Chapter 6 DEVELOPMENT PLANS BY ECONOMIC SECTOR

6.1 Agriculture

The WSB region has been mainly agricultural, with half of the regional employment generated in the agricultural sector. Agricultural development, however, faces a number of constraints, and therefore a development plan should be strategically formulated to achieve restructuring and modernization. Agricultural development is particularly important to accelerate development in the rural areas and to mitigate disparities between rural and urban incomes. (Refer to Volume 6)

6.1.1 Objectives and Strategy

(1) Present Situation

The WSB region has 1.12 million ha (or 7.03 million rail) of cultivated land, which accounts for about 26 per cent of the total land in the WSB or about 5 per cent of the total farmland in Thailand. Soils in the WSB, in general, are low in organic matter and are relatively infertile. On this farmland, about 51 per cent of total regional employment or 820,000 persons are engaged in agriculture in 1994. The value of regional agricultural production amounted to 27.2 billion Baht in 1994, which accounted for 19.3 per cent of the gross regional product (GRP). The contribution of the agricultural sector to GRP decreased from 32.3 per cent in 1981 to 25.0 per cent in 1990. The agricultural GRP, however, maintained a minimum growth rate of 1.8 per cent in 1990-1994.

Most of the farmland in the WSB region is used for cultivation of paddy (240,000 ha), field crops, e.g., sugar cane, cassava, maize, and pineapple (432,000 ha), and tree crops, e.g., coconut, mango, lemon, and guava (336,000 ha). Cultivation of vegetables is still relatively limited (32,000 ha). An increase in the agricultural production cost has been notable in recent years, including an increase in labor cost and the cost of fertilizer, agro-chemicals, and other agricultural inputs. A crop model of the regional agricultural products indicates that cultivation of wet season rice has become financially marginal.

The Government is currently implementing an agricultural restructuring program (1994-1997) with the objective to promote a shift from the traditional crop cultivation toward the production of higher value crops. Obviously, demand is increasing for non-traditional crops such as fruit and vegetables, as well as for meat and dairy products, while demand for traditional crops is stagnant. Export markets are also changing, and the trade of agricultural products is clearly heading towards a free trade regime. The agricultural restructuring program of the Government will have to be extended for some years to attain the objective of the program and to sustain growth in the agricultural sector (a growth rate of 3.0 per cent per annum is envisaged under the 8th National Plan). The development of the agricultural sector in the WSB is to be programmed in accordance with the general policies adopted by the Government, as well as in view of the potential for regional growth.

(2) Objectives of Agricultural Development

The objectives of agricultural development in the WSB region, including those relating to crop cultivation and livestock, have been established in line with the general development objectives of the WSB, as well as in light of regional constraints and the potential for agricultural development. These objectives are enumerated below.

(i) To promote higher-value crops and to raise farmers' income levels in order to narrow the disparity between rural and urban incomes;
(ii) To promote agricultural production that is less vulnerable to natural conditions and more responsive to domestic and international market conditions; and
(iii) To continue to provide job opportunities for rural people, and to preserve social values and the environment.

(3) Strategy for Agricultural Development

To attain the objectives listed above, the following strategies are proposed for the development of the agricultural sector in the WSB region:

(i) Since land and other natural resources in the WSB are almost fully exploited and regional agriculture is well diversified, further growth through expansion of the land area is difficult. Efforts should be focused on improving efficiency in the use of available resources.

(ii) Increase in agricultural production should be programmed through a shift in land use toward the cultivation of the higher value crops, as well as through improvements in crop productivity.

(iii) To improve efficiency and productivity and to cope with the ever-changing consumption patterns in the markets, further development of human resources should be promoted. Farmers should be able to respond to and take advantage of emerging market opportunities.

(iv) Farmers should strive to meet challenges in the new environment, while Government institutions should extend support to farmers including research and extension services, financial support, marketing, and assistance responding to other issues that may arise.

6.1.2 Development Targets

(1) Agricultural Land Development

Since agricultural land use in the WSB has already been well established, significant changes in agricultural land use patterns would be costly, if not technically impossible. It is therefore proposed that agricultural land use be rationalized with marginal changes. Major criteria to be applied for the rationalization of agricultural land use include the following:

(i) To increase the area planted with high value crops (upland crops, fruit, and tree crops) in conformity with land suitability;
(ii) To decrease the sugar cane area confining it to the area where the land is most suited to this crop, and to increase the area for maize to strategically promote livestock;
(iii) To decrease the paddy area but intensify its production under irrigation; and
(iv) To establish multi-story farming combining tree crops and upland crops (e.g., vegetables).

As presented in Section 3.5, the area cultivated with paddy will be decreased from 185,300 ha to around 148,500 ha, while the area for intensive upland crops will be increased to 480,300 ha. The area planned for fruit and tree crops will also be increased from 264,200 ha to 402,300 ha.

With the proposed rationalization of agricultural land use alone, crop value added would be increased by 25 per cent from the present level, representing an average growth rate of 1.3 per cent per annum over the 1994-2011 period.

(2) Agricultural Value Added

Farming practices will need to be further improved to increase crop value added and productivity in the WSB region. Through improved farming practices, an additional increase of 25-40 per cent from the present level of production would be attainable by 2011. Together with the effect of land use rationalization, which is estimated to increase by 25 per cent in 1994-2011 or 1.3 per cent per annum, the overall increase in crop production would correspond to an annual growth rate of 2.4-3.0 per cent over the 1994-2011 period.

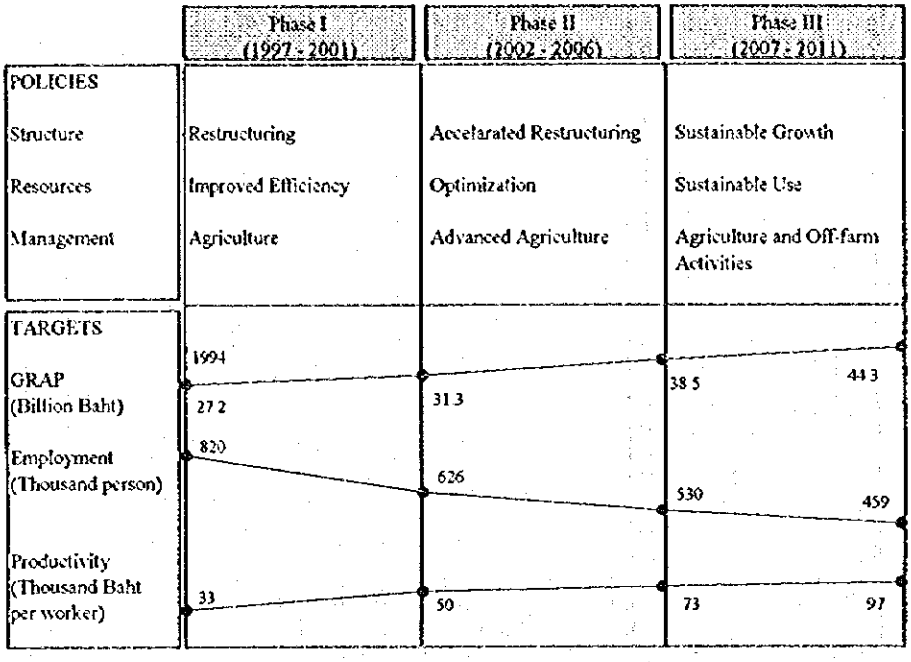
When projection of the value added in other subsectors is added to the projected crop value added, the total value added in the agricultural sector would be increased from 27.2 billion Baht in 1994 to 44.3 billion Baht in 2011 (an average annual growth rate of 2.9 per cent), as tabulated below.

Table 6.01 Projected Agricultural GRP

Subsector	Value Added (million Baht) 1994	2011	Growth Rate (% per annum)
Crops	15,444	24,931	2.9
Livestock	2,778	5,411	4.0
Fisheries	4,871	6,274	1.5
Forestry	1,063	1,259	1.0
Agricultural services	487	577	1.0
Simple agro-processing	2,569	5,888	5.0
Total	27,212	44,340	2.9

The framework and targets in the agriculture sector are illustrated in the following figure:

Framework and Targets of Agriculture

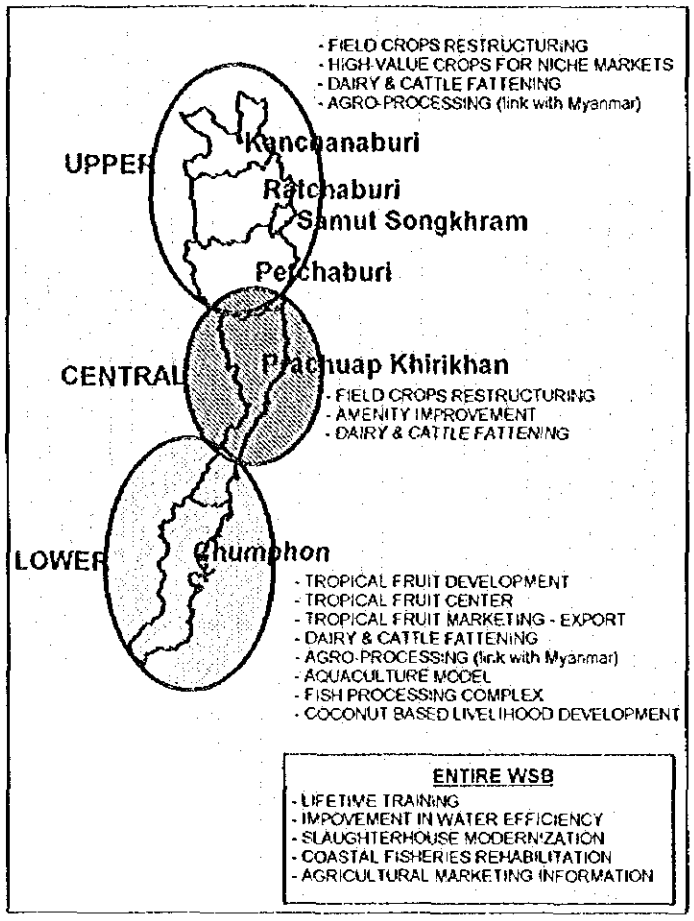


(3) Perspectives by Zone

Based on agro-climatic conditions and the current agricultural setting, agricultural development in the WSB region may be divided into three zones; i.e., the Upper, Central, and Lower WSB. In the Upper WSB, which is largely covered with the Greater Mae Klong irrigation scheme, water is available for dry-season farming. It is proposed that the area cultivated with paddy and sugar cane be decreased in accordance with the planned land use policy for the WSB. Since this zone is located relatively close to the BMA, it is proposed that cultivation of high-value crops (e.g., fruit, vegetables and cut flowers) be promoted for niche markets in the BMA and for export. Promotion of cattle fattening and dairy production should be encouraged in the Upper WSB; agro-processing should also be encouraged wherever feasible in the Upper WSB.

In the Central WSB, production of pineapple, sugar cane, and coconut is concentrated at present. This zone has less fertile soils and therefore agricultural potential is rather limited. Since the yield of sugar cane in this zone is low and decreasing, it is not recommended to continue sugar cane cultivation in the non-irrigated areas. On irrigated land, the production of high-quality fruit and vegetables should be encouraged and the production of pineapple planned to continue at around the present level. Dairy cattle raising should be promoted further to fully utilize pineapple waste and other by-products readily available in the area.

In the Lower WSB, a high share of agricultural land is used for fruit and tree crops (e.g., 77 per cent in Chumphon province). This zone will continue to be the base of commercial plantation of coconut, palm oil, rubber, and various tropical fruit trees. Increased production and exports of tropical fruit should be encouraged in the Lower WSB through expansion of the cropped area and improvements in quality. Restructuring of coconut plantation with replanting and inter-cropping should also be programmed. Since cattle raising for meat and dairy is a promising activity in this zone, it is proposed that livestock production be further promoted in the Lower WSB.



6.1.3 Recommended Measures

To attain the regional development target in the agricultural sector, it is recommended that the following programs be implemented:

- A *crop restructuring program* is recommended particularly in the areas currently cultivated with paddy (Upper WSB) and sugar cane (Upper and Central WSB). The rice and sugar production area is to be reduced gradually and shifted into the cultivation of higher value crops such as vegetables and fruit, and the production of livestock and dairy products (Project AG1).

- To promote a shift into the cultivation of higher value crops, it is recommended that a *pilot project for intensified agricultural production for niche markets* be implemented. It is proposed that a pilot site be selected in the Upper WSB, where

the Greater Mae Klong irrigation scheme extends. In addition, the pilot project may facilitate rural development by exploitation of emerging economic opportunities (Project AG2).

- An *export-oriented tropical fruit improvement program* is recommended particularly in the Lower WSB. Quality improvement in production and marketing, as well as expansion of the area for fruit cultivation, should be promoted under the program. The program also envisages promotion of agro-processing of the products (Project AG3).

- To promote the tropical fruit improvement program, it is recommended to set up a *tropical fruit research and dissemination center* in the Lower WSB (Chumphon province). The center will be planned not only for improvement of fruit cultivation in the WSB and other regions of Thailand, but also for promotion of subregional cooperation with neighboring countries (Project AG4).

- A *cattle fattening program* is recommended in the Upper and Lower WSB, considering that about half a million head of cattle is brought into these areas at present. Agricultural by-products for animal feed are available in these zones. The program will be implemented to supplement and raise farm incomes and to increase meat supply for the BMA market (Project AG5).

- A *dairy production promotion program* is proposed in the Upper and Central WSB, considering that the increasing domestic demand for this product is not satisfied by domestic output. Nongpho Dairy Cooperative in Ratchaburi is an example of the proposed program; it is recommended to further promote the dairy production program through dissemination of technology (Project AG6).

- A *slaughterhouse modernization program* is to be implemented because the existing slaughterhouses in the region are too old and in poor hygienic condition. The program should include not only the construction of modern slaughterhouses, but also institutional improvement (e.g., laws, regulations, and tax incentives) (Project AG7).

- An *agro-processing promotion program* is recommended for implementation, in line with the promotion of crop restructuring. Agro-processing of fruit and vegetables is promising, and it should be promoted further in the Upper and Lower WSB. In the

longer term, the WSB region is a potential area to receive an additional supply of products for processing from the Myanmar side of the isthmus (Project AG8).

- A *water application efficiency promotion program* is recommended, because water in the Upper WSB is not efficiently utilized in the irrigable areas and water in the Central WSB (Western Coast river basins) is insufficient for agricultural use. With the shift in cropping patterns, the new methods of irrigation will become particularly significant (Project AG9).

- A *coconut-based livelihood development program* is recommended for implementation particularly in the Central and Lower WSB. Old plantations of this crop need to be replaced with young and better varieties, and coconut wood should be processed for furniture. Promotion of livestock raising under coconut trees is another program to be implemented (Project AG10).

- An *agricultural marketing information improvement program* is recommended in order to upgrade the existing agricultural information system and to increase farmgate prices for farmers. Many isolated farmers in the WSB lack market information and prices are set by middlemen (Project AG11). Improvement of the marketing information system is proposed jointly with development of the telecommunication system (Project TL 3).

- A *program for farmers' lifetime training* is proposed considering that agricultural production is shifting into products of higher value but smaller in production quantities and that cropping patterns are always changing. Practical knowledge should be extended continuously to farmers through formal and non-formal education (Project AG12). It is encouraging that the Rajabhat Institute, Petchaburi has recently initiated some courses designated for the public in the region.

Further details of the recommended projects/programs, as well as the results of agriculture sector studies, are presented in Volume 6.

6.2 Fisheries

Although the development targets of the fisheries subsector are incorporated in the agriculture sector, the development strategy for the fisheries subsector is separately discussed as the development of small-scale coastal fisheries is particularly important for

socially-oriented development in the WSB region. (Refer to Volume 6, Chapter 2)

6.2.1 Objectives of Fisheries Development

(1) Present Situation

The fisheries subsector, though its contribution to the Thai economy is relatively small at 1.7 per cent of national GDP and 16.5 per cent of agricultural GDP (1994), is of particular significance to the development of the WSB since the region has a long coastline to the east on the Gulf of Thailand. In 1993, total marine fish production in the WSB region was 164,000 tons, or 6.0 per cent of national production.

Production of marine fisheries in Thailand increased from 2.34 million tons in 1988 to 3.39 million tons in 1993, with the increase due partly to catches in zones other than the exclusive economic zone of Thailand. Because of difficulties in continuing catches in such zones under the UN Law of the Sea Convention, Thailand's fish production has drastically declined since 1994; however, it is still far above the marine sustainable yield (MSY) in the Gulf of Thailand, which is estimated in the range of 700,000 to 800,000 tons a year. Destructive effects of uncontrolled fisheries are now emerging, and catch rates have been drastically reduced in the Gulf. For reference, catch rates of demersal fish by trawlers fell from 254 kg/h in 1962 to 170 kg/h in 1966, 40 kg/h in 1982, and as low as 20 kg/h in 1989.

The WSB region had 2,860 registered fishing boats in 1992, representing a decrease from 3,973 in 1989. This decline follows the national trend. The number of fishing boats in the WSB is still excessive if compared with the recent decline in production and the estimated MSY in the Gulf. Another serious problem of fisheries in the Gulf is trawl fishing. The fisheries in the WSB region are seriously affected by the uncontrolled trawl fishery along the coastline, where small-scale fisheries are scattered over a number of coastal communities. Further, small-scale fisheries are not protected because of the lack of an adequate legal framework of fishing rights in Thailand.

Coastal shrimp aquaculture had been widely developed in the WSB, particularly in Samut Songkhram and Petchaburi provinces, until the early 1980s when the first crisis came and a huge area of shrimp ponds was abandoned due to environmental deterioration. Shrimp aquaculture was thrown into a second crisis more recently when viral diseases inflicted serious damage. After the crisis, shrimp fields were abandoned in Samut Songkhram and Petchaburi provinces, and moved south to Prachuap Khirikhan

and Chumphon provinces. Production of black tiger shrimp in the WSB region accounted for about 7-8 percent of the total national production (168,000 tons) in 1993. In the WSB, it is no longer permissible to raise shrimp production by further destroying mangroves along the coastline.

(2) Objectives of Fisheries Development

The objectives of the development of fisheries in the WSB, including commercial fisheries, small-scale coastal fisheries, coastal shrimp aquaculture, and fresh water aquaculture, have been established in line with the general WSB regional development objectives, as follows:

(i) To revitalize coastal fisheries to provide stable and sustainable livelihood opportunities for small fisherfolk through rehabilitation of coastal fisheries resources;
(ii) To establish/expand new opportunities such as non-traditional aquaculture, sustainable shrimp farming, and a fish processing complex; and
(iii) To promote the sound management of fishery and coastal resources for sustainable use.

6.2.2 Recommended Measures

In view of the current situation of and constraints on fisheries development in the WSB, as well as in line with the objectives set out to attain sustainable development in the fisheries sector, the following measures and strategies for commercial fisheries, small-scale fisheries, aquaculture, and fish processing are recommended:

- Since overfishing in the Gulf of Thailand is indisputably evident and fishing in foreign waters has become difficult, it is recommended that fishing be reduced in Thai waters by extending curbs on the operations of trawlers. Learning from the lessons of other countries in controlling fishing by trawlers, effective control of commercial fisheries should be undertaken, supported by strong political will.

- Rehabilitation of coastal resources for small-scale fisheries is an urgent economic and social issue in order to alleviate rural poverty and preserve the environment. In this context, the WSB region is in a position to spearhead a model project in which appropriate technology (e.g., artificial reefs), small-scale infrastructure (e.g., small

jetties and hatcheries), and new social systems (e.g., marine parks, territorial fishing rights) would be demonstrated in a combined form (Project AF1).

- In the aquaculture subsector, it is no longer permissible to raise shrimp production by further destroying mangroves. It is therefore recommended that a project be initiated in the WSB to disseminate environmentally sustainable aquaculture practices. Specifically, farmers should improve their water management with a closed farm system supported by sea water pumping, and the authorities concerned should implement strict and regular control of hatcheries (Project AF2).

- The fish processing industry is now confronted with serious constraints due to shortages in raw materials and labor in the Upper WSB. It is recommended, in this context, that a detailed study be conducted on the establishment of a fish processing complex in Chumphon province, accommodating both modern and traditional processors in the Lower WSB (Project AF3).

Further details of the recommended projects/programs, as well as the results of fisheries sector studies, are presented in Volume 6, Chapter 2.

6.3 Industry

Under the development scenario proposed for the WSB region, the industrial sector is expected to become a driving force for the region's economic development. Perspectives for industrial development are discussed to verify if the development scenario is attainable and how it should be attained. (Refer to Volume 7)

6.3.1 Objectives and Strategy

(1) Present Situation

The development of the industrial sector in this Study is primarily discussed with respect to the manufacturing sector, which accounted for 23.3 per cent of GRP in 1994. Though the recent development of the WSB's manufacturing sector has been notable, the sector's contribution to GRP is still lower than the national average (28.2 per cent). The most notable recent development in the region's manufacturing sector has been the construction of a large steel complex at Bang Saphan, which will increase regional value

added by about 7 billion Baht in 1997. Also a gradual spillover of manufacturing industries from the BMA has been observed in the Upper WSB.

Although the WSB region has potential for the development of its manufacturing sector, there are still a number of constraints. Physical constraints are mainly infrastructure-related, i.e., the high cost of electricity, water, and transport. WSB enterprises have indicated that major constraints in production are the high cost and unstable supply of raw materials, the low level of supporting industries, and the limited demand in domestic markets. Increased labor cost is also a prime concern of most enterprises in the WSB. The limited agglomeration of existing industry in the region, a lack of linkage among industries, and a lack of research and development activities are also constraints that prevent accelerated industrial development in the WSB region. The Upper WSB (Kanchanaburi, Ratchaburi, and Samut Songkhram) is categorized as Zone 2 in the BOI's incentive zoning scheme, while the Central and Lower WSB are more distant from the BMA than several other provinces in Zone 3. Further, local administrations have been less competent in industrial development and planning.

(2) Objectives of Industrial Development

In view of the need to address the region's constraints in industrial operations and the basic objectives for the development of the WSB region as a whole, the overall objectives of the industrial development in the WSB region have been set out as follows:

(i) To contribute to regionally balanced development of the Kingdom, by mobilizing the WSB region's potential and comparative advantages to the fullest extent;
(ii) To establish a firm foundation for the sustainable growth of existing industries, in harmony with the natural environment and amenities;
(iii) To attract new industries to diversify the industrial structure of the region and the country as a whole; and
(iv) To improve infrastructure, both software and hardware, in order to strengthen industrial competitiveness.

(3) Strategy for Industrial Development

The industrial sector is expected to be a driving force for the development of the WSB region. To attain the objectives noted above and to accelerate industrial development in the region, several strategies are proposed as outlined below.

(i) Regional and area development strategies are proposed, including creation of linkages, promotion of industrial spillover from the BMA, promotion of an industrial core to integrate industrial and regional development, and promotion of community-based industrialization.

(ii) Quality and productivity development strategies are proposed to strategically promote industrial modernization, intersectoral integration, interindustry linkages, manpower development, and R&D strengthening.

(iii) Subsectoral development strategies are proposed to promote industries with high growth potential and industries that utilize the region's competitive advantages.

(iv) Entrepreneurial development strategies are proposed particularly for enhancement of the entrepreneurship capability of a third generation of managerial leadership.

(v) Institutional development strategies are proposed for promotion of decentralization, devolution, and deregulation.

6.3.2 Development Targets

(1) Manufacturing Value Added

As discussed in Section 3.2, a macroeconomic scenario has been set for Moderate Development, in which the region's industrial sector has been forecast to grow at an average annual rate of 11.2 per cent between 1995 and 2011. The industrial sector, under this scenario, includes manufacturing, mining and quarrying, construction, and electricity and water supply. The manufacturing sector is expected to grow at a higher rate than the average growth rate for the industrial sector.

Based on the assessment of the growth potential of the existing manufacturing industries in the region, and based on the strategies proposed for development of the manufacturing subsector, the growth of manufacturing in the WSB has been projected to set a target for the development of the manufacturing subsector in the region. Inclusive of the value added of the new steel complex in Bang Saphan, the value added in

the manufacturing subsector in the WSB region has been projected by industrial category, as tabulated below.

Table 6.02 Value Added in Manufacturing

(Million Baht; %)

Industrial Classification	1994	2011			Growth Rate	
		Existing	New	Total	Existing	Total
31. Food, beverage, tobacco	14,837	34,007	22,592	56,599	5.0	8.2
32. Textile, apparel, leather	3,509	10,210	5,287	15,497	6.5	9.1
33. Wood, wood products	735	1,386	2,594	3,980	3.8	10.4
34. Paper, printing, publishing	5,692	16,663	3,078	19,741	6.5	7.6
35. Chemicals, rubber, plastic	988	4,703	5,574	10,277	9.6	14.8
36. Non-metallic	2,923	9,232	5,419	14,651	7.0	9.9
37. Basic metal	279	3,000	44,816	47,816	15.0	35.3
38. Fabricated metal, machinery	361	1,117	26,983	28,100	6.9	29.2
39. Others	3,123	8,014	3,860	11,874	5.7	8.2
Total	32,451	88,332	120,203	208,535	6.1	11.6

As shown in the table, the gross provincial manufacturing product (GPMP) in the WSB is forecast to grow at an average rate of 11.6 per cent per annum, or from 32.5 billion Baht in 1994 to 208.5 billion Baht in 2011 (in 1994 prices). It is further estimated that the additional demand for land for factory use would be around 2,000 hectares by that time. It is expected that value added in the manufacturing subsector would account for about 70 per cent of value added in the industrial sector.

Through a relatively high growth rate in the manufacturing subsector, the industrial structure in the WSB will be transformed to a structure with strong interindustrial and intersectoral linkages, as can be expected for example in the case of basic metal industry linked with machinery and equipment industries.

(2) Employment and Productivity

Based on projected value added in the manufacturing subsector, and based on the projection of employment in the industrial sector, employment and value added per worker in the WSB region has been estimated as tabulated below.

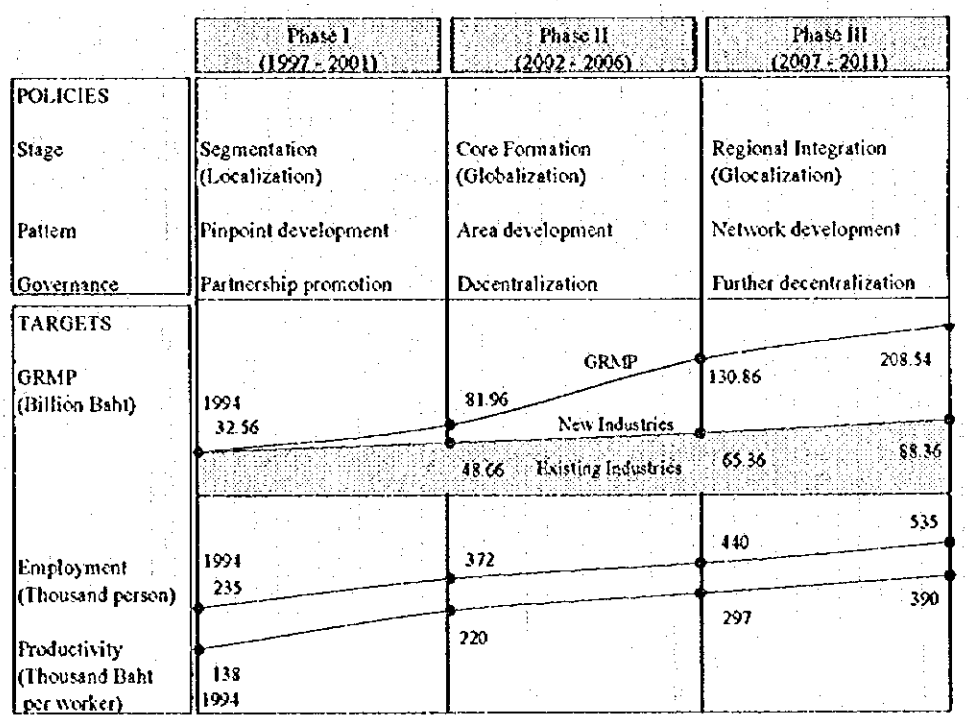
Table 6.03 Employment /Productivity in Manufacturing

(Value/worker: Thousand Baht per worker)

Industrial Classification	Employment		GPMP/Worker		Growth Rate/year	
	1994	2011	1994	2011	Employment	Value
31. Food, beverage, tobacco	152,692	268,095	97.2	211.1	3.4%	4.7%
32. Textiles, apparel, leather	12,324	30,070	284.7	515.4	5.4%	3.6%
33. Wood, wood producets	10,301	26,375	71.4	150.9	5.7%	4.5%
34. Paper, printing, publishing	3,005	13,119	1,894.2	1,504.8	9.1%	-1.3%
35. Chemicals, rubber, plastics	10,766	37,691	91.8	272.7	7.6%	6.6%
36. Non-metallic products	14,116	37,177	207.1	394.1	5.9%	3.9%
37. Basic metal products	729	19,625	382.7	2,436.5	21.4%	11.5%
38. Fabricated metal, machinery	11,891	67,630	30.4	415.5	10.8%	16.6%
39. others	11,891	67,630	30.4	415.5	10.8%	16.6%
Total	234,794	535,110	138.2	389.7	5.0%	6.3%

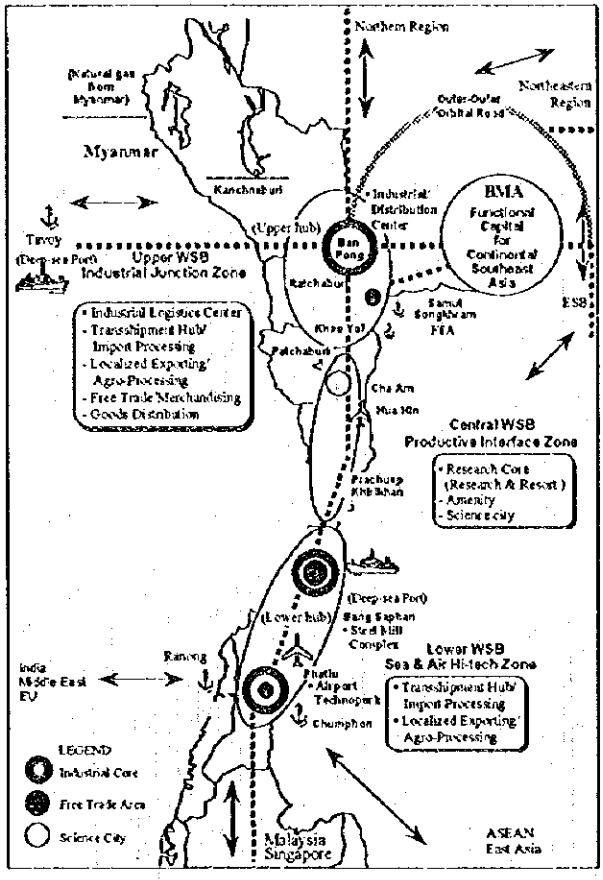
As shown in the table, the total employment in the region's manufacturing subsector is forecast to reach about 551,000 workers, or 69 per cent of total industrial sector employment (802,000) in 2011. The value added per worker is expected to grow from 138,000 Baht in 1994 to around 380,000 Baht in 2011, with an average growth rate of 6.1 per cent per annum. Judging from the above assessment of employment, value added, and productivity in the manufacturing subsector, the Moderate Development Scenario proposed in Section 3.2 may be considered attainable and a reasonable framework on which to base regional planning.

Framework and Targets of Manufacturing Sector



(3) Perspectives by Zone

The formation and integration of industrial cores is a basic strategy of industrial as well as spatial development in the WSB. In this context, the Upper WSB is characterized as an "industrial junction zone" with an industrial logistics center linking the WSB with other regions and subregions. It will receive industrial spillover from the BMA and will serve as an import processing area through linkages with Myanmar.



The Lower WSB is characterized as a "sea and air high-tech zone", with two industrial cores; one in Bang Saphan with the deepest seaport in Thailand and the other at Chumphon with the newly constructed Pathiu airport. The combined availability of sea and air transport will attract investments in high-tech areas; for example, the steel complex under development at Bang Saphan will apply state-of-the-art technology in production.

The Central WSB, which is designated as an amenity zone under the spatial development plan, is characterized as an "productive interface zone" in which knowledge-based industries, including information technology, will be promoted. The proposed Science City is expected to integrate industrial production and relevant research and development activities which will induce greater industrial productivity in the WSB.

6.3.3 Recommended Measures

Industrial development is mostly undertaken by private initiative, while the Government's role is mainly confined to implementing measures to facilitate and encourage private investment. In addition to supporting infrastructure, some useful

measures and programs may be taken up by the public sector or by a public-private partnership. These recommended measures include the following:

- The WSB region should grow and sustain itself in the globalizing economy in which competition for investment is intensified. To attract sizable investments before the AFTA and WTO agreements come into full force, it is recommended that three free trade areas (FTAs) be developed in the WSB; one in and around the Bang Saphan port and industrial complex, another in Samut Songkhram province, and the third near Pathiu airport in Chumphon province. The proposed FTAs will trigger and spearhead the development of the WSB region, thereby accelerating decentralization through autonomous management and operation body (Project ID1).

- Industrialization and urbanization in the WSB region should be synchronized. It is therefore recommended to develop an industrial/distribution center in Ban Pong in order to accommodate, in particular, the small and medium enterprises in urban areas with the objective to enhance the business environment and quality of life (Project ID2).

- Agro-industrialization is one of the focal points for the development of rural areas. Since the WSB regional plan should promote rural development, it is recommended to further promote the rural industrial development programs initiated by the Ministry of Industry. At the same time, it is recommended to materialize a "one product - one village" program and a "barn factory" program in the WSB region (Project ID3).

- The quality and productivity of manufacturers in the WSB should be enhanced to increase competitiveness and to attain sustainable growth. In this context, modernization in specific industrial subsectors is essential. Further, it is recommended that manpower development be programmed so as to upgrade skills and to cope with the advanced needs and markets (Project ID4).

- In the same context, it is recommended that R&D activities be supported by establishing a regional R&D and testing center. An integrated incubation system will also be important to foster the entrepreneurial qualities of a third generation of Thai industrialists. In addition, it is recommended to guide technology development in the WSB by organizing local manufacturers, as well as R&D staff in universities, colleges, and public institutes to form a consortium (Project ID4).

- Investment in the manufacturing sector should be further accelerated by means of promotional activities and incentives specific to the region. In this context, it is recommended that a development consortium be formed to promote industrial investment along with the Kanchanaburi-Tavoy (Dawei) corridor. It is also recommended that resource recycling industries be promoted to create a high-quality environment (Project ID5).

Further details of the recommended projects/programs, as well as the results of industrial sector studies, are presented in Volume 7.

6.4 Tourism

Tourism is the most notable subsector of the WSB's service sector, as several tourism centers are currently located in the WSB region and millions of tourists are visiting the WSB. Perspectives for tourism development are discussed to show how tourism development can be incorporated in the overall social and economic development of the WSB region. (Refer to Volume 8)

6.4.1 Objectives and Strategy

(1) Present Situation

The WSB region has a number of tourism centers and spots; the most well known centers are the Cha Am - Hua Hin and Kanchanaburi areas. In 1994, about 2.2 million Thai tourists and 472,000 foreign tourists visited the tourism centers/spots in the WSB. The number of visitors (tourists and day-trip excursionists) to the WSB is highly variable year by year, and their stay is shorter than at other tourism centers in Thailand. For instance, the average length of stay was 2.1 days in Cha Am and Kanchanaburi in 1994, and the hotel occupancy rate in Kanchanaburi was only 38 per cent. The quality of tourism facilities in the WSB is relatively low and unattractive for both Thai and foreign visitors, except for the facilities in Cha Am and Hua Hin. Since some environmental degradation is already apparent in certain tourism areas, it is necessary to implement measures to remedy past damage and prevent future degradation.

(2) Objectives of Tourism Development

The tourism development objectives for the WSB, established to support the general objectives for development of the WSB region, are enumerated below.

(i) To contribute to the preservation of a natural atmosphere and environment for the region while selectively promoting tourism development;
(ii) To improve rural and urban amenities through development of tourism in specific areas;
(iii) To provide sources of income for local people related directly and indirectly to the tourism activities; and
(iv) To promote participation in regional development and communication with international society.

(3) Strategy for Tourism Development

The WSB region has resort centers in Cha Am and Hua Hin. By reviewing the past and future development in these centers, as well as at other tourism spots and resources in the region, a number of strategies for tourism development have been formulated for the WSB, as follows:

(i) Tourism development in the WSB will be strategically promoted by differentiating the region from other resort areas, particularly for family groups, small groups of friends, and conference tourism;

(ii) Since nature and society will become tourism products in the WSB, coexistence with regional society will be enhanced, without excessive concentration around one stop or center;

(iii) Linkages with other tourism centers will be promoted, including linkages with the BMA in the short term and linkages with Myanmar in the longer term;

(iv) Tourism facilities, such as hotels, convention centers, and restaurants will have to be upgraded in tourism and resort centers other than the Cha Am and Hua Hin area; and

(v) Improvement in tourism infrastructure, particularly roads to network tourism centers and spots and sewerage treatment facilities, and development of human resources will be further promoted in the WSB region.

6.4.2 Development Targets

(1) Projected Number of Tourists to the WSB Region

On the basis of past trends and considering the relationship between tourism and GDP growth, the number of international and local tourists visiting the WSB region have been projected as summarized below.

Table 6.04 Projected Tourists to WSB

	1994	2001	2006	2011
Number of tourists to Thailand (1,000s)	6,166	10,529	13,695	17,479
Share of tourists to WSB (%)	7.7	8.0	8.0	8.0
Foreign tourists to WSB (1,000s)	472	840	1,100	1,400
Thai tourists to WSB	2,192	2,700	3,230	3,950
Total tourists to WSB	2,664	3,540	4,330	5,350

(2) Number of Visitors to Respective Tourism Zones

The projected number of visitors to the WSB region in 2011 is expected to be distributed among the major tourism zones as summarized below.

Table 6.05 Projected Visitors in 2011

(Thousand)

	Upper WSB (Kanchanaburi, Ratchaburi, S.Songkharm)	Central WSB (Petchaburi, P.Khirikhan)	Lower WSB (Chumphon)	Total WSB
Tourists:				
Thai	1,850	1,650	450	3,950
Foreign	400	850	150	1,400
Total	2,250	2,500	600	5,350
Excursionists:				
Thai	1,250	600	50	1,900
Foreign	250	250	-	500
Total	1,500	850	50	2,400
Total:				
Thai	3,100	2,250	500	5,850
Foreign	650	1,100	150	1,900
Total	3,750	3,350	650	7,750

As shown in the above projections, it is expected that a total of 7.7 million tourists will visit the tourism zones in the WSB region in 2011, with about 75 per cent of all visitors to the WSB likely to be Thai nationals.

6.4.3 Recommended Measures

The Tourism Authority of Thailand (TAT) under contract to Chulalongkorn University has recently prepared a master plan for tourism development in the WSB, identifying the potential tourism spots of the region. Also, a master plan for tourism development in the Cha Am - Hua Hin area was prepared by JICA in 1992. Basically, it is recommended that these master plans be followed in developing the tourism sector in the WSB. It is further recommended that the following measures be taken to achieve regional development objectives and to attain the sectoral targets noted above:

- Since the tourism centers and spots in the WSB are widely distributed, it is desirable that a zone-wise development program be formulated and promoted, rather than development by province. It is proposed that a Kanchanaburi/Ratchaburi zone and the Samut Songkhram zone be designated in the Upper WSB, a Petchaburi/Prachuap Khirikhan zone in the Central WSB, and a Chumphon zone in the Lower WSB. It is recommended that the zone-wise development plan to be executed under the 8th Plan be compiled, together with an action program (Project TO1).

- For development of the Petchaburi/Prachuap Khirikhan zone, it is recommended that actions be taken to follow up the programs and recommendations of the 1992 JICA study, which focused on the Cha Am - Hua Hin area.

- For Kanchanaburi zone development, a preliminary study has been made as presented in Volume 8, Appendix II. Since the Kanchanaburi zone is full of natural attractions, the development of eco-tourism in this zone is recommended. Improvement of tourism facilities and amenities, with a total investment of about $44 million in 1997-2011, is called for in the Kanchanaburi tourism promotion program.

- It is desirable that tourism development contribute to human-centered development in the WSB. In this context, it is recommended that a natural science museum plan contemplated by the Royal Forestry Department be invited to locate in the

Kanchanaburi zone. It is also recommended that EGAT and RID set up an exhibition center at the Khao Laem or Srinakarindra damsite to show how these water resources projects have been developed and are benefitting the country.

- To promote human-centered development in the tourism sector, it is also recommended that the educational and vocational training institutes in the WSB region be strengthened further. Appropriate measures should be taken to reinforce teaching/training staff in these institutes.

- The coastal zone from the estuary of the Petchaburi river extending to Cha Am, Hua Hin, Kui Buri, and to the south of Prachuap Khirikhan is recommended to be preserved as a coastal amenity zone. For amenity preservation, it is proposed to improve sewerage systems and other social infrastructure in urban centers along the coast and to protect beach erosion, as recommended by the 1992 JICA study. Preservation of urban amenities is also recommended (Project TO2).

- It is recommended that tourism-related infrastructure in the WSB be further improved, including road network and navigation routes to facilitate access to tourism areas and to diversify tourism routes. In the longer term, further development will be required to integrate tourism development on the Myanmar side with tourism in the WSB (Project TO3).

- Hotel accommodations in the WSB region are relatively of low grade except in the Cha Am - Hua Hin area, and more than 10,000 additional high- and medium-class rooms will be required by 2011. It is recommended that incentives (e.g. accelerated depreciation) be granted to induce the private sector to make the required investment in upgraded hotel accommodations and facilities (Project TO4).

- While TAT has been actively promoting tourism information services, localized information services should be further promoted. To this end, it is recommended that a "tourism promotion council" be set up in each tourism development zone, with participation of local people (Project TO5).

Further details of the recommended projects/programs, as well as the results of tourism sector studies, are presented in Volume 8.

Chapter 7 DEVELOPMENT PLAN FOR RESOURCES AND INFRASTRUCTURE

7.1 Resources Management and the Environment

Land, water, and forest resources are vulnerable to economic development, and therefore they should be carefully managed to protect the regional environment. Strategies and measures for resources management and the environment are proposed to realize environment-friendly development in the WSB region. (Refer to Volume 9, Chapter 1)

7.1.1 Objectives and Strategy

(1) Present Situation

The baseline situation with respect to the land, forest, and water environment in the WSB region, as well as environmental quality improvements, is characterized by the following facts: (i) soil degradation is in process due to widely practiced mono-cropping with excessive use of chemical fertilizers, with problematic soil of low fertility especially in the Central WSB; (ii) water quality has been degrading due to the discharge of untreated wastewater, affecting tourism and other coastal activities; (iii) the area of virgin forests near the border with Myanmar has been decreasing, and deforestation of mangrove areas has been notable in recent years; (iv) rapidly increasing volume of solid waste and continuing use of open dumping are posing a threat to the sanitary conditions of people in the WSB; and (v) limited environmental advocacy is hindering the adoption of appropriate natural resources management and environmental quality improvements in the region.

(2) Objectives for Resources Management and Environmental Quality Improvements

In view of the current situation of resources management and the environment in the WSB region and with reference to the WSB regional development objectives (Section 2.5), the objectives for resources management and environmental quality improvements in the region are proposed as follows:

(i) To protect and improve the quality of environment and ecosystems as inherited assets of people and the base for tourism and other non-consumptive resource use activities;

(ii) To expand and enhance resource capacity through the restoration of degraded land, water, and forestry resources to support various economic activities on a sustainable basis; and

(iii) To develop consciousness of environmental quality through public participation in reduction of solid waste volume, soil-improving and water-saving activities, as well as through education and advocacy.

(3) Strategy for Environmental Management

To attain the objectives proposed above, the following strategies are elaborated for resources management and conservation in the WSB region:

(i) Soil conservation and management should be promoted widely in the WSB region. Particular attention should be paid to the areas in lower Petchaburi and upper Prachuap Khirikhan provinces where soil degradation is notable.

(ii) The forests in watershed classification and conservation area and the coastal mangrove areas should be protected, and reforestation promoted for watershed management and for the management of coastal ecosystems.

(iii) Water quality in the major river systems in the WSB should be improved though implementation of waste water treatment at major urban centers along the river systems.

(iv) Unsanitary open dumps for solid waste disposal should be replaced by sanitary landfills in major municipalities in the region. Further, installation of a composting plant in the "amenity zone" in the Central WSB should be studied for early implementation.

(v) To promote consciousness of environmental quality, promotional activities should be conducted through formal and non-formal education, mass media, and communications with NGOs.

7.1.2 Recommended Measures

The following resources management and environmental quality improvements are recommended in the WSB region:

- Excessive use of chemical fertilizers and pesticides has reduced soil productivity and increased the potential risks of residue accumulation. To improve the soil productivity and to reduce risks associated with the use of chemical substances, it is recommended to promote organic farming for environment-friendly agriculture. The markets for organically grown products have been increasing for domestic consumption and export (Project EV1).

- For more effective protection of existing forests, it is recommended that: (i) logging in the rainy season be banned; (ii) permitted logging be supervised to reduce damage and encourage rapid regeneration; (iii) land be restored by grading and reseeding of disturbed areas; and (iv) protected forest areas be well-protected from illegal encroachment. For erosion control, it is recommended to promote tree replanting as it is practiced in Petchaburi and other provinces. It should be noted that watershed management in river basin areas in the WSB, particularly in the Petchaburi river basin, has been greatly enhanced by reforestation. Reforestation in the catchment area provides various beneficial effects on the watershed management. It is also recommended that the existing mangrove reforestation program be continued in Samut Songkhram, Prachuap Khirikhan, and Chumphon provinces (Project EV2).

- Since a major cause of water quality degradation is domestic waste water discharged into bodies of water, the construction of new waste water treatment systems in major municipalities is recommended (Project EV3). Priority should be accorded to the urban centers of Kanchanaburi, Ratchaburi, and Samut Songkhram, effluents from which are causing deterioration in the water quality of the Mae Klong river. Project implementation should take into account the OEPP's ongoing Provincial Environmental Action Plan that focuses on domestic waste water treatment and solid waste management. For industrial waste water treatment, it is desirable that new industrial establishments be located in industrial estates/parks, and that the relocation of small- and medium-scale polluting industries be promoted with financial assistance.

- To improve sanitary conditions and reduce waste volume, it is recommended that densely populated municipalities in the WSB be equipped with sanitary landfill systems to avoid the unnecessary sanitation and health risks associated with poor solid waste management (Project EV4). Composting, a waste-recycling technique with many beneficial effects, is recommended in the municipalities of the Central WSB; it is also beneficial for production of a nutrient-rich, stable product useful for reclaiming land, improving soil, and/or animal fodder. Again, project implementation should be considered in line with the Provincial Environmental Action Plan that has a main function of fund allocation for the feasible solid waste management projects.

- Industrial hazardous waste has become a subject of concern in the WSB, and it is recommended that concentrations of hazardous waste, particularly heavy metals, be carefully monitored in the region. It is also recommended that industrial plants potentially generating hazardous waste be located in industrial estates/parks and that their waste be properly treated therein to prevent unnecessary environmental problems. (The industrial development plan in the Bang Saphan area proposes to set up a hazardous waste disposal plant in this area.)

- It is not recommended that a large industrial complex be set up in the amenity zone in the Central WSB. Installation of a power plant in this zone is not recommended, unless its environmental impacts are assessed to be negligible by an independent third party. If a coal-fired power plant is developed in the Lower WSB, its residual ash should be used for the composition of concrete blocks for artificial reefs in the coastal fisheries rehabilitation project.

- Effective environmental improvements will only be attainable with the understanding and support of local inhabitants. To enhance public environmental awareness, it is recommended that an environmental research and training center be established in the region (Project EV5). The proposed center would have the functions of: (i) environmental monitoring supported by measurement instruments; (ii) research base for development of challenging new approaches for soil improvement; and (iii) environmental education in the fields of waste management, natural resources conservation, and environmental aesthetics.

- Where appropriate, direct NGO involvement in enhancement of the environmental awareness is to be encouraged. NGOs can be effective in providing local information, assisting in the understanding on the environment for local inhabitants.

Some good examples include the posting of informative materials prepared by NGOs at public gathering places.

Further details of recommended projects, as well as the results of the sector review on resources management and the environment, are presented in Volume 9, Chapter 1.

7.2 *Water Resources*

Water resources are unevenly distributed in the WSB region. Efficient use of water resources, including transbasin water supply to areas with insufficient water resources, is one of the key factors for the development of infrastructure in the WSB region. (Refer to Volume 9, Chapter 2)

7.2.1 Objectives and Strategy

(1) Present Situation

The WSB region is geographically a narrow stretch of land between the Gulf of Thailand and mountain ranges of 500-1,000 m in elevation forming part of the Thai border with Myanmar. From the water resources point of view, the WSB is divided into four subdivisions: (i) the Mae Klong river basin (30,800 km^2, of which 15,500 km^2 are located in the Study area); (ii) the Petchaburi river basin (5,603 km^2); (iii) the Western Coast river basins of 7,100 km^2 composed of various small river basins; and (iv) the Southeastern Coast river basins of 6,700 km^2 composed of three sub-basins.

Development of the Mae Klong river basin has been fairly advanced; a large dam/reservoir (Khao Laen and Srinakarindra), a regulator (Tha Thung), and a diversion weir (Vijaralongkorn) have been constructed mainly for irrigation (about 3 million rai or 480,000 ha), power generation (1,020 MW in total), flood control, and salinity control in the downstream area. In the Petchaburi river basin, a large-scale dam/reservoir (Keang Krachan) has been constructed for irrigation (74,000 ha), power generation (17.5 MW), and water supply. In the Western Coast river basins, a dam/reservoir has been constructed only on the Pranburi river for irrigation (36,900 ha) and water supply. To the south of Pranburi, no sizable reservoir has been constructed due mainly to the limited water resources in the area. Water resources development in the Southeastern Coast

river basin has been planned, including the Tha Sae and Rub Ro dams, but construction of these dams/reservoirs has not been initiated yet.

In the WSB region, a total of about 3.7 million rai or 592,000 ha of farmland is under large-scale irrigation schemes at present, which accounts for 53 per cent of the region's total farmland. These irrigation schemes have been mainly designed for paddy and sugar cane cultivation. However, on-farm development of the irrigated areas is not well advanced. For instance, on-farm development through extensive land consolidation in the Greater Mae Klong Irrigation Scheme has been implemented but only covers 15 per cent of the irrigated land. Further, the existing irrigation systems with long-distance canals are relatively inefficient from a water management point of view. In the lowland extending along the coast, the irrigable area has been affected by gradual salinization.

Water for domestic use is supplied by surface and groundwater in the region, with the total volume of water supply amounting to approximately 8.5 million cubic meters (MCM) a year. The extent of access to the public water supply in the region is reported to be about 36 per cent of population, and per capita water consumption by those connected to the public water supply systems is about 57 m^3 per annum (156 liters per day). Water demand for industrial use has been increasing in recent years. Although the Upper WSB region has sufficient water for industrial use, as well as for irrigation and domestic water supply, the Central WSB in the Western Coast river basins has already been confronted with difficulties in securing water for agricultural and industrial use.

The downstream areas in each river basin are subject to periodic flooding during the rainy season. Flood damage is reported in cultivation areas and in public structures such as roads and bridges in low-lying areas. Provision of water storage for regulation and river protection works is insufficient in all four river basins in the WSB region.

(2) Objectives of Water Resources Development

The objectives of water resources development in the WSB region have been defined in view of the potential and constraints of each river basin, as well as in line with the general WSB regional development objectives, as set out below.

(i) To ensure sufficient supply of domestic water of reasonable quality as part of basic human needs;
(ii) To expand urban and industrial water supply to support high economic growth with accelerating industrialization; and

(iii) To manage watershed and irrigated land as essential part of integrated land and water ecosystems.

These objectives are attainable through adoption of various strategies and measures recommended for implementation in the WSB region.

(3) Strategy for Water Resources Development

To achieve the objectives noted above, several strategies are proposed for the development of water resources in the WSB region.

(i) Since a large area of land is irrigated but remains less effectively used at present, the strategy of prime significance is to advance on-farm development with land consolidation in the currently irrigated areas, particularly in the areas of the Greater Mae Klong irrigation scheme and the Petchaburi irrigation scheme.

(ii) Since cropping patterns will gradually shift from paddy cultivation to upland crops of higher value added, enhancement of irrigation efficiency and water management will become more important. Measures should be taken to adopt more efficient irrigation practices.

(iii) Further water storage and regulation are proposed to regulate the unevenly distributed rainfall and runoff in the region, as well as to control flooding. The regulated water should be used for expansion of irrigation, domestic and industrial water supply, and flood control, including a trans-basin water conveyance to river basins where potential of water supply is insufficient.

(iv) Since salinization is increasing in the downstream reaches, appropriate measures should be taken to prevent saline water intrusion in these areas.

7.2.2 Development Targets

An overall framework for the development of water resources in the WSB region has been formulated by referring to: (i) existing and planned development schemes; (ii) requirements for water supply and regulation; (iii) the development plans envisaged in the agricultural, industrial, and urban sectors; and (iv) social and macroeconomic scenarios adopted in this master plan.

Based on this framework, the current and future water balance in each river basin has been evaluated as summarized in the table below.

Table 7.01 Water Balance in the Four Water Basins in the WSB

(MCM/Year)

	Available Water	1996		2001		2011	
		Demand	Balance	Demand	Balance	Demand	Balance
Mae Klong	10,720	8,077	2,643	8,093	2,627	8,113	2,607
Petchaburi	1,540	1,215	325	1,391	149	1,446	94
Western Coast	1,450	1,215	235	1,350	100	1,566	-116
Southeastern Coast	4,360	572	3,788	1,182	3,178	1,502	2,858
Total	18,070	11,079	6,991	12,016	6,054	12,627	5,443

As indicated in the table, water resources in the Mae Klong river basin are sufficient to meet the requirements of the Upper WSB region, though further analysis is required to assess the maintenance flow required for salinity control and other purposes. On the other hand, water potential in the Petchaburi river basin is quite marginal to meet the basin's water demand in 2011. Water resources in the Western Coast river basin will not be sufficient to meet basin demand, and therefore water should be secured from the Southeastern Coast river basin where water potential is fairly large.

7.2.3 Recommended Measures

In view of the need to further develop the WSB's water resources to address the identified constraints and promote the balanced development of the region in line with the proposed strategies, the following recommended actions and measures are put forward:

- Since land consolidation in the existing irrigation scheme has lagged to a great extent, it is recommended that on-farm development with land consolidation be promoted by renewed efforts of the agencies concerned at the central and regional levels (e.g., RID, Land Consolidation Office, Agricultural Land Reform Office, and Agricultural Extension Office). This recommendation should be particularly adopted for the Greater Mae Klong irrigation scheme which represents nearly 43 per cent of the total farmland in the WSB region (Project WR1).

- Water management for irrigated farming should be improved in line with the shift in cropping patterns from paddy cultivation to upland crops of higher value added as

proposed in the agriculture sector master plan. In this context, it is recommended that additional regulation and farm ponds be constructed along the principal canals to facilitate irrigation practices of higher efficiency to meet variable irrigation requirements (Project WR2).

- Water storage and regulation schemes should be further implemented to secure water for domestic, irrigation, and industrial use, as well as to prevent periodic floods in the lowland areas. In the Mae Klong river basin, it is recommended to work out a plan for the development of Lam Pa Chin sub-basin. In the Petchaburi river basin, two additional reservoirs planned by RID are recommended to be put forward. Further, in Chumphon province in the Southeastern river basin, it is recommended to construct the Tha Sae dam/reservoir and Rub Ro dam/reservoir as planned and studied by RID. The implementation of the Tha Sae reservoir is critically required for industrial and urban water supply to the Bang Saphan area (Project WR3).

- With respect to salinity control in the downstream reaches of the Mae Klong river, it is recommended that a thorough review be conducted of reservoir operations at the Khao Laen and Srinakarindra dams, and on the discharges released from the Vajiralongkorn diversion works (50 m^3/s or 1,577 MCM per annum) from the technical, economic, and environmental points of view. In particular, a plan to construct a salinity control weir at the estuary of the Mae Klong and Chumphon rivers should be carefully studied from such points of view (Project WR4).

- Improvement of drainage systems in the lower river basins is of great significance, as major urban centers are developed along the lower reaches of the principal rivers in the WSB. It is recommended that such drainage improvement be promoted together with flood control schemes along the major rivers and in the major urban centers of the WSB region (Project WR5).

Further details of recommended projects, as well as the results of the sector review on water resources, are presented in Volume 9, Chapter 2.

7.3 *Energy and Power*

Existing development plans, when implemented, will turn the WSB region into a center for energy (imported natural gas) and electric power generation. The WSB regional plan

has examined the programming of energy and power for development and whether additional measures can be proposed for the social and economic development of the region. (Refer to Volume 9, Chapter 3)

7.3.1 Objectives and Strategy

(1) Present Situation

Energy consumption in the Kingdom was around 43.8 million tons of oil equivalent (Mtoe) in 1994, of which transportation accounted for 37 per cent, industry for 33 per cent, residential/commerce for 26 per cent, and agriculture for 4 per cent. During the period from 1990 to 1994, industrial consumption increased at an annual rate of 13 per cent and transport consumption at 9.3 per cent, while residential/commerce use increased at 7.5 per cent per annum. On the other hand, energy supply from modern energy sources totaled 45.7 Mtoe (of which petroleum was 30.2 Mtoe, petroleum products 8.3 Mtoe, lignite 5.2 Mtoe, electricity 1.1 Mtoe, and coal 0.9 Mtoe). In addition, renewable energy (fuelwood, bagasse, and others) supplied 19.4 Mtoe. Out of the total energy supply of 65 Mtoe, domestic energy accounted for 57 per cent (37 Mtoe) and imported energy for 43 per cent (28 Mtoe). Imported energy was mainly in the form of crude oil (66 per cent) and petroleum products (30 per cent). One of the major policies in the energy sector is the diversification of energy sources. Reduction of fuelwood consumption is another policy, as it is reported that about 70 per cent of rural households are still using fuelwood or charcoal as fuel.

The demand for and supply of natural gas was 911 million cubic feet per day (MMCFD) in 1993, of which 716 MMCFD were consumed for power generation by EGAT, 56 MMCFD for industry, and 139 MMCFD for feedstock. It is projected that the demand for natural gas will increase, reaching 2,940 MMCFD by 2003 (domestic supply of 1,870 MMCFD and imported natural gas of 1,070 MMCFD). Ratchaburi will be terminus of natural gas imports from Myanmar (525 MMCFD at the initial stage), which will be used mainly for power generation (scheduled completion in 1998).

Electric power consumption in the Kingdom increased from 20,030 GWh in 1985 to 62,510 GWh in 1994, i.e., at an average annual rate of 13.5 per cent. Per capita consumption increased from 308 kWh in 1982 to 1,058 kWh in 1994. Power consumption is composed of 46.2 per cent for industry, 32.2 per cent for commerce, 20.6 per cent for residential use, and 1.0 per cent for agricultural use. Peak power

demand is projected to increase from 10,710 MW in 1994 to 21,990 MW in 2001 and 42,650 MW in 2011.

Electric power demand in the WSB region was 2,433 GWh, with a peak power demand of 614 MW in 1994. Per capita consumption was 840 kWh, and the household electrification rate was 92.1 per cent. The intensity of energy consumption in the WSB (17,235 kWh per one million Baht of GDP) was quite similar to the national average. Due to the expected power demand for industrial use (including a steel complex at Bang Saphan), peak demand is projected to increase to 2,390 MW in 2001, 2,840 MW in 2006, and 3,390 MW in 2011 (i.e., at an average annual growth rate of 11 per cent).

The WSB region has four hydropower stations with a total installed capacity of 1,036 MW. In addition, independent power producers (IPPs) have been invited to install natural gas-fired and/or combined cycle power stations and coal-fired power stations in the WSB region with a total installed capacity of 4,600 MW by 2001 and an additional 5,000 MW in 2001-2011. Consequently, the WSB region is expected to assume a role as a power supply center for the Kingdom. The national power transmission grid of 230 kV and 115 kV lines runs through the WSB region, and installation of a 500 kV line from Ratchaburi to Bang Saphan is planned for completion in 2001. The power supply in each province of the WSB region is networked to the national grid.

(2) Objectives of Energy and Power Development

The objectives of energy and power development in the WSB are complementary to the general WSB regional development objectives, which are as follows:

(i) To **support** high economic growth with accelerated industrialization;
(ii) To **secure** a wide range of opportunities in rural areas for socio-economic activities;
(iii) To attain environmental **sustainability** in energy supply, reducing dependence, especially in rural areas, on primary energy sources;
(iv) To ensure a **safe** and **sound** supply of energy at affordable prices for all the people as part of basic human needs; and
(v) To promote **subregional** cooperation to induce economic development in the region, resulting in a better life for people of the subregion.

These objectives should be pursued not only on the suppliers' side but also on the users'/demand side.

(3) Strategy for Energy and Power Development

Strategies proposed specifically for energy and power development in the WSB region include the following:

(i) Minimization of the use of fuelwood and charcoal and introduction of affordable technology particularly in rural areas and in fuelwood-consuming industries (such as ceramic and lime industries);
(ii) Further promotion of demand side management (DSM) by power consumers, particularly by industries to be newly located in the WSB region;
(iii) Improvement in the stability and reliability of power supply for existing customers and for the accelerated industrialization of the WSB region; and
(iv) Promotion of subregional cooperation with Myanmar in the energy and power sector for the mutual benefit of the people in the two countries.

7.3.2 Recommended Measures

Several energy and power projects have been programmed for implementation in the WSB region, including: (i) a natural gas pipeline from Myanmar to Ratchaburi; (ii) an oil pipeline from the Gulf coast to Ratchaburi; (iii) IPP power plants in Ratchaburi; and (iv) IPP coal-fired plants in Prachuap Khirikhan province. These ongoing projects will be incorporated in the WSB regional development plan, subject to the findings of their EIAs.

In addition, the following measures are recommended for the development of the WSB region:

- For demand side management and the alleviation of deforestation, it is recommended that the new energy saving cooking stove (which consumes 40 per cent less energy per unit than the old model) be disseminated in the rural areas, where 60-70 per cent of households are still using old stoves. It is suggested that the Government make a stronger commitment to the dissemination program, by providing, if necessary, some incentives for the use of the energy saving cooking stove (Project EP1).

- The ceramic and lime industries in Ratchaburi, which are using fuelwood as an energy source, should be guided to use affordable alternative energy, including natural gas imported from Myanmar. It is recommended that a preferential tariff be applied for a defined period to induce a decisive shift in the energy source of these industries and thereby stop further deforestation in the WSB region (Project EP2).

- Since the coal-fired IPPs planned in Prachuap Khirikhan province will be located along the coastline, it is recommended that a thorough EIA be prepared by an independent institute in order to assure preservation of the environment and amenities in this coastal zone. As suggested in Subsection 7.1.2, it is recommended that the ash produced by the coal-fired IPPs be utilized for production of artificial reefs for the rehabilitation of small-scale coastal fisheries in the WSB region.

- As a consequence of the accelerated industrialization of the WSB, a number of manufacturing industries would be newly established or relocated from the BMA. Since new factories are in a better position to install energy-efficient equipment than existing factories, it is recommended that the manufacturing industries to be set up in the WSB region be guided to apply DSM under an existing program of the DSM Office of EGAT (Project EP3).

- To ensure stable and reliable power supply in the WSB region, partially insulated cables (PICs) are proposed for use in electricity distribution systems instead of bare wires. It is recommended that gradual replacement of bare wires with PICs be programmed with the improvement of transmission and distribution systems in the region (Project EP4).

- It is proposed that subregional cooperation with Myanmar be promoted in the power sector. One possible cooperation project is a hydropower development project on the Kra river, which runs along the border between Thailand and Myanmar. It is recommended that a feasibility study of this hydropower project be conducted as early as possible, including examination of a bilateral arrangement for utilization of the international river (Project EP5).

Further details of recommended projects, as well as the results of the sector review on energy and power, are presented in Volume 9, Chapter 3.

7.4 Telecommunications

Development in the telecommunications sector, which has lagged in the WSB region, is of vital significance to achieve regional prosperity through promotion of linkages and partnerships. (Refer to Volume 9, Chapter 4)

7.4.1 Objectives and Strategy

(1) Present Situation

Telecommunications in Thailand have expanded rapidly in recent years. Total line capacity increased from 1.69 million lines in 1990 to 4.38 million lines in 1995, i.e., at an average annual rate of 21 per cent. About 68 per cent of total line capacity was in the BMA, with the provincial services accounting for the other 32 per cent. Most of the telephone stations under TOT are for residential (68 per cent) and business (25 per cent) uses. Mobile telephone services have shown a remarkable increase, from 32,000 units in 1990 to 707,000 units in 1995. The number of telephone lines to population was 3.0 lines per 100 persons in 1990, which increased to 7.4 lines per 100 persons in 1995 (the BMA had 34.5 lines per 100 persons, while provincial areas had 3.3 lines per 100 persons). The Government has a target to increase the number of telephone lines so that there will be 18 lines per 100 persons by 2001, which means that 6 million additional lines are to be installed between 1996 and 2001.

The increase in local calls in the provincial telephone service areas, from 700 million pulses in 1990 to 3,236 million pulses in 1995, has also been remarkable. Under the telecommunications master plan, the Government is promoting rural public telephone service so that the number of telephone stations (1.8 million lines in 1995) will be increased by the One Million Line Expansion Project (800,000 lines in provincial areas and 200,000 lines in the BMA).

In the WSB region, the number of existing telephone lines is still limited. The region had a total of 98,200 stations (121,900 line capacity) in 1995, or around 3.4 stations per 100 population. Under the assumption that the region's GDP increases at 9.2 per cent (Moderate Growth, as defined in Section 3.2) and that the demand elasticity is 2.1, the number of additional telephone lines to be installed in the WSB would reach around 1.5 million by 2011. To promote the Government's policy for decentralization and a bottom-up approach for development, telecommunications services at the provincial level should be improved in an accelerated manner.

(2) Objectives of Telecommunications Development

The development objectives in the telecommunications sector in the WSB region presented below have been formulated to support the general WSB regional development objectives.

(i) To improve the living standards and quality of life in the region, through expanded telecommunications services in the field of education, health, cultural preservation, agriculture, and other economic activities;
(ii) To promote local participation in decision-making processes through increased information exchange via telecommunications services;
(iii) To promote linkages within the region and within zones, as well as with other regions and countries, and to facilitate national and international linkages in the process of globalization; and
(iv) To support social and economic development in the WSB region, particularly in the development of R&D activities in industry.

(3) Strategy for Telecommunications Development

Strategies proposed for development of the telecommunications sector of the WSB region include the following:

(i) Since facilities for telecommunications in the WSB region are currently limited, the number of facilities should be substantially increased to attain the objectives enumerated above (for reference, the average number of telephones per 100 population at present is 43 lines in the Republic of Korea and Taiwan, and 50 in Singapore).

(ii) Telecommunications development should support promotion of information technology (IT) in the WSB region as basic infrastructure for social and economic development.

(iii) IT should be more widely applied to education, medical services, agricultural services, and industrialization in the WSB region, as well as to environmental advocacy and broad-based public participation in the regional development.

7.4.2 Recommended Measures

The telecommunications master plan formulated by the Government should be implemented as programmed, including privatization, expansion of telephone services in provincial areas, and networking of major cities through fiber optic systems. It is expected that the expansion of telecommunications facilities in the WSB would be strategically incorporated into such a master plan and implemented to attain the regional development targets (Project TL1).

Additionally, it is recommended that the following measures be taken specifically for the accelerated development of the WSB region:

- Since the WSB regional development master plan proposes some core development projects, such as free trade areas (FTAs) in Bang Saphan and Samut Songkhram, and a Science City in Petchaburi, it is recommended that these cores be networked through fiber optic systems or through installation of teleports with satellite earth stations (Project TL2).

- As suggested in the section on the agricultural sector (refer to Project AG11), an agricultural information service program should be implemented to provide farmers with useful information and extension services. It is therefore recommended that telecommunications systems and IT be disseminated to the agricultural sector and the agricultural information service program be modernized to attain balanced sectoral development of the WSB region (Project TL3).

- As suggested in the section on the education sector (refer to Project ED4), computerization in education should be promoted in the WSB region along with the improvement of the telecommunications networks. It is recommended that the region's universities, colleges, and institutes be linked to foreign universities and institutes to exchange information through the Internet (Project TL4). In this regard, it is encouraging that Rajabhat Institute, Petchaburi has recently set up an Internet center to promote linkages through information technologies.

- The WSB region has a shortage of physicians and medical personnel, particularly in rural areas. It is recommended that remote clinics in rural areas be networked with the regional center through the Internet and an ISDN network. In turn, the regional center would be linked to some centers in the BMA and overseas. Through this network, medical personnel in remote clinics would be able to confer with their

colleagues to obtain support in diagnosis, treatment, and rehabilitation (Project TL5).

- As suggested in the section on the tourism development sector (Project TO5), tourism information service improvements are important for the WSB, including an upgrading of telecommunications. It is recommended that the suggested "tourism promotion councils" in each tourism development zone and several tourist spots be networked by the Internet and an ISDN network to maintain updated information on domestic and international tourists (Project TL6).

Further details of recommended projects, as well as the results of the sector review on telecommunications, are presented in Volume 9, Chapter 4.

7.5 Transportation

Transportation networks in the WSB region have been fairly well developed and they are nearly at the same level as the national average. However, further development is required to promote linkages between rural and urban areas, and among zones in the WSB, as well as linkages with other regions and among economic sectors, for the economic and social prosperity of the WSB region. (Refer to Volume 9, Chapter 5)

7.5.1 Objectives and Strategy

(1) Present Situation

The transport sector covers roads and road transport, water transport (ports and inland navigation), railway transport, and air transport, all of which are important for promotion of linkages in the WSB for integrated development of the region under the multiple access model (refer to Chapter 3.3). Running through the WSB region, Route 4 and the Southern railway provide north-south arteries. Several points of access to the region have been and are being newly developed, including a deep-sea port at Bang Saphan and a regional airport at Pathiu north of Chumphon. Regional and subregional linkages would be further enhanced if east-west corridors were developed in the Upper, Central, and Lower WSB.

The transport sector in the WSB, however, still faces a number of constraints. For instance, the primary and secondary road network is still immature, as reflected by poor road links in the Upper WSB and insufficient feeder roads in the Central and Lower WSB. Deteriorating railway infrastructure and facilities, as manifested by poor track quality and aging rolling stock, is another constraint. A suitable new deep-sea port location is difficult to find along the Inner Gulf facing the WSB, with the region's only opportunity to develop seaborne transport through the expansion of Prachuap port at Bang Saphan.

(2) Objectives of Transport Development

Transport development objectives for the WSB have been defined in view of the current situation and prospects, as well as in light of the spatial development framework of the region to further promote linkages. These transport sector objectives are set out below.

(i) To improve the comparative advantage of the WSB for the location of various economic activities by strengthening linkages with the BMA, the ESB, and other regions by reducing transportation costs;
(ii) To link different zones within the WSB for more active economic interactions;
(iii) To improve access to rural areas for better provision of social services and minimization of rural-to-urban migration;
(iv) To facilitate labor mobility and non-consumptive resources use for optimal allocation of various resources; and
(v) To open linkages with Myanmar and promote subregional cooperation to bring about mutual benefits and prosperity.

(3) Strategy for Transport Development

To attain the objectives for the regional transport sector, several strategies are proposed, involving both demand-serving and demand-leading elements, with the *overarching strategy to promote linkages*, between regions and between sectors. Specific strategies include the following:

(i) Establishment of a multi-modal transportation system in line with spatial development based on the multiple access model;

(ii) Strengthening of the road network as the prime mode of transport with establishment of subregional links, upgrading interregional roads, and improved road links within the WSB;

(iii) Maximizing route choice for regional exports and imports, providing the region with flexibility in negotiating freight rates, which will result in lower transport costs and increased service quality; and

(iv) Establishment/strengthening of direct access points from other regions by air, water, and rail transport.

7.5.2 Development Targets

An overall framework for the development of various transport subsectors has been formulated by referring to: (i) broad concepts on which to base regional development, such as globalization, and subregional and interregional cooperation; (ii) demand forecasts available from existing databases and previous studies; (iii) social and macroeconomic scenarios adopted in this master plan; and (iv) broad national and regional trends in transport and other related sectors.

Based on this framework, transport growth rates have been projected as summarized in the table below.

Table 7.02 Forecasts of Traffic Growth Rates

(%)

Traffic Indicator	1997-2001	2002-2006	2007-2011
Vehicular Road Traffic	11.1	10.2	8.7
Road Freight Tonnage	11.7	9.1	8.5
Port Traffic (Prachuap)	18.0	15.3	12.4
Port Traffic (Coastal Ports)	21.0	21.0	15.0
Rail Traffic			
Freight (tons)	3.0	3.0	3.0
Freight (ton-km)	1.0	1.0	1.0
Passengers	1.0	1.0	1.0
Air Traffic			
Passengers	15.0	10.0	10.0
Freight	30.0	20.0	20.0

These forecasts provide the basic background with which to evaluate development options and projects in the transport sector.

7.5.3 Recommended Measures

In view of the need to further develop the WSB's transport sector to address the identified constraints and promote the overall development of the region, the following recommended actions and measures (i.e., projects) have been put forward:

- Several road improvement projects are proposed within the WSB region: (i) access roads to support specific industrial developments (Project RP1); (ii) links between Ratchaburi and other provincial capitals in the Upper WSB (Project RP2); (iii) links between Pathiu airport and development centers (Project RP3); (iv) a scenic coastal road to link Hua Hin - Prachuap Khirikhan - Chumphon (Project RP4); (v) secondary/feeder road improvements (Project RP5); (vi) ring/bypass and other urban roads (Projects RP6A and RP6B); rural road development projects (Project RP7); and (vii) reinvestment in existing roads (Project RP8).

- Road improvement projects are further proposed to promote interregional cooperation and linkages. These projects include: (i) an outer-outer orbital route for the extended BMA, including options running from Ban Pong to Lop Buri or Ayutthaya (Project RP9); (ii) further improvement of transport along the north-south axis (Project RP10); and (iii) a east-west corridor between Chumphon and Ranong in the Lower WSB (Project RP11).

- It is proposed that subregional links with Myanmar be developed through: (i) a Kanchanaburi - Tavoy (Dawei) corridor in the Upper WSB; (ii) a Kra Buri - Marang (Myanmar) - Kawthaung corridor in the Lower WSB, and (iii) a Kanchanaburi - Three Pagoda - Moulmein (Mawlamyine) corridor in the Upper WSB (Project RP12). In the long term, the east-west corridor across the Thai-Myanmar border can be opened in the Central WSB to link with Mergui (Myeik) and Bokpyin.

- Interregional road transport development projects are recommended for implementation, including: (i) an intercity and rural bus transport improvement (Project RT1); (ii) a truck terminal project, including a terminal at Ban Pong with an inland depot as recommended in the industrial sector (Project RT2); and (iii) promotion of a road safety program (Project RT3). Since Route 4 has been recently improved, it is recommended that special attention be paid to road safety promotion along this highway.

- Water transport should be further developed to promote interregional linkages. The projects recommended in this subsector include: (i) expansion of Prachuap deep-sea port at Bang Saphan (Project WT1); (ii) feeder ports at Chumphon, Samut Songkhram, and Ban Laem (Project WT2, WT3, and WT4); and (iii) a tourist pier at Cha Am or Hua Hin (Project WT7). It is further recommended that "inland navigation" along the Gulf of Thailand be promoted along with the proposed port improvement projects (Project WT5).

- To promote linkages at the subregional level, water transport should be further developed through implementation of: (i) a Tavoy (Dawei) deep-sea port in Myanmar at the western terminus of the Kanchanaburi - Tavoy corridor (Project WT8), and (ii) a Ranong/Phangnga port along the Andaman Sea (Project WT9). It is recommended that the Tavoy deep-sea port be developed along with an industrial complex as a gateway to the Andaman Sea and the west.

- Railway improvement is indeed a difficult task. For the development of the WSB region, however, it is recommended that further effort be made for: (i) improvement of the Southern main line as a part of an international railway link (Project RW1), together with improvement of freight transport (Project RW5); (ii) completion of a missing link between the Southern line and the Northern/Northeastern lines (i.e., between Ban Pong and Ayutthaya) (Project RW2); and (iii) development of spur lines or long loop lines serving major industrial estates (e.g., in the Bang Saphan area).

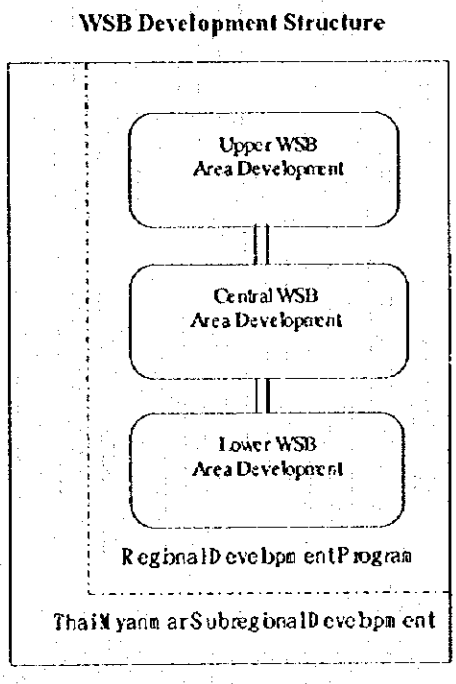
- In the air transport subsector, the aggressive marketing of Pathiu airport, which is scheduled for completion in 1997, is recommended together with the development of an airport-based industrial/trade complex (Project AT1). At the same time, it is suggested that subregional air linkage agreement be concluded, including coverage of Pathiu airport (Project AT4).

Further details of recommended projects, as well as the results of the transport sector study, are presented in Volume 9, Chapter 9.5.

Chapter 8 WSB REGIONAL DEVELOPMENT PLAN

8.1 *WSB Development Structure*

The WSB regional development plan has been formulated by integrating the sectoral development plans proposed in Chapters 4 to 7 within the frameworks for balanced regional development discussed in Chapter 3. The sectoral development plans are be classified into: (i) regional projects/programs that cover the whole WSB region, (ii) area or local projects/programs that will be directed to specific areas, and (iii) subregional projects that would promote subregional cooperation between the WSB region and Myanmar.



Regional projects or programs are commonly applicable to each area or zone in the WSB region and are complementary with one another in realizing overall regional development. Some might be promoted sector-wise for realization. On the other hand, area or local projects can be grouped into three area development programs in view of the macro-zoning of the spatial development plan proposed in Section 3.4. Some area projects/programs are complementary and can effectively be packaged into several development initiatives for realization in an integrated form. In addition, subregional projects will open access for regional and area development and will therefore be integrated into regional development programs. The interrelation among regional development programs, area development programs, and subregional development projects is schematically illustrated above.

The WSB regional development plan will also be structured by a development axis or artery running north to south through the WSB region. This development artery, connecting all three area development program zones, will be strengthened as regional development and area development programs are promoted as proposed in this Study. A few regional arteries might be developed additionally when east-west corridors are

opened through subregional cooperation with Myanmar. Such east-west corridors, if and when developed, would further strengthen the development structure of the WSB region.

8.2 *Regional Development Programs*

(1) Intraregional and Interregional Development Programs

A number of projects/programs have been proposed in the sectoral development plans, of which many are applicable widely in the whole WSB region. These projects/programs are referred to as regional development programs. While most of the regional development programs target (intraregional) development within the WSB region, some promote (interregional) cooperation with other regions of the country.

The intraregional and interregional development projects proposed in the WSB regional development plan are listed in Table 8.01. These projects might be promoted and implemented sector-wise by the authorities and institutions concerned or by interested parties in the public and/or private sectors.

Table 8.01 Regional Development Program

No.	Project Program	Outline
	[Social]	
SS1	Social Monitoring and Evaluation	Monitoring of social aspects/indicators
SS2	Local Governance System Improvement	Improvement of provincial offices for decentralization, planning, and budgeting
SS3	Social Partnership Promotion	Promotion of partnership with private sector
	[Education]	
ED1	Experimental Schools Curriculum Revision	More technology-oriented education
ED4	Computer Availability Extension	Computer for secondary schools
	[Public Health]	
PH2	Regional Occupational Health	Promotion of industrial safety, health control
PH3	Emergency Medical Services Upgrading	Emergency services within the region
PH4	Integrated HIV/AIDS Control	Education/campaign related to HIV/AIDS
PH5	Health Promotion Upgrading	Community-based health promotion
	[Rural/Urban]	
RD1	Rural Development Models	Models at seven Amphoes
UD3	Urban Social Infrastructure	Improvement of social infrastructure
UD4	Urban Amenity Improvement	Improvement of urban amenities
UD5	Institutional Strengthening for Urban Development	Strengthening of urban and housing related institutions

No.	Project/Program	Outline
	[Agriculture]	
AG1	Field Crops Restructuring	Shift from paddy/sugar cane to high value crops
AG2	High-value Crops for Niche Markets	Promotion of high-value crops
AG8	Agro-processing Promotion	Promotion of agro-based industries
AG9	Water Application Efficiency Promotion	Promotion of tube, drip, sprinkler irrigation
AG11	Agricultural Marketing Information	Dissemination of agricultural marketing
AG12	Farmers' Life-Time Training	Life-time training for farmers
AF1	Coastal Fisheries Rehabilitation	Rehabiltaion of environment for fisheries
	[Industry]	
ID3	Rural industrial Community Model	Rural industrialization, one -product one-village
ID4	Quality/Productivity Enhancement	Factory park, manpower improvement
ID5	Industrial R&D Promotion	Regional R&D testing center, incubation
ID6	New Investment Promotion	Promotion of resource recycling industries
	[Tourism]	
TO2	Amenity Preservation Program	Preserve amenities in tourist areas
TO3	Tourism-related Infrastructure	Road, water, sewage, garbage and other infrastructure
TO5	Tourism Information Services	Information services for tourism promotion
	[Resource Mangement & Infrastructure]	
EV1	Organic Farming	Promotion of organic farming
EP1	Cooking Stove Dissemination	Dissemination of new cooking stove
EP3	Demand Side Management	Electricity saving at demand side
EP4	Partially Insulated Cable Promotion	Use of PIC for transmission and distribution
TL1	Telecommunications Expansion	Target: 50 telephones per 100 population
RP5	Secondary Feeder Road Improvement	Improvement of feeder roads
RP7	Rural Road Development	To be combined with Rural Development
RP8	Upgrading Road Maintenance	Improvement/upgrading of road maintenance
RT1	Inter-city and rural bus transport	Improvement of public transport system
RT3	Road Safety	Preventive measures of traffic accidents
WT5	Gulf Navigation Promotion	Navigation network among Gulf ports

The proposed regional development programs include some programs that are preferably promoted and implemented not only on a regional basis but also at the national level. For instance, the Cooking Stove Dissemination project proposed in the energy sector is an important program for the WSB region but it is desirable that this project (including incentives) be studied and programmed at the national level. It is expected that the projects and programs proposed for development of the WSB region would spearhead the nationwide development programs as well.

(2) Socially- and Human-Oriented Development Programs

The frameworks and scenarios for overall development of the WSB region have been formulated with special attention to socially-oriented and human-centered development, as discussed in Section 3.1. A number of projects/programs have been planned and proposed to promote such development, and they have been integrated into the regional development programs. The socially-oriented and human-centered emphasis in the WSB plan is not limited to the development plans in the social sector, but is also reflected in the plans for other sectors (i.e., economic and infrastructure).

All the projects/programs proposed in the social sector are socially-oriented. A number of projects have been proposed for education and human resource development in the WSB region, and several other programs have been proposed for promotion of public health. These projects/programs, if implemented, would greatly enhance the "quality" of social services and create a socially acceptable living area in the WSB region, as well as enhance the local governance system and local participation in planning and implementation of the projects/programs.

The rural development projects/programs proposed for the WSB regional development plan are also socially-oriented. For rural development, several tambons and/or amphoes that have lagged in terms of household income and social services have been selected as models for rural development. It is proposed that these model projects be implemented together with the social infrastructure projects/programs to enhance the implementation efficiency of the socially-oriented rural development programs.

Most of the agricultural development projects proposed in the WSB region are programmed to pursue socially-oriented and human-centered development objectives in rural areas. For instance, the proposed "Field Crops Restructuring Program" and "Promotion of High-Value Crops for Niche Markets" are planned to extend technical and financial support services to farmers and farmers' groups in the WSB region so that their income opportunities may be enhanced and their social standards of living improved. The proposed "Farmers' Lifelong Training Program" is particularly human-oriented, as it aims at upgrading farmers' knowledge and technologies and improving the quality of life in rural areas. Some projects proposed in the fisheries sector are also socially-oriented. For instance, the proposed "Coastal Fisheries Rehabilitation Project" aims at rural poverty alleviation in the backward fishing villages in the WSB region; this project intends to safeguard small-scale fisherfolk along the coast of the region.

In the industrial sector, socially-oriented development is highlighted as well. Under the proposed "Rural-Industrial Community Model", industrial development in rural areas is programmed, including promotion of rural agro-processing industries, promotion of a "one-product one-village" program, and promotion of "barn factories" with the aim of enhancing job opportunities and improving the quality of life in rural areas. At the same time, certain industrial development projects are proposed to develop human resources for the social and economic development of the WSB region. For instance, since the "Quality/Productivity Enhancement Program" and "Industrial R&D Promotion Program" are proposed for manpower development and enhancement of technologies, these programs are regarded as human-centered projects in the industrial sector.

The energy and telecommunications sectors also envisage socially-oriented and human-centered development through various projects/programs. For instance, a program for "Cooking Stove Dissemination" is proposed not only for environmental protection but for enhancement of the quality of daily life in rural areas. In addition, various telecommunications projects are proposed to enhance levels of social services and amenities, to improve the living environment in a holistic way, and to empower local people by diversifying opportunities for various social activities in rural and urban areas.

Socially-oriented projects/programs are also proposed in the transportation sector. Particularly social-oriented are (i) Secondary/Feeder Road Improvements, (ii) Urban Roads, (iii) the Rural Road Project, (iii) Intercity and Rural Bus Transport Improvement, and (iv) the Road Safety Project. Many other transport improvement projects will also serve to empower local people by improving access to various social and economic activities and to enhance levels of social services and amenities in the WSB region.

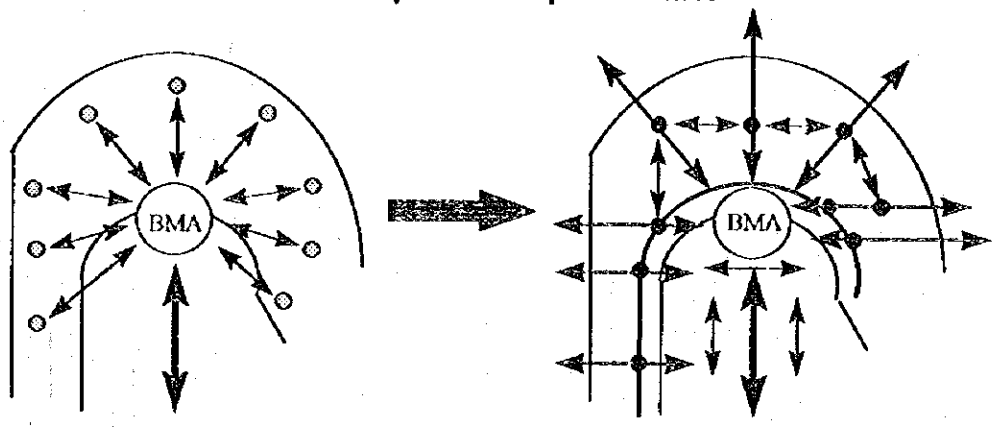
8.3 Area Development Programs

It is planned that the local projects be grouped into three area development programs, referring to the macro-zoning of the WSB region as discussed in Section 3.4. The three packages are: (i) Upper WSB area development, (ii) Central WSB area development, and (iii) Lower WSB area development. In each area, some core projects that will lead the development initiatives are planned to integrate the related programs area-wise.

(1) Upper WSB Area Development

As discussed in Sub-sections 6.1.2 and 6.3.2, the Upper WSB is located relatively close to the BMA and therefore agricultural sector development is envisaged in this area to promote cultivation of high-value crops for niche markets in the BMA and for export. From the viewpoint of industrial development, the Upper WSB will be integrated into the multipolar structure to be developed around the BMA and this area is characterized as an "industrial junction zone" with an industrial logistics center linking the WSB with other regions and subregions, as illustrated below.

From Unipolar to Multipolar Structure



About 25 projects/programs proposed in each sectoral development plan are specifically directed to lead Upper WSB area development. These projects are listed in Table 8.02.

Table 8.02 Upper WSB Area Development

No.	Project Program	Outline
	[Social/Urban]	
ED3	Industry-based Training Center	Training center in/around industrial estates
RD1	Rural Development Models	Rural development in Dan Makhan Tia Phanom Thuan
UD1	Upper WSB Urban Cluster	Clustering of urban centers
	[Agriculture]	
AG1	Field Crop Restructuring	Shifting from rice/sugar cane to high-value crops
AG2	High-value crops for Niche Markets	Promotion combined with crop shifting
AG5	Cattle Fattening	Cattle raising and fattening
AG6	Dairy Production	Dairy production
AG9	Water Application Efficiency	Improvement of irrigation water application
WR1	Irrigated Agriculture Intensification	On-farm development
	[Industry]	
ID1	Free Trade Areas	FTA in Samut Songkhram
ID2	Strategic Industrial Estates	Industrial/distribution center in Ban Pong
EP2	Ceramic/Lime Energy Substitution	Energy substitution for ceramic/lime industries
	[Tourism]	
TO1	Zone-wise Development	Kanchanburi tourism promotion
TO3	Tourism Related Infrastructure	Improvement of access and social infrastructure
TO4	Lodging Facility Upgrading	Upgrading of hotels and facilities
TO5	Tourism Information Service Promotion	Promotion of information services
	[Infrastructure]	
TL2	Teleport Promotion	Telecom. port to be set up in FTA
RP1	Industry-supporting Roads	Highway linkage to FTA
RP2	Ratchaburi-S.Songkhram Link	Ratchaburi - S.Songkhram highway
RP9	Outer-Outer Orbital Route	Highway linkage between Ban Pong and Ayuttaya Lop Buri
RT2	Ban Pong Truck Terminal	Truck terminal combined with inland depot
WT4	Samut Songkhram Feeder Port	Feeder port facility in FTA
WT6	Mae Klong Inland Navigation	Navigation improvement along Mae Klong
	[Environment]	
EV3	Waste Water Treatment	Sewage treatment in Kanchanaburi Ratchaburi S.Songkhram
EV4	Solid Waste Management	Compost/Sanitary landfill

These projects will be integrated in terms of location and objectives to form four development initiatives for Upper WSB area development, as follows:

① Kanchanaburi Tourism Promotion Initiative

Kanchanaburi province offers a favorable environment for eco-tourism for domestic and foreign visitors. Several projects/programs are proposed to promote tourism in this province, integrating projects not only in the tourism sector (i.e., TO1, TO2, TO4, TO5) but also in the industrial (ID3) and resources management sectors (EV3, EV4).

② Kanchanaburi Agriculture Intensification Development Initiative

Several programs proposed in the agriculture sector (i.e., AG1, AG2, AG11), rural development sector (RD1), and water resources sector (WR1, WR2) are to be integrated to form one agricultural development initiative in Kanchanaburi province.

③ Ban Pong Industrial/Distribution Development Initiative

Since Ban Pong is located at the crossroads of north-south and east-west arteries, it offers an attractive site for location of an industrial logistics center. Several sector projects are strategically proposed for integrated development at Ban Pong, including projects not only in the industrial sector (ID2, ID5) but also in the urban (UD1) and transport sectors (RP9, RT2).

④ Smut Songkhram Free Trade Area Development Initiative

It is proposed that part of the abandoned shrimp fields in Samut Songkhram be utilized to set up a free trade area (FTA). In planning the Samut Songkhram FTA, it is proposed to integrate not only the cornerstone industrial project (ID1) but also social and urban projects (ED3, UD1) and transport projects (RP1, RP2, WT4) in order to comprehensively develop the area.

(2) Central WSB Area Development

The Central WSB is designated as an amenity zone under the spatial development plan. This zone has relatively less fertile soils and agricultural potential is rather limited. No manufacturing industry will be promoted for location in the Central WSB, except for knowledge-based industry. The Central WSB will function as an "interface zone" with favorable amenities and the environment. In this context, it is proposed to promote the

development of Science City to serve as a center for intellectual infrastructure, as well as a center for knowledge-based industry including research and development activities.

About 20 projects/programs that have been proposed in the various sectoral development plans will be implemented in the central amenity zone to be developed in the Central WSB, as listed in Table 8.03.

Table 8.03 Central WSB Area Development

No.	Project/Program	Outline
	[Science City Related]	
UD2	Petchaburi Science City	Establishment of a new Science City
ED2	High-technology University	Science, technology and management-oriented
PH1	Medical Research Laboratory with Hospital	First-rate research hospital in Science City
EV5	Environmental Research Center	Monitoring, research, and training center
TL2	Teleport Promotion	Telecom. port in Science City
TL4	Medical Information Services	Research hospital and clinics linked by internet
TL6	Information Highway for Education	Internet for education
	[Agriculture/Rural Related]	
RD1	Rural Development Models	Models at Nong Ya Plong and Kui Buri
AG3	Tropical Fruit Improvement	Improvement for export of fruit products
AG9	Water Application Efficiency	Improvement of water application
AF2	Aquaculture Model	Pilot/model for aquaculture development
WR1	Irrigated Agriculture Intensification	Agriculture intensification in Petchaburi irrigation
WR3	Petchaburi Multipupose Reservoir	Construction of two additional reservoirs
WR5	Flood Control and Drainage System	Improvement of flood control
EV1	Organic Farming	Promotion of organic farming
	[Tourism Related]	
TO2	Tourism Amenity Preservation	Preservation of amenities in resort areas
WT7	Hue Hin tourism Pier	Pier for Gulf navigation
RP4	Hua Hin - P. Khirikhan Scenic Coastal Road	Coastal Road between Hua Hin and P.Khirikhan
EV4	Solid Waste Disposal (Compost)	Compost in resort areas and Science City

In the Central WSB, the development initiative is proposed at Petchaburi for promotion of research and development (R&D) activities and development of intellectual infrastructure as follows:

⑤ Science City Development Initiative

It is proposed to develop a new Science City in Petchaburi. Into the proposed Science City, various programs will be integrated to form a comprehensive development initiative, including social sector development (ED2, PH1), industrial development (ID5), and resource management (EV4, EV5).

(3) Lower WSB Area Development

The Lower WSB encompasses the Bang Saphan area and Chumphon province. There is a sizable land for agricultural development in the Lower WSB, particularly for the cultivation of tropical fruit under favorable agro-climatic conditions. Livestock development and fisheries development are also promising in this zone. For industrial development, two industrial cores are to be developed; one will be a water-front core in Bang Saphan and the other an air-front core in Chumphon.

About two dozen projects/programs proposed in the various sector development plans will be implemented in the Lower WSB, as listed in Table 8.04.

Table 8.04 Lower WSB Area Development

No.	Project/Program	Outline
	[Agriculture/Rural Related]	
RD1	Rural Development Model	Rural development in Bang Saphan Noi
RD1	Rural Development Model	Rural development in Lamae/Thung Tako
AG3	Tropical Fruit Improvement	Improvement for export of fruits products
AG4	Tropical Fruit Center	Expansion of HRC for tropical fruit
AG6	Dairy Production Promotion	Livestock under coconut trees
AG7	Slaughterhouse Modernization	To be combined with livestock production
AG10	Coconut-based Livelihood	Promotion of agro-processing
AG11	Agricultural Marketing Information	Promotion/dissemination of marketing information
AF1	Coastal Fisheries Rehabilitation	Rehabilitation of small-scale fisheries
AF2	Aquaculture Model	Pilot/model of shrimp cultivation
AF3	Fish Processing Industrial Complex	Processing industry complex in Chumphon
EV2	Mangrove Reforestation	Reforestation of mangrove areas
	[Industry/Bang Saphan]	
ID1	Free Trade Area (FTA)	FTA in Bang Saphan
ID5	Industrial R&D Promotion	Center for material research/testing
ED3	Industry-based Training Center	Vocational training for industries
PH2	Occupational Health Center	Regional occupational health center
UD2	Bang Saphan Industrial City	Industrial city development
WT1	Prachuap Port Expansion	Expansion of deep-sea port
RP1	Prachuap Port Access Road	Route 4 - Prachuap Port access highway
TL2	Teleport Promotion	Telecom. port in Bang Saphan
WR3	Tha Sae-Bang Saphan Pipeline	Water pipeline from Tha Sae to Bang Saphan
	[Transport]	
RP3	Pathiu Access Road	Route 4 - Pathiu airport highway
RP3	Bang Saphan - Pathiu Linkage	Highway between Bang Saphan and Pathiu
RP12	Subregional links with Myanmar	Chumphon-Kraburi-Marang-Kawthaung
WT2	Chumphon Feeder Port	Feeder port at Chumophon

Two development initiatives are proposed for implementation in the Lower WSB, integrating several projects and programs proposed in this zone.

⑥ Bang Saphan Free Trade Area Development Initiative
A steel complex has been and is being developed in the Bang Saphan area, together with a deep-sea port (Prachuap port). It is proposed to further develop this area, integrating several other projects in the industrial sector (ID1, ID5), social sector (ED3, PH2), urban development sector (UD2), water resources sector (WR3), and transport sector (WT1, RP1. RP3).

⑦ Chumphon Tropical Fruit Development Initiative
Nearly 80 per cent of the agricultural land in Chumphon province is used for fruit and tree crops, and it is proposed to further develop fruit production and marketing in the province, integrating various agriculture sector projects (AG3, AG4, AG10, AG11).

Further details of the proposed development initiatives are discussed in Section 9.2 as they are recommended for priority projects/programs to be implemented during the 8th Plan period.

8.4 Subregional Development Programs

For the WSB regional development plan, promotion of subregional cooperation with the Myanmar side of the Isthmus will play a significant role. This role will include, but not be limited to: (i) improving access to and from the WSB region, (ii) increasing trade through such access, (iii) exchanging resources sufficiently available on one side and insufficiently available on the other side, (iv) exchanging basic information of common interest, (v) disseminating traditional and modern technologies, and (vi) conserving the environment for mutual benefit.

Although this Study does not involve a comprehensive appraisal of the potential for subregional cooperation, the Study has examined the possibility of cooperation in development of infrastructure linking the WSB with the Myanmar side of the Isthmus, with particular attention to the transport and energy sectors.

Regarding the transport sector, it is of great importance for the WSB region to open some (east-west) corridors between the WSB and the Andaman Sea, in short term (a Kanchanaburi-Tavoy corridor in the Upper WSB), in the medium term (a Kra-Marang corridor in the Lower WSB), and in the long term (a Bang Saphan-Myeik/Bokpyin corridor). In the energy sector, water resources along the Thai-Myanmar border and on

the Myanmar side of the Isthmus could be harnessed for export to and utilization in the WSB region. The subregional development projects proposed in these sectors are illustrated below and listed in Table 8.05.

Subregional Development

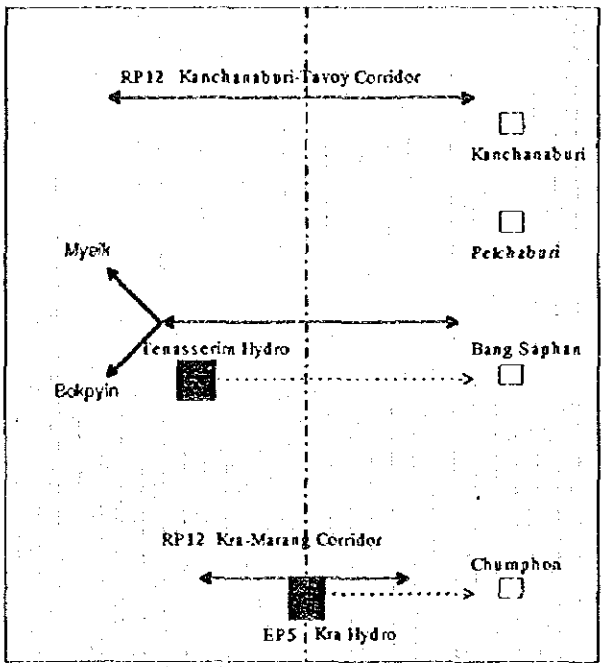


Table 8.05 Thai - Myanmer Subregional Development

No.	Project Program	Outline
	[Transport]	
RP12	Kanchanaburi-Tavoy Corridor	Corridor between Kanchanaburi and Tavoy (Dawei), together with a deep-sea port at Tavoy
WT8	Tavoy (Dawei) Deep-Sea Port	Deep-sea port and industrial estate in Tavoy
RP12	*Kra Buri-Marang-Kawthaung Corridor*	*Corridor between Kra Buri and Marang, with extension to Kawthaung*
RP12	Kanchanaburi-Three Pagodas-Moulmein Corridor	Improvement of existing roads
RP12	Central WSB-Myeik corridor	Corridor between Bang Saphan and Myeik/Bokpyin
	[Power]	
EP5	Kra Hydropower	Hydropower on the international river (130 MW)
(Ref)	Tenasserim Hydropower	Hydropower on the Tenasserim river downstream (700 MW)

It is recommended that a bilateral (i.e., Thai-Myanmar) committee for development of these subregional projects be organized and that the committee take necessary actions to initiate studies and coordinate bilateral cooperation for the implementation of these proposed projects.

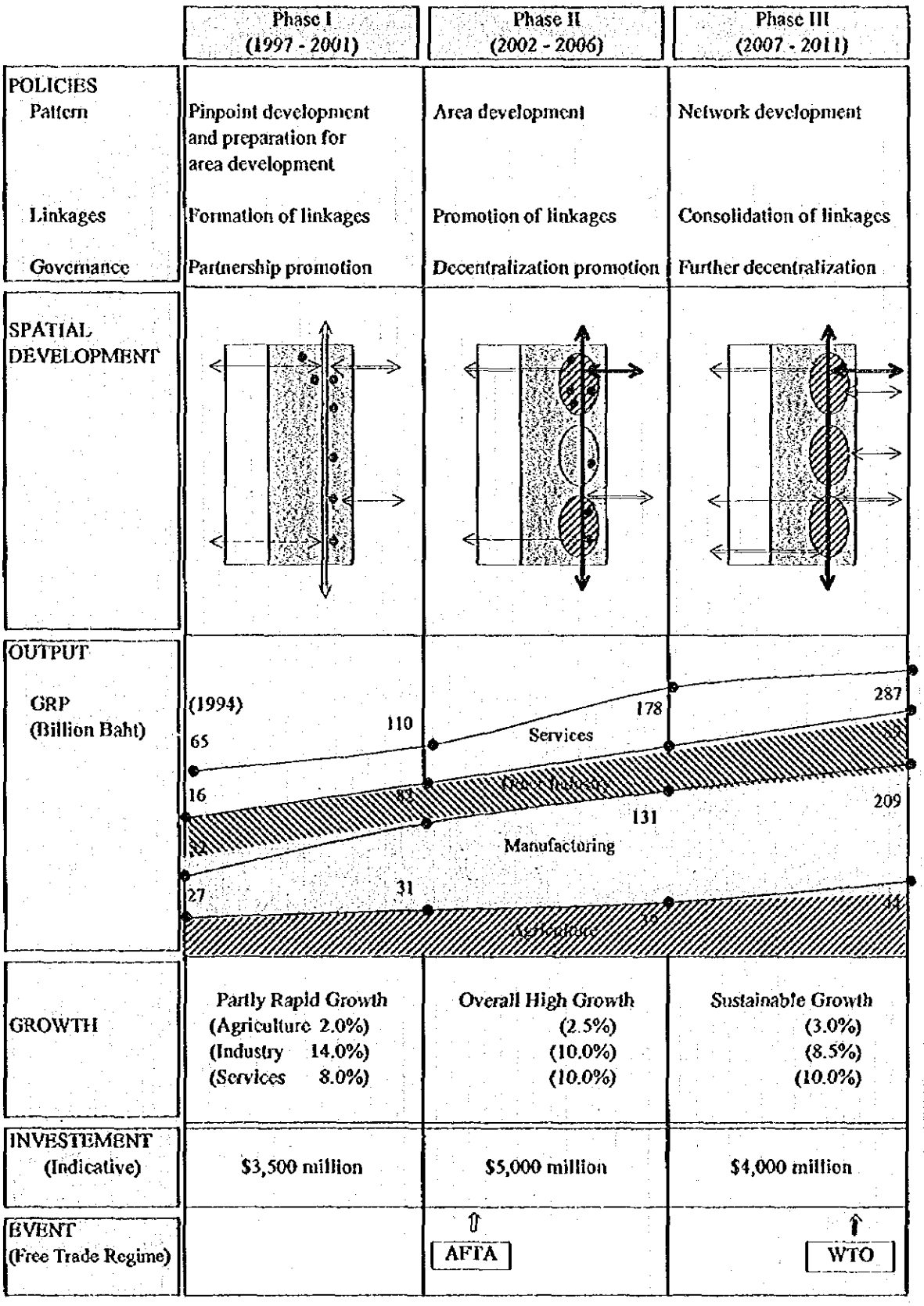
8.5 *Development Phasing for Balanced Development*

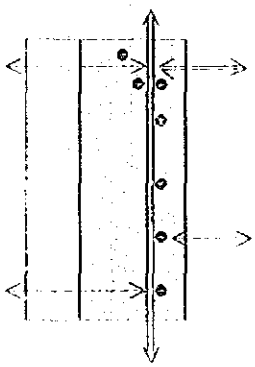
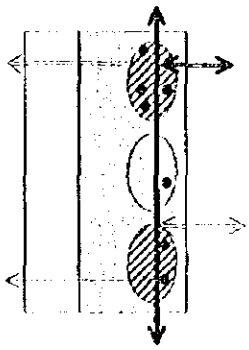
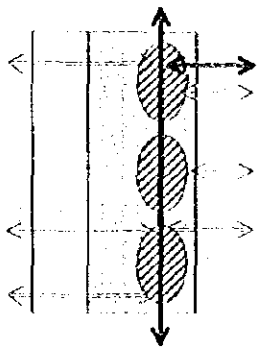
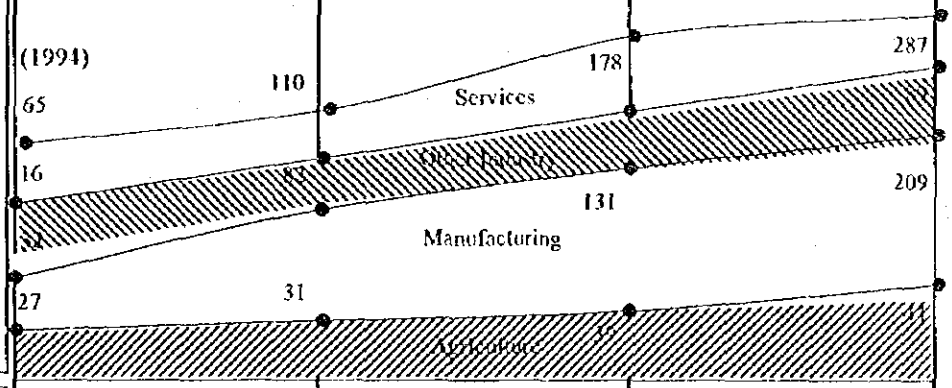
The WSB regional development plan will be programmed for realization in steps, as the resource base and financial capacity expand and as related institutional development takes place over time. The programming period is broadly divided into three phases: Phase I up to 2001 (the end of the 8th Plan), Phase II for 2002-2006 (the 9th Plan period), and Phase III for 2007-2011 (the 10th Plan period).

(1) Development Phasing

It is planned that during Phase I pinpoint development will continue at several development centers in the WSB, including ongoing industrial development at Bang Saphan and electric power development at Ratchaburi. In parallel, preparation for area development should be initiated and promoted in the Upper, Central, and Lower WSB through study and implementation of development initiatives proposed in this Study. At the same time, it is planned to formulate linkages within the region, and with other regions, as well as linkages among the agriculture, industry, and service sectors, and between rural and urban areas. Partnerships between the public and private sectors and between the government and non-government organizations should also be promoted during Phase I. Since the free trade regime under the AFTA agreement comes into force in the early years of Phase II, preparation for the free trade regime should be advanced during Phase I. It is expected that the target annual growth rates in agriculture (2.0 per cent), industry (14.0 per cent), and services (8.0 per cent) are attained during Phase I. (Refer to the Figure in the previous page.)

During Phase II, area development will be promoted in the Upper, Central, and Lower WSB together with development around the core development centers. Area-wise and sector-wise linkages, as well as public and private partnerships, should be further promoted during Phase II. High growth rates are expected in agriculture (2.5 per cent), industry (10.0 per cent), and services (10.0 per cent) during Phase II.


Phase I
(1997 - 2001)
Phase II
(2002 - 2006)
Phase III
(2007 - 2011)
POLICIES
Pattern
Pinpoint development and preparation for area development
Area development
Network development
Linkages
Formation of linkages
Promotion of linkages
Consolidation of linkages
Governance
Partnership promotion
Decentralization promotion
Further decentralization
SPATIAL DEVELOPMENT
OUTPUT
GRP
(Billion Baht)
(1994)
65
110
178
287
Services
16
83
131
209
Manufacturing
32
27
31
44
Agriculture
GROWTH
Partly Rapid Growth
(Agriculture 2.0%)
(Industry 14.0%)
(Services 8.0%)
Overall High Growth
(2.5%)
(10.0%)
(10.0%)
Sustainable Growth
(3.0%)
(8.5%)
(10.0%)
INVESTEMENT
(Indicative)
$3,500 million
$5,000 million
$4,000 million
EVENT
(Free Trade Regime)
AFTA
WTO

	Phase I (1997 - 2001)	Phase II (2002 - 2006)	Phase III (2007 - 2011)
POLICIES Pattern	Pinpoint development and preparation for area development	Area development	Network development
Linkages	Formation of linkages	Promotion of linkages	Consolidation of linkages
Governance	Partnership promotion	Decentralization promotion	Further decentralization
SPATIAL DEVELOPMENT			
OUTPUT GRP (Billion Baht)			
GROWTH	Partly Rapid Growth (Agriculture 2.0%) (Industry 14.0%) (Services 8.0%)	Overall High Growth (2.5%) (10.0%) (10.0%)	Sustainable Growth (3.0%) (8.5%) (10.0%)
INVESTEMENT (Indicative)	$3,500 million	$5,000 million	$4,000 million
EVENT (Free Trade Regime)		⇑ [AFTA]	⇑ [WTO]

During Phase III, area development should turn into network development, particularly in the Upper and Lower WSB. Linkages within the areas and linkages among regions and subregions should be consolidated in line with decentralization, which will be further promoted during this period. The free trade regime under the AFTA and WTO agreements will be widely diffused into each region and each sector, and the WSB region is therefore expected to make use of such a regime in its overall regional development. Sustainable growth is to be attained during Phase III, and it is expected that the average per capita GDP in the WSB region would reach the level of national average by 2011.

(2) Indicative Investment Schedule

In line with the development phasing discussed in the foregoing section, it is planned that the projects/programs proposed in each sector of the Study will be implemented by Phase. An indicative investment schedule in each Phase is preliminarily estimated as summarized in Table 8.06.

Table 8.06 Indicative Investment Schedule for Proposed Projects/Programs

($ Million)

No.	Project/Program	Agency	Phase I	Phase II	Phase III
	[Social]		4	2	2
SS1	Social Monitoring and Evaluation	NESDB	1	2	2
SS2	Local Governance System Improvement	MOI	2		
SS3	Social Partnership Promotion	MOI, BOI	1		
	[Education]		13	25	
ED1	Experimental Schools and Curriculum Revision	MOE	1	10	
ED2	High-technology Universities	MOUA	5	10	
ED3	Industry-based Training Center	MOL	5		
ED4	Computer Availability Expansion	MOE	2	5	
	[Health]		30	7	4
PH1	Medical Research Laboratory with Hospital	MOPH	20		
PH2	Regional Occupational Health Center	MOPH, MOL	2	4	4
PH3	Emergency Medical Service Upgrading	MOPH, PHO	2	3	
PH4	Integrated HIV/AIDS Control	MOPH, PHO	5		
PH5	Health Promotion Upgrading	MOPH, PHO	1		
	[Rural/Urban]		678	1,149	645
RD1	Rural Development Models	NRDC, ARD	30	80	100
UD1	Upper WSB Urban Cluster	DTCP	5	2	
UD2	Specific City Plans	NESDB, etc.	640	1,064	540
UD3	Urban Social Infrastructure	Local	1.5		
UD4	Urban Amenity Improvement	Local	1	3	5
UD5	Institutional Strengthening	MOI	0.5		
	[Agriculture/Fisheries]		232	266	110
AG1	Field Crops Restructuring	MOAC, BAAC	20	20	40
AG2	High-value Crops for Niche Markets	MOAC, BAAC	30		
AG3	Tropical Fruit Improvement	MOAC, BAAC	62	114	

No.	Project/Program	Agency	Phase I	Phase II	Phase III
AG4	Tropical Fruit Center	MOAC	13	6	
AG5	Cattle Fattening	MOAC, BAAC	5	10	15
AG6	Dairy Production Promotion	MOAC, BAAC	5	10	10
AG7	Slaughterhouse Modernization	MOI, MOAC	10	13	
AG8	Agro-processing Promotion	MOAC, MOC	10	10	10
AG9	Water Application Efficiency Improvement	MOAC, RID	10	10	15
AG10	Coconut-based Livelihood	MOAC	5	10	10
AG11	Agricultural Marketing Information	MOAC, MOC	10	13	
AG12	Farmers' Lifetime Training	MOAC	10	10	10
AF1	Coastal Fisheries Rehabilitation	OEA, DOF	10	10	
AF2	Aquaculture Model	DOF	12		
AF3	Fish Processing Industrial Complex	DOF	20	30	
	[Industry]		764	662	180
ID1	Free Trade Areas (FTAs)	MOI, IEAT	753	342.5	180
ID2	Strategic Industrial Estates	MOI, IEAT	-	284	-
ID3	Rural-industrial Community Model	MOI	3.5	3.5	
ID4	Quality/Productivity Enhancement	MOI	6.5		
ID5	Industrial R&D Promotion	MOI	-	32	-
ID6	New Investment Promotion	MOI, BOI	0.5	-	-
	[Tourism]		60	51	40
TO1	Zone-wise Development	MOSTE, TAT	1	1	
TO2	Amenity Preservation Program	OEPP, TAT	6.5	3.5	
TO3	Tourism Related Infrastructure	DOH, etc.	10	6	
TO4	Lodging Facility Upgrading	BOI	40	40	40
TO5	Tourism Information Service Promotion	Local, TAT	2		
	[Resource Management/Environment]		204	317	100
EV1	Organic Farming	DA, etc.	6	10	
EV2	Reforestation Program	RFD	3	32	
EV3	Domestic Waste Water Treatment	OEPP	96	160	100
EV4	Solid Waste Management	OEPP	96	35	
EV5	Environmental Research Center	DEQP	3	80	
	[Water Resources]		123	122	140
WR1	Irrigated Agriculture Intensification	RID	120	120	120
WR2	Improvement of Water Management	RID		1	20
WR3	Multipurpose Reservoir Development	RID	2		
WR4	Salinity Control	RID		1	
WR5	Flood Control and Drainage Improvement	RID	1		
	[Energy/Power/Telecommunications]		37	283	7
EP1	Cooking Stove Dissemination	PDA	3		
EP2	Energy Substitution (Ceramic/Lime)	DEDP	5	5	
EP3	Demand Side Management	EGAT	1.5	2	2
EP4	Partially Insulated Cable Promotion	PEA	5	55	
EP5	Kra Hydropower	EGAT		200	
TL1	Telecommunications Expansion	TOT	20	20	5
TL2	Teleport Promotion	TOT/CAT	0.5		
TL3	Agricultural Information System	TOT	0.5		
TL4	Medical Information System	MOPH	0.5	1	
TL5	Tourism Information System	TAT	0.5		
TL6	Information Highway for Education	MOE, PTD	0.5		
	[Transport]		1,355	2,116	2,772
RP1	Industry-Supporting Roads	DOH	47	68	
RP2	Ratchaburi-Provincial Capital Links	DOH	0.5	20	40
RP3	Pathiu-Route 4 and Pathiu-Bang Saphan	DOH	15	70	
RP4	Scenic Coastal Road	DOH		20	20
RP5	Secondary/ Feeder Roads	DOH	240	240	240

No.	Project/Program	Agency	Phase I	Phase II	Phase III
RP6A	Urban Ring/Bypass	DOH	-	25	25
RP6B	Urban Roads	Local	10	10	10
RP7	Rural Roads	PWD	25	25	25
RP8	Upgraded Road Maintenance	DOH	140	140	140
RP9	Outer-Outer Orbital Route	DOH	5	300	500
RP10	North-South Links	DOH	600	700	1,000
RP11	Chumpon-Ranong Links	DOH	1	100	50
RP12	Subregional Links with Myanmar	DOH	2	140	
RT1	Intercity and Rural Bus Transport	LTD	5	5	5
RT2	Truck Terminals	LTD		16	
RT3	Road Safety	HPD	5	5	5
WT1	Prachuap Deep-sea Port Extension	HD, IEAT	81	21	21
WT2	Chumphon Feeder Port	HD	1	25	
WT3	Ban Laem/Feeder Port	HD			10
WT4	Samut Songkhram Feeder Port	HD		10	
WT5	Gulf Navigation Promotion	HD	100	90	80
WT6	Mae Klong River Navigation	HD		30	
WT7	Hua Hin/Cha Am Tourist Pier	HD		2.5	
WT8	Tavoy/Dawei Deep-sea Port	(MPA)	1		
WT9	Ranong/Phangnga Port	HD		1	
RW1	Southern Line Railway Improvement	SRT	25	2	
RW2	Southern Line-Northern Line Link	SRT			500
RW3	Bangkok-Songkhram-Pak Tho Link	SRT			-
RW4	Spur Lines to Industrial Estates	SRT			51
RW5	Freight Transport Improvement	SRT	50	50	50
RW6	Tourist Train to Hua Hin/Cha Am	SRT	-	-	-
RW7	Thai-Myanmar Railway	SRT	-	-	-
AT1	Marketing of Pathiu Airport	DOA	1	-	-
AT2	Hua Hin Airport Expansion	DOA	-	-	-
AT4	Subregional Air Linkage	DOA	-	-	-
TOTAL			3,500	5,000	4,000

As shown in the table, the estimated cost of the proposed projects/programs will amount to $3,500 million in Phase I, $5,000 million in Phase II, and $4,000 million in Phase III, totaling $12,500 million (312.5 billion Baht) in 15 years. About 50 per cent of the estimated total cost of projects relates to the transportation sector. The investment list reflects the importance of the transportation sector in applying a "multiple access model" for regional development of the WSB to promote intraregional, interregional, and subregional linkages.

The macroeconomic scenario for the moderate growth (Case 2) predicted that total capital requirements (in 1994 prices) would amount to $15.4 billion (385 billion Baht) during Phase I, $23.4 billion (585 billion Baht) during Phase II, and $34.2 billion (855 billion Baht) during Phase III, totaling $73 billion (1,825 billion Baht) in 15 years (an annual average of 122 billion Baht) based on assumed incremental capital/output ratio (ICOR) of about 4 (See Volume 3, Chapter 3). Accordingly, the estimated total cost of the proposed projects/programs ($12.5 billion or 312.5 billion Baht) would amount to 17.1 per cent of expected investment requirements.

It is assumed that about 30 per cent of the proposed project/program cost and nearly 60 per cent of the non-transportation component investment would be due to the private sector. If the private sector estimate for participation is broadly correct, the implied public sector investment component would amount to about $8.8 billion (220 billion Baht) in 15 years, about 15 billion Baht annually. This implies an average public sector investment ratio equal to about 4 per cent of the projected GRP of the WSB over the full period (1997-2011). It may be noted that in recent years the public sector has generated savings of about 10 per cent of GDP, readily financing investments that have averaged at 8.5 per cent of GDP at the national level. Thus, it would appear that the proposed project/program investments, when coupled with a reasonable provision for other required public capital expenditure in the region, would not likely be excessively large in relation to the WSB's proportionate share of national public sector resources that would likely become available. In relation to the estimated total investment requirements for the economic growth scenario adopted, the implied public sector investment would average about 12 per cent of the projected WSB investment over the full period. From this perspective as well, it would appear that the proposed projects/programs for the WSB could be readily accommodated in framing successive national development plans, since public sector investment in recent years have amounted to about 20 per cent of capital investment at the national level.