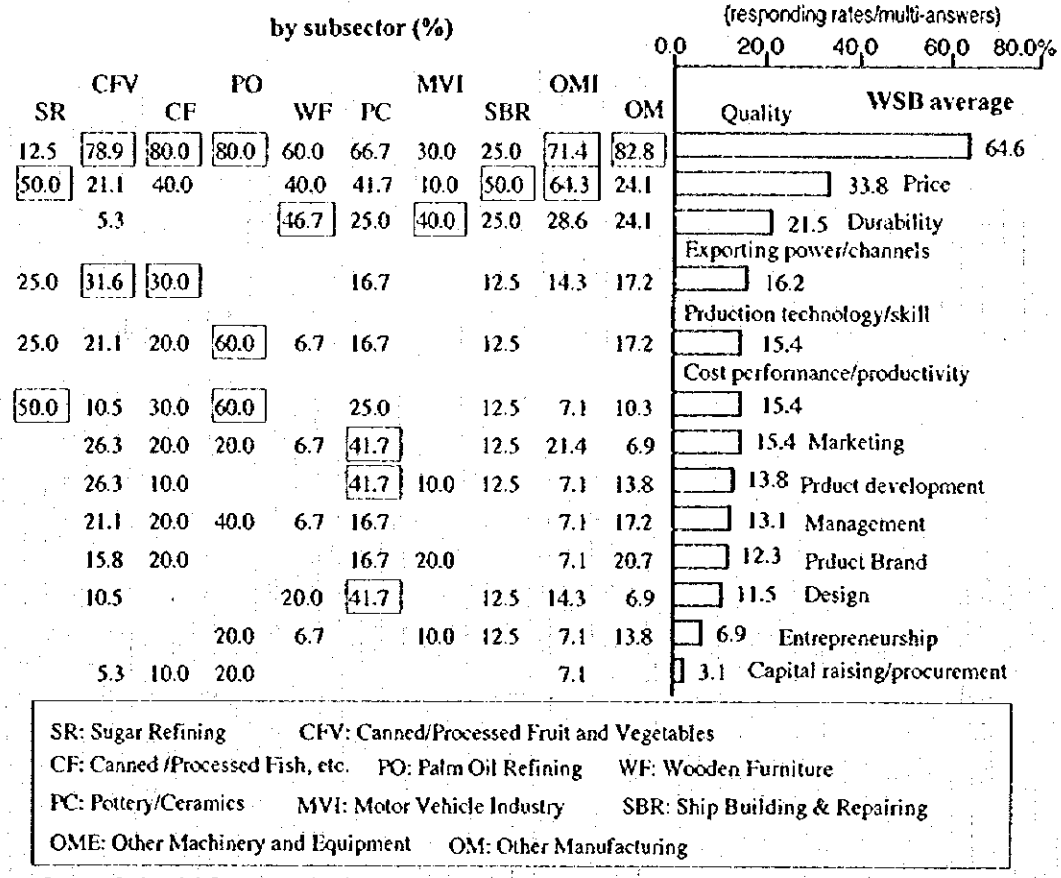
Other comparative advantages of the region include its relatively abundant agricultural and fishery resources, natural gas imported from Myanmar and pipelined to Ratchaburi, water resources in the Upper WSB, and the region's role as a national center of electricity supply, all of which were mentioned in Chapter 1.

Industrial clusters such as bus body assembly, pottery/ceramics, canned/processed fruit and fish, and ship building and repair, are also regional comparative advantages and may become leading cores or bases for further economic growth in the region. A steel mill complex at Bang Saphan in Prachuap Khirikhan is a core for an extension of related industries.

In order to successfully proceed with industrial development in the WSB region, not only its regional comparative advantages but also its potentials should be mobilized and materialized.

There are "quality enterprises" in the WSB region that produce high-quality products and export them. Of the total of 130 manufacturers in the region responding to the IQS/ST, 84 answered that their strength lies in the quality of their products, as shown in Figure 7.2.7.

Figure 7.2.7 Self-Evaluation of Existing Manufacturers in terms of their Strength



Source: Industrial Questionnaire Survey by the Study Team (IQS/ST)

These quality enterprises are concentrated in the following industries: canned/processed fruit and fish, wooden furniture, pottery/ceramics, other machinery and equipment, and other manufacturing including textiles, paper, and cement. Some quality enterprises also have strengths in areas such as price, productivity, marketing, and product development. Therefore, they would be expected to lead the development of other manufacturers toward the growth of an "industrial society."

It is also promising that there are at least 68 manufacturers carrying on R&D in the region. Public skill development centers including the Western Skill Development Institute will further contribute to industrial development in the WSB region. The Rajabhat Institute-Petchaburi will serve as a center of science and technology and a promoter of the region's development.

The private sector will be active in regional development. The Board of Trade (BoT) is organized in every province, with active local entrepreneurs serving as members. BoT is also a member of the Provincial Joint-Private Consultative Committee. The BoT of Ratchaburi is well known for its industrial promotion activities. The Chamber of Commerce (CC) and the Federation of Thai Industries (FTI) are other main industrial organizations. Their provincial chapters/clubs are already established in the WSB region and are expected to play a leading role in the industrial development.

The WSB region has sizable regional comparative advantages as seen above. It could be said that the region has been underestimated or neglected so far, mainly because development efforts were concentrated on the ESB and the region was therefore unknown to investors. Recently, however, much has changed; Prachuap port at Bang Saphan has been developed by private initiative, and private investment is to be channeled into the region. Thus, clarifying the objectives of and vision for industrial development is crucial for the success of the planned development of the WSB region.

Chapter 3 Objectives of and Vision for Industrial Development in the WSB Region

The WSB region, which will be grouped into three to four subareas, has potential and regional comparative advantages for industrial development as seen in Chapter 2. However, industrial development is an instrument, not an objective *per se*. It should be directed to address socioeconomic issues, and it should contribute to the upgrading of living conditions and economic growth in the WSB region and Thailand as a whole.

3.1 Overall Development Issues

Past development

The 8th National Economic and Social Development Plan (1997-2001) summarizes the past development achievements of the country, stating that while it has been economically successful, it has brought about social problems, including the following:

- **Income disparity among people or regions;**
  - The disparity of household income between those in the top 20 per cent and those in the bottom 20 per cent has widened, from 12.2 times in 1988 to 15.5 times in 1993.
  - The disparity of per capita income between those in Bangkok and those in the Northeastern region has widened, from 10.2 times in 1991 and to 11.9 times in 1994.
- **Deterioration of natural resources and environment;**
  - One million rai of forest area was exploited each year in 1992 and 1993.
  - Only 0.16 million rai of afforestation was attained during the same period.
  - 182 million rai of land (56.8 per cent of the total national land area) are afflicted with acidic soil and salinity problems.
  - 107 million rai of land (33.4 per cent of the total national land area) are adversely affected by soil erosion.
  - Water quality has deteriorated, especially in the lower part of the Chao Phraya river.
  - Air and noise pollution has been exacerbated by widespread congestion and insufficient basic services, especially in Bangkok and major cities.

- **More complex and materialistic society;**

  - Ethical and moral problems have increased, including a relaxing of social discipline.
  - Materialism and changes in ways of life conducive to a lack of self sufficiency, self dependency, and compassion have been widespread.
  - Family ties have weakened.
  - Modern hazards and illnesses, such as accidents, cancer, and heart disease, have increased.
  - A large investment-saving gap mainly derived from a heavy dependence on imported foreign technology and capital goods has emerged.
  - The investment-saving gap has widened to 5.6 per cent of GDP in 1994.
  - The import value of capital goods increased to 430 billion Baht in 1993 from 330 billion Baht in 1991.

Objectives of the 8th Plan

The 8th Plan (1997-2001), addressing the social problems and threats to sustainable growth, presents the following objectives:

- GDP growth at 8 per cent per annum
- Objectives

  (1) Increase human potentials in terms of physical well-being, intellect, vocational skills, and ability to adapt to changes in economy, society, and politics.

  (2) Develop a stable society, strengthen family and community, support human development, improve the quality of life, and increase community participation in national development.

  (3) Achieve balanced economic growth with stability and open up opportunities for people to participate in the creation of and to receive fair share of benefits from growth.

  (4) Utilize, preserve, and improve the national resources and environment such that they can advance economic and social development and the quality of life.

(5) Reform the administrative system in order to increase the opportunities for non-governmental organizations (NGOs), the private sector, community, and individuals to participate in national development.

Strategies of the 8th Plan

In order to achieve the above objectives, the 8th Plan indicates seven development strategies as follows:

1) **People development** for increasing human potentials, self-reliance, and participation in national development

2) **Social and environmental development** focused on human surroundings such as family, community, arts and culture, and the strengthening of social cores such as family, community, and social security.

3) **Building the development potentials of regional and rural areas to enrich the quality of life of people** through an area development approach, enhancement of individual and community capability, and promotion of participation in development.

4) **Developing economic support for the development of people and the quality of life** through policies addressing growth with stability, production restructuring, science and technology (S&T) development, and relevant infrastructure and area development

5) **Natural resources and environmental management** targeted to preservation and enrichment of the national resources, with their utilization conducive to a balance in ecology, improvement of quality of life, providing long-run foundations for development, and establishment of a relevant management system including fair utilization to benefit society and community.

6) **Development of "People State"** through the creation of public sector commitment to develop human potentiality, the formation of partnership between people in society and public servants in national development, and the mobilization of public participation.

7) **The administrative and management system for effective implementation of the development plan** comprising the direction for translating the development plan into implementation by using a location-specific management system based on tasks of government agencies together with participation from all stakeholders, the development of a public mechanism in implementation, and the adjustment of the role of multiple in participating in development.

Industrial Development Issues

The 8th Plan pursues sustainable development by regarding human development as the main target of national development. It is the first national development plan introducing a bottom-up approach for development planning. The Plan also places an emphasis on fair opportunities for growth not only for people but also for regions other than the BMR, the people/community-based development or participatory approach to development, the quality of life, value formation and new ways of life, and the preservation and rational utilization of natural resources. Accordingly, the development issues regarding industrial development could be summarized as follows:

- Acceleration of decentralization or dispersal of manufacturing industries from the BMR/Zone 1 through development of relevant infrastructure and an incentive system
- Development of community-based industries using local/indigenous resources including human resources
- Creation of open and fair accessibility to business opportunities and public services
- Restructuring of industry from labor-intensive to technology/information- intensive, addressing the globalizing economy to sustain economic growth
- Establishment of industrial structures to attain higher value-added
- Development of capital goods industries to lessen the high investment-saving gap
- Promotion of research and development (R&D) activities to make industries more competitive and conducive to production of Thai regional products
- Harmonization of industrial development with the natural environment
- Industrial development conducive to rational urbanization and social integration

3.2 Objectives of Industrial Development in the WSB Region

The objectives of industrial development in the WSB region should be set by taking the industrial development issues mentioned above into consideration, while addressing the region's constraints and incorporating the basic objectives of the region's development. Accordingly, the objectives will be set as follows:

(1) To contribute to regionally balanced development of Thailand by mobilizing the region's potentials and comparative advantages to the fullest extent;

(2) To establish a firm foundation for the sustainable growth of existing industries in the WSB region;

(3) To induce new industries conducive to generation of employment opportunities and a resulting rise in incomes, and to diversification of the region's industrial structure;

(4) To lessen constraints and improve econonic and social infrastructure conducive to strengthening of industrial competitiveness;

(5) To provide better job opportunities conducive to a better quality of life and social integration in both urban and rural areas; and

(6) To create an "industrial amenity zone" harmonized with the natural environment and urban/rural amenities.

The first objective of contributing to regionally balanced development is a response of the WSB region to the issue of acceleration of industrial decentralization or industrial dispersal in Thailand. The WSB region will play a role as a main receiving area of industrial spillover from the BMR, which will contribute to the regional restructuring of industry in Thailand.

The second objective of establishing a firm foundation for sustainable growth is to provide the existing industries with better public services and the infrastructure necessary for their growth.

The third objective of inducing new industries is the main objective for further growth and upgrading of the WSB's industrialization, which also relates to the issue of restructuring of industry in Thailand.

The fourth objective of eliminating constraints is to intensively mobilize policy measures and the relevant resources so as to attain industrial competitiveness within the globalizing economy.

The fifth objective of providing better job opportunities and contributing to social integration in both urban and rural areas is to promote balanced development aiming at a good quality of life within the WSB region.

The last objective, creation of an "industrial amenity zone", is to focus not only on industrial development harmonized with the natural environment, but also on a good business and production environment with attractive urban and rural amenities. Achievement of this objective will change the image of the WSB region and thereby attract many investors.

3.3 Vision toward 2011

The target year for the WSB Regional Development Master Plan is 2011. It is expected that during the 15-year planning period the region will be developed to a point at which it will be able to play a new role within the globalizing economy. Industrial development in the WSB region will be successfully realized if it is led by a regional vision or regional identity jointly held among people, communities, provinces, manufacturers, investors, developers, and concerned agencies of the Government. It is desirable that there be a global perception of such a vision. The WSB region will attract the development efforts of investors from all over the world.

Vision for the WSB region toward the year 2011:

Gateway 21, ISO 2011, and WSB-World-class Quality Zone (WQZ)

The Eighth National Economic and Social Development Plan (1997-2001) indicates that the GDP of Thailand will grow by 8.0 per cent annually during the Plan period. "Thailand Vision 2020" sets an annual 7.0 per cent GDP growth rate target for the period from 2011 to 2020. Despite such relatively rapid GDP growth, the corresponding population growth rate is to average only about 1.0 per cent and 0.7 per cent for these two periods, respectively. Accordingly, "Quality" must be one of the key words in guiding development efforts in the country and region. Thailand and the WSB will have to attain their development goals with a limited population in numerical terms, with only a small population increase likely. Consequently, the WSB is envisioned to become a "World-class Quality Zone (WQZ)" in Thailand.

"Gateway 21" is proposed as a gateway toward the 21st century, incorporating the WSB's regional comparative advantage in the gateway function supported by multi-modal access to the rest of the world, including a deep sea-port at Bang Saphan in Prachuap Khirikhan province. This function will be further strengthened by development of deep sea-ports in the Southern region and at Tavoy in Myanmar.

"ISO 2011" is an abbreviation for "Integration through Segmentation and Open-ports toward the year 2011". The six WSB provinces have different characteristics, resources, and industries, and there are relatively weak linkages among them. Therefore, the individual attributes of the provinces should be integrated effectively for industrial development. In this context, segmentation of the specific attributes of each province is a precondition for integrated industrial development conducive to a higher value added or productivity with multiplier effects on development. Open-ports in the WSB region will address the globalizing economy under the Asian Free Trade Agreement (AFTA) and World Trade Organization (WTO), which will create a free trade regime in the 21st century.

Major components of the vision for the WSB

There are several components of the vision of the WSB in 2011, which are set out below:

- Transshipment hub/import processing center in line with the region's gateway function;
- Localized export base supported by the existing local resource-based industries;
- Free trade/merchandising plaza in line with the gateway function and in anticipation of the emerging free-trade regime;
- Production with world-class quality to achieve a competitive edge under a free-trade regime;
- World-class research and development (R&D) support for high-quality and competitive products;
- Industrial amenity attracting human, goods, capital, information, and other resources from the rest of the world; and
- World-class quality of life with creativity and originality supported by endowment of natural/cultural resources in the WSB region and by regional development harmonized with such resources.

This vision for industrial development in the WSB region may be deemed ambitious. The 21st century, however, will be characterized by a more information-oriented society. A wider perception of the WSB region will lessen the psychological distance between and among its people, traders, and investors. The WSB, together with the Eastern Seaboard (ESB) and Southern Seaboard (SSB), will spearhead Thailand's industrial growth well into the 21st century. To realize this vision, a set of strategies should be established and development efforts should be focused on the relevant infrastructural development.

Chapter 4 Strategy for Industrial Development in the WSB Region

4.1 *Components of the Strategy*

Integration through segmentation and open-ports toward the year 2011 (ISO 2011) will be the basic strategy for industrial development in the WSB region. Further, from a strategic perspective, certain other significant and critical factors should be taken up to promote the successful development of the WSB region. The strategy will therefore incorporate the following five elements:

1) Regional and Area Development Strategy

The regional and area development aspect of the strategy will include: (i) subregional linkages or strategic alliances with foreign countries to promote the region's gateway function, (ii) promotion of industrial spillover from the BMR, (iii) industrial core development to integrate industrial and regional development, and (iv) community-based development.

The Eighth Plan places strategic importance on the area development approach. The six provinces of the WSB region are broadly divided into three to four subregions with different characteristics and conditions for industrial development. In this context, an area development approach will be pursued to effect industrial development in the WSB region.

2) Quality and Productivity Development Strategy

The vision of a "World-class Quality Zone" within the globalizing economy will be strategically pursued through : (i) industrial modernization, (ii) intersectoral integration and inter-industry linkages, (iii) manpower development, and (iv) strengthening of R&D functions, all of which will support productivity and the manufacturing of high-quality products.

3) Subsectoral Development Strategy

The subsectoral development strategy will induce new industries with growth potential, to contribute to the diversification/strengthening of industrial structure and technology transfer, and to utilize the WSB region's regional comparative advantages. The industrial sector is

also expected to provide the basis for an integrated industrial agglomeration including "supporting industries".

4) Entrepreneurial Development Strategy

A second generation of businessmen now manage Thailand's industrial activities, while a third generation will manage them toward the end of the study horizon (i.e., 2011). Accordingly, a strategy to foster the development of this third generation should be pursued, with the focus on open and strong entrepreneurial attributes. In addition, household/cottage industries, often referred to as the "non-modern sector", should be brought into the modern sector, with formal registration, since manufacturers never upgrade their activities without improving their management systems.

5) Institutional Development Strategy

Decentralization of the Central Government, as well as devolution and deregulation, is emerging as a crucial issue in Thailand. Promotion of autonomous administrative bodies will need to be strategically programmed. Strengthening of industrial associations, cooperatives, people, and communities will be important for decentralization and deregulation. In addition, promotion of small and medium enterprises (SMEs) should be programmed with a view toward enhancing employment opportunities for farmers, community-based development, and promotion of supporting industries.

4.2 Regional and Area Development Strategy

The regional and area development strategy comprises four components as follows:

(1) Subregional linkages or strategic alliances with foreign countries to promote the region's gateway function,

- This element focuses on the linkage(s) with Myanmar, among others. Natural gas imports from Myanmar have already been contracted by PTT. In the longer term, the import of agricultural products and forest resources from Myanmar is expected to increase in line with the progress of Myanmar's open market policy. Likewise, Thai investment in Myanmar will almost certainly increase when bilateral trade is more aggressively promoted. Myanmar will be a market for the WSB's industries. In the Industrial Questionnaire Survey by the Study Team (IQS/ST), 42 per cent of the effective respondents (45 manufacturers out of 107) recognized the importance

of the emerging Myanmar market and expressed interest in developing business with Myanmar.

(2) Promotion of industrial spillover from the BMR

- Industrial investment in Ratchaburi and Petchaburi provinces has been active recently, with 40 factories located in these provinces in 1995. Such active investment may be attributable to recent improvement of Route 4. Inclusive of Kanchanaburi and Samut Songkhram, day-trip areas within around 150 km of Bangkok in these four provinces are suitable for receiving industrial spillover from the BMR. In this context, industrial estate development should be promoted in the areas that offer day-trip access to/from the BMR.

(3) Industrial core development to integrate industrial and regional development

- The Central and Lower WSB, which are 200 to 500 km from Bangkok, require a different strategy since they have no significant hinterland/market, urbanized area, or number of workers. In these areas, pinpoint area development should be strategically promoted to induce core industries such as seaport- and airport-oriented industries, which are conducive to development of the related and supporting industries. This agglomeration of industries will at the same time contribute to urbanization. The steel complex development at Bang Saphan is a good example of this strategy. Further development around Chumphon port and Pathiu airport should be promoted along with urban development.

(4) Community-based development

- In the WSB region, there is no urban core with adequate functions, partly because almost all the government and business functions have been centralized in Bangkok. Community-based development, a sort of bottom-up approach to industrialization using local/indigenous resources, is applicable to both urban and rural areas. Development of the agro-industrial community is one component of this strategy. Supported by division of work within an area, such a community would function as if it were one factory. The "one product in one village" concept in Japan provides a good example of this strategy.

- The "barn factory" program is put forward as another innovative approach for generating self-employment opportunities in rural areas where people are living in scattered locations. Such factories would produce a specific item of mechanical

parts or components on a subcontract basis with machinery provided by a consignor or procured through hire-purchase system.

4.3 *Quality and Productivity Development Strategy*

"Quality" is one of the keywords to open the door for Thailand toward sustainable growth in the 21st century. This strategy comprises the following four components:

(1) Promotion of industrial modernization

- Existing manufacturers in the WSB region recognize that their production method should be modernized. In the Industrial Questionnaire Survey by the Study Team (IQS/ST), 70 manufacturers or 53.8 per cent of the total respondents attributed the least importance to production scale/economies of scale, while 23.8 per cent indicated that they have obsolete production facilities. Thus, industrial modernization targeted toward competitiveness should be accelerated to assure industrial survival and growth.

(2) Strengthening of intersectoral integration and inter-industry linkages

- As noted in Chapter 1, the industrial structure in the WSB region is characterized by relatively few interindustry and interregional linkages, since most manufacturing is local resource-based agro-industry. In addition to agro-industrial linkages, intersectoral integration and linkages among manufacturing, trading, and tourism development should be strengthened. Such linkages would bring about multiplier effects and lead to higher productivity in the affected sectors.

(3) Strengthening of manpower development

- Manpower and human capital is essential for achieving value added. Manpower should be an "engine" driving higher productivity and quality. Skill development by the public sector should be further promoted in the WSB region, with attention paid to the quality of skill development programs, particularly curricula and methods. Some public assistance will be desirable for promotion of on-the-job-training, which is regarded as one of the most effective methods for manpower development.

(4) Strengthening of R&D functions

- It is generally accepted that exports, especially to advanced countries, should be higher in quality than products that are marketed domestically. It is encouraging

that, according to IQS/ST, there are 68 manufacturers carrying out research and development (R&D) in the WSB region and most of them export their products; their activities are concentrated on production technology and product development.

- Quality of products and productivity are supported by R&D. However, R&D activity is sometimes costly and risky. On the other hand, direct subsidies and incentives for export promotion will be phased out in accordance with WTO rules. Under such circumstances, public assistance to R&D activities will be an effective means for export promotion, with assistance such as strengthening of public institutions for R&D, incentives for R&D, and creation of R&D programs specific to the manufacturing industries in the WSB region.

4.4 Subsectoral Development Strategy

This strategy focuses on new industries as follows:

(1) Industries with growth potential including spillover from the BMR

- The growth potential of specific industries in Thailand will depend not only on demand-supply relationships and resource availability, but also on worldwide regional comparative advantages and the industrial policy of the Government. In view of these factors, industrial categories with high-growth potential are likely to include durable consumer goods including passenger cars, electric ovens, high-quality audio-visual equipment, and multi-media equipment. Consumer goods such as food products will also grow in line with changes in increasingly enhanced lifestyles and income levels. In the long term, capital goods production should be expanded in Thailand. Intermediate goods or parts/components will also grow to some significant extent. Spillover industries from the BMR will mainly comprise market-oriented industries such as food products that require the daily transport of goods, as well as industries linked with Bangkok-based industries.

(2) Industries contributing to diversification/strengthening of industrial structure and technology transfer

- The food, beverage, and tobacco industries have been dominant in Thailand, but their collective share of total manufacturing GDP has decreased from 21.3 per cent in 1989 to 17.2 per cent in 1994. Textiles and wearing apparel accounted for 21.4 per cent of total manufacturing GDP in 1989 but decreased to 17.4 per cent in 1994.

Electrical/electronic products and transport equipment have grown in recent years, with their shares of total manufacturing GDP reaching 9.3 per cent and 9.2 per cent in 1994, respectively. On the other hand, basic raw material and intermediate goods industries have remained at a relatively low level as compared to the size of Thailand's economy; for instance, paper products accounted for 1.6 per cent, chemical products for 2.4 per cent, rubber and plastic products for 3.0 per cent, basic metal products for 1.7 per cent, and fabricated metal products for 2.6 per cent of total manufacturing GDP.

- Recently, however, new petrochemicals and basic metal industries have emerged, including petrochemical complexes and steel industries at Map Ta Phut in Rayong province, and a steel complex at Bang Saphan in the WSB region. In the future, metal processing industries will grow and contribute to the strengthening of the industrial structure of Thailand. Capital goods, as noted earlier, will emerge and contribute as well. Further, supporting/linkage industry will play a significant role in diversifying and deepening the industrial structure of Thailand.

(3) Industries utilizing the WSB region's comparative advantage

Industries capitalizing on regional comparative advantage may be categorized into the following types:

- Export and import processing industries attracted to the global gateway function of the WSB region
- Seaport-oriented industry (deep-sea port at Bang Saphan, commercial ports at Bang Saphan and Chumphon)
- Airport-oriented industry (Pathiu airport in Chumphon)
- Local resource-based/oriented industries such as agro-industry, water-intensive industries in the Upper WSB region, land-intensive industry to make use of cheaper land prices, downstream gas industries in Ratchaburi, and power-intensive industries to make use of the national power supply center of the WSB region.

4.5 Entrepreneurial Development Strategy

The entrepreneurial development strategy focuses on how to foster a third generation of businessmen and industrialists with open and strong entrepreneurial characteristics.

A recent policy paper of the Ministry of Industry (MOI) has noted that "there are a few industrialists in Thailand. Most owners are traders and financialists who have different viewpoints in terms of technology from those of industrialists". This situation is closely related to increasing imports of machinery and technology.

It is expected that Thailand's third generation of businessmen and industrialists will develop original technology producing high-quality products competitive in the world market. Therefore, for example, investment in human capital is strongly urged. In order to foster such third-generation people, incubation and training functions should be developed through cooperation among universities, business schools, industrial associations such as the Chamber of Commerce and the Federation of Thai Industries, and the Government.

In this context, it is worth noting that the self-evaluation of manufacturers in the WSB region has indicated that their level of entrepreneurship is not strong. The IQS/ST found that only 6.9 per cent of the respondent manufacturers considered their entrepreneurial skills to be strong. In addition, community-based development should be promoted in the WSB region. Addressing these new circumstances, the training of manufacturers should be organized to develop entrepreneurship.

The transformation of the "non-modern sector" into the "modern sector" could be accelerated through deregulation and a reduction in overly strict factory inspections, since some manufacturers have indicated reluctance to formally register their operations, pointing to possible complications and trouble from doing so.

4.6 Institutional Development Strategy

The institutional development strategy highlights the establishment of institutional arrangements so that people in the WSB region can mobilize their ability and capabilities for industrialization of the region.

(1) Establishment of a new free trade area as an experimental project demonstrating devolution of authority to the local level.

(2) Promotion of public participation in industrial development in the WSB region through strengthening of such industrial associations as the Chamber of Commerce, the Federation of Thai industries, and cooperatives in specific subsectors.

(3) Establishment of community-based public corporations or cooperatives to manage development of agro-industries and integrated industrial clustering of small manufacturers including those engaged in producing canned/processed fruit and fish, dairy, furniture, pottery/ceramics, and ship building and repair.

(4) Promotion of small and medium enterprises (SMEs) so that they can manage themselves and have access to such services as loans; information services; technical, testing, and training services; and assistance in product/design development.

(5) Institutionalization of partnerships with public institutes, manufacturers/industrialists, community colleges, international universities, and NGOs, so as to effectively mobilize limited resources toward successful industrial development in the WSB region.

To promote institutional development, it is proposed that the Rural Industrial Development Project initiated by the Department of Industrial Promotion-MOI be fully mobilized.