STUDY REPORT ON DEVELOPMENT PROGRAMMES OF INDUSTRIAL STANDARDIZATION, TESTING AND METROLOGY IN THE KINGDOM OF THAILAND

DECEMBER 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

STUDY REPORT ON DEVELOPMENT PROGRAMMES OF INDUSTRIAL STANDARDIZATION, TESTING AND METROLOGY IN THE KINGDOM OF THAILAND

DECEMBER 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to the request of the Government of the Kingdom of Thailand, the Government of Japan has decided to conduct a study on the Development Programmes of Industrial Standardization, Testing, and Metrology in Thailand, and entrusted the study to the Japan International Cooperation Agency (JICA).

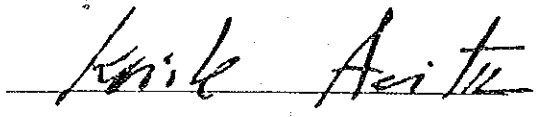
The JICA sent to Thailand a study team headed by Mr. Kanji Kakinuma, Japanese Standards Association, from February 25 to March 26, 1987.

The team had discussions on the Project with the officials concerned of the Government of Thailand and conducted a field survey in the project-related areas. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Kingdom of Thailand for their close cooperation extended to the team.

December 1987



Keisuke Arita
President
JAPAN INTERNATIONAL COOPERATION AGENCY

CONTENTS

CHAPTER 1

BASIC POLICIES AND METHODS OF THE STUDY

1. BASIC POLICIES AND METHODS OF THE STUDY

1.1 Background of the Study

The Thai Government has long been examining the introduction of measures to develop industrial standards and the certification system, to promote the diffusion of the quality control techniques, to strengthen the testing and inspection capabilities and to improve the metrological and calibration services in view of achieving the export promotion of domestically manufactured industrial products through the enhanced international competitiveness of these products and also to achieve the competitiveness of domestic products vis-a-vis imported products in the domestic market.

To be more precise, Thailand's 6th 5 Year National Economic and Social Development Plan regards the promotion of industrial standardization and the testing/inspection and metrological systems to be extremely important for the promotion of Thai industries and for the diversification of export products. The urgency to strengthen the testing and inspection functions in particular has not only been stressed in industrial circles but also noted in the resolution adopted by the Industrial Restructuring Committee, established under the authority of the National Economic and Social Development Board (NESDB). Furthermore, it has also been taken up by the Sub-Committee on the Restructuring of Economic Relations Between Thailand and Japan (which discusses such questions as trade frictions and economic cooperation), resulting in a strong request by the Thai Government to the Japanese Government for cooperation.

The aforegoing circumstances led to the request submitted in July, 1985 by the Thailand Institute of Scientific and Technological Research* to the

---

* Thailand Institute of Scientific and Technological Research (TISTR), a non-profit making foundation under the jurisdiction of the Ministry of Science, Technology and Energy and serving as an authorized industrial product inspection institution.

Japanese Government for a study on measures to promote industrial standardization and metrological technologies. This request was followed by a further request by the Institute in June, 1986 for a specific study focusing on the improvement of the testing, metrological and calibration services.

In August, 1986, a request was also submitted by the Thai Industrial Standards Institute, Ministry of Industry (TISI), responsible for industrial standardization, to the Annual Consultation Session on Technical Cooperation Between Thailand and Japan for the grant aid of laboratory and testing equipment to reinforce the industrial standards testing function of the Institute.

Reasons (bases) for requests and gists of the details are as follows:

(1) TISI

(a) Certification tests are currently entrusted to many public organizations. However, substantial delays are seen in the certification process due to the insufficient testing equipment/facilities and heavy work loads of the organizations concerned. The development of TISI standards is also lagging behind the pace of industrial development due to the absence of TISI's own laboratories. Construction of research laboratories and provision of testing equipment are thus requested to Japan by the TISI on the grounds that such measures are necessary to solve the said problems.

(b) A substantial increase in number of testing and research staff shall take place for the operation of the test equipment mentioned in (a) above and for the effective implementation of certification tests. In this regard, project type technical cooperation is thus requested to improve the technical level of the staff.

(2) TISTR

(a) It is necessary to expand the scale of operations for standard conformity tests for industrial products and processed agricultural products in order to facilitate Thailand's trading activities. Therefore, additional construction of laboratory buildings and provision of additional testing and chemical analysis equipment are requested on the ground that they are necessary to meet increasing demands from government agencies and private companies for such tests and evaluations.

(b) Establishment of metrological standards and improved calibration services for various equipment are required to upgrade quality levels of products manufactured in Thailand so that they can compete in the international market. Additional construction of metrological laboratory buildings and provision of additional equipment for metrological standardization and calibration services are thus requested.

(c) A substantial increase in number of testing and research staff shall take place to meet increasing demands for the expansion of test/research operations. Project type technical cooperation is thus requested to improve the technical level of the staff.

The requests of the TISTR and TISI were both taken up at the above-mentioned Annual Consultation Session and were further discussed at the administrative level by the two governments concerned. It was subsequently decided that the two requests would be unified with a view to conducting a developmental study for the preparation of a master plan to promote industrial standardization and the testing/inspection and metrological systems. The agreements between the Japan International Cooperation Agency, TISTR and TISI were then shaped into the "Scope of Work for the Survey on Development Programmes of Industrial Standardization, Testing and Metrology in the Kingdom of Thailand" which was signed by all three parties. The present Study has been conducted based on this Scope of Work.

1.2 Objective of the Study

The objective of the present Study is the preparation of a master plan for the development of industrial standards and the certification system, the promotion of quality control, the strengthening of the testing and inspection functions and the improvement of the metrological and calibration services.

1.3 Basic Policies

Industrial standards and testing/inspection and metrological systems form the foundation of a country's industrial activities and, therefore, have a potentially far reaching influence on the national economy. Their impact on individual industrial activities is, however, believed to vary depending on the industrial structure of a given country and the basic framework and actual application methods of the standards and systems.

In general, any search for concrete solutions presupposes the systematic arrangement of the problems and a clear understanding of what roles are performed by whom. In addition, a priority order should be established among the proposed solutions, following a study on a comprehensive method to effectively, as well as efficiently, solve the problems so that the limited resources can be effectively utilized.

Based on the general understanding given above, the necessary information was gathered and analyzed, problems were identified and proposals were examined in view of the following being presented in the results of the Study.

In respect of legally regulated metrology, the present Study will not go beyond the extent necessary for determining the national metrological standard quantities and system requiring to be established.

(1) Analysis of the current state and future prospects of Thai industry (industrial structure and export trends) to provide the basic data to determine the impact of industrial standards and testing/inspection and metrological systems on the Thai economy.

(2) Analysis of the status of industrial standards and testing/inspection and metrological systems in the industrial promotion policies of the Thai Government and a summary of each system and identification of their current states and problems.

(3) Classification of the possible measures to deal with the problems identified in 2) above into the development programmes of the different implementation bodies (i.e. government, academic society, private enterprises and ASEAN, etc.)

(4) Proposal of a comprehensive project as a strategic move for the efficient implementation of the above programmes and analysis of this proposal.

(5) Presentation of the economic effects expected as a result of the above project and programmes.

The overall study flow is as shown in Fig. 1.3-1.

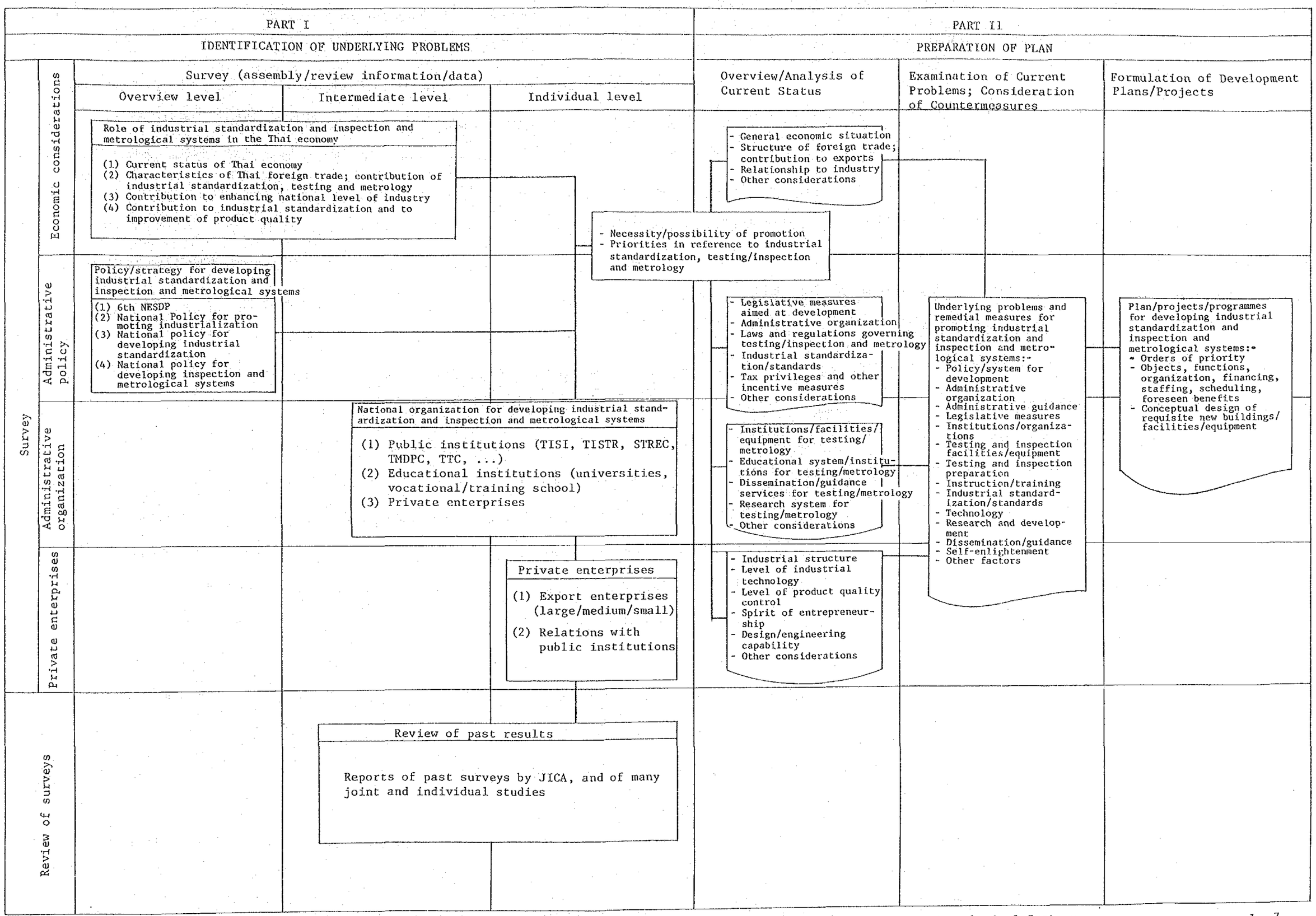


Fig. 1.3-1 Study Flow of Programmes for Developing Industrial Standardization and Inspection and Metrological Systems

1.4 Subject Area of the Study

In principle, the entire national territory of Thailand should be subject to the present Study. However, in view of the fact that almost all of the relevant administrative and government institutions, as well as the majority (approximately 60%) of private enterprises, are concentrated in Bangkok, all materials, data and information required for the preparation of the Master Plan should be obtainable in the metropolitan area. As a result, it has been decided that the subject area of the present Study be a circle around Bangkok of a 100km radius (see map in Fig. 1.4-1).

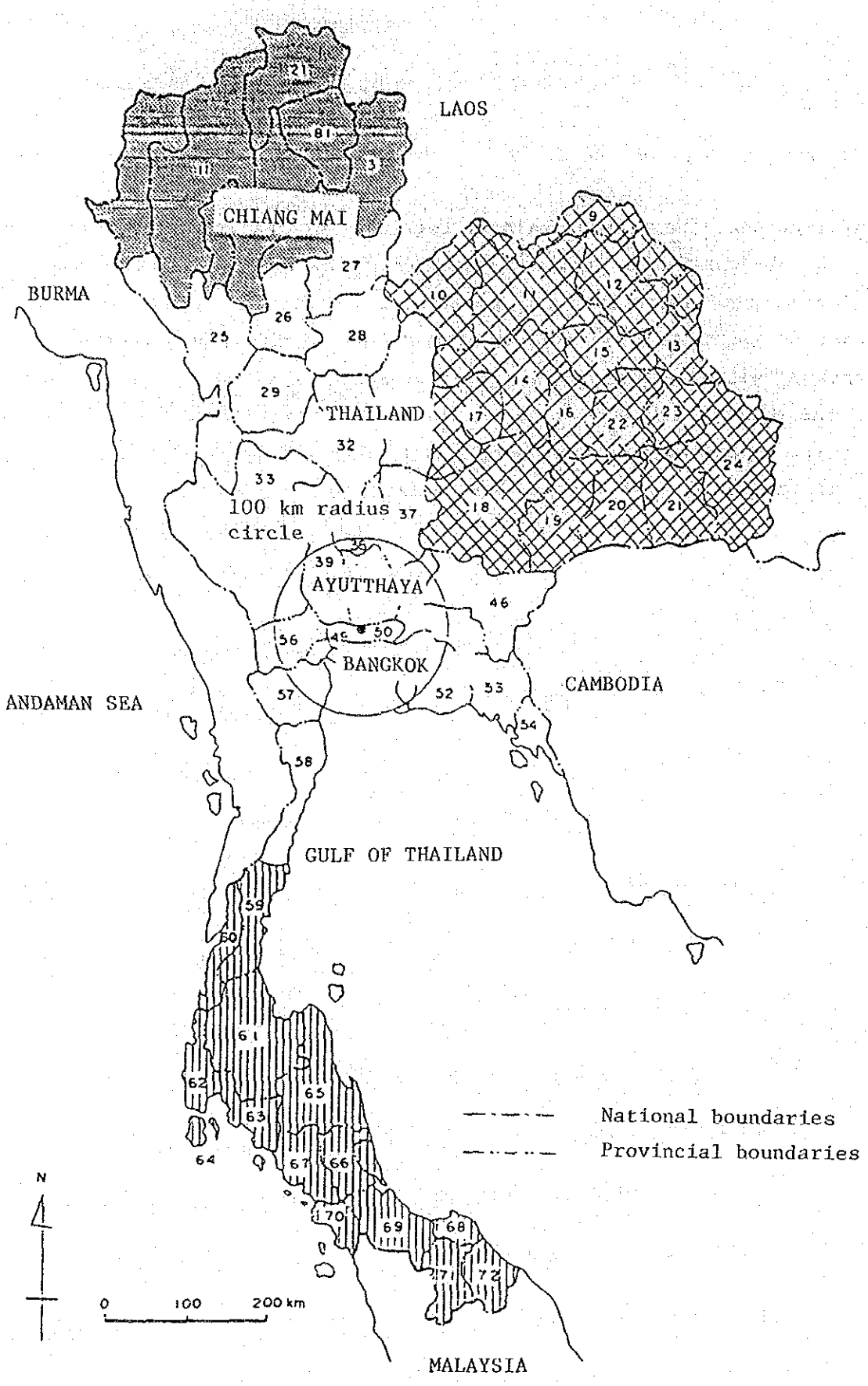


Fig. 1.4-1 Geographical Area of the Study

1.5 Subject Institutions and Industries

1.5.1 Government and Public Institutions

In addition to the Thai Industrial Standards Institute (TISI) and the Thailand Institute of Scientific and Technological Research (TISTR) which made the original requests leading to the present Study, the Study Team also visited a wide range of establishments, organizations and institutes associated with the economic policies, industrial promotion, export promotion and technological research promotion relevant to the present Study. The government offices visited were as follows.

- o Ministry of Industry (MOI)
  - Thai Industrial Standards Institute (TISI)
  - Department of Industrial Promotion (DIP)
  - Office of Permanent Secretary
  - The Metalworking and Machinery Industries Development Institute (MIDI)
- o Ministry of Science, Technology and Energy
  - Thailand Institute of Scientific and Technological Research (TISTR)
  - Department of Science Services (DSS)
- o Ministry of Commerce (MOC)
  - Commodities Standards Division (CSD)
  - Department of Commercial Registration (DCR)
  - Trade Training Centre (TTC)
- o Office of the National Economic and Social Development Board (NESDB)
- o National Statistical Office (NSO)
- o Office of the Board of Investment (BOI)
- o The Industrial Finance Corporation of Thailand (IFCT)
- o The Bank of Thailand (BOT)

- o Industrial Estate Authority of Thailand (IEAT)
- o Thai-Japan Technological Promotion Association (TPA)
- o The Scientific and Technological Research Equipment Centre, Chulalongkorn University (STREC)
- o Institute of Food Research and Product Development, Kasetsart University (IFRPD)

Fig. 1.5.1-1 shows the relation between the administrative offices associated with industrial standardization and the testing/inspection and metrological systems.

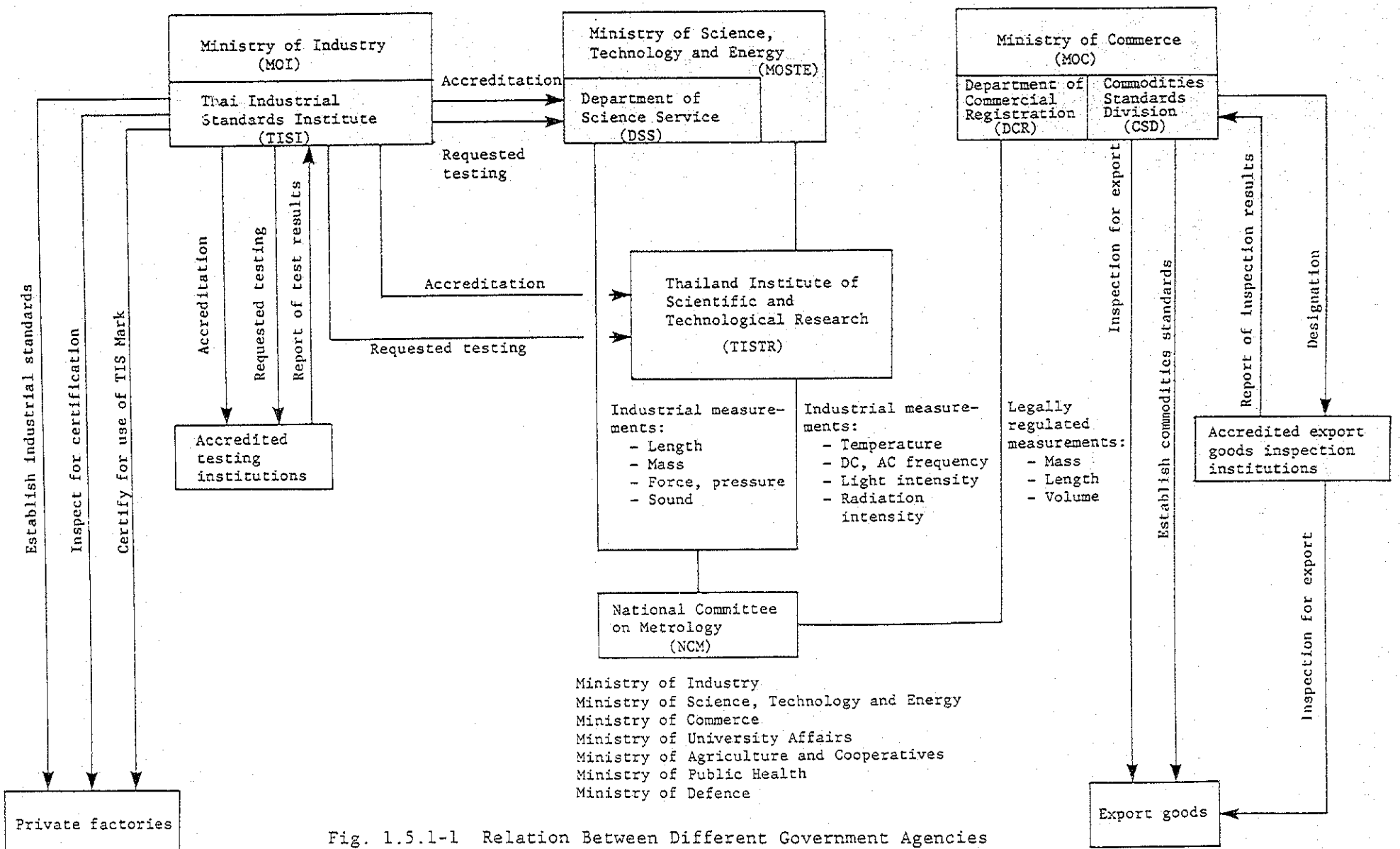


Fig. 1.5.1-1 Relation Between Different Government Agencies Administrating Industrial Standardization, Testing/Inspection and Metrology

1.5.2 Subject Industries and Selection of Study Items

For the preparation of a programme to promote industrial standardization and the testing/inspection and metrological systems in Thailand, a clear understanding of the current conditions of those private enterprises involved in production activities is an absolute necessity in view of understanding the requirements, status and problems of the current systems.

As a study on all Thailand's private enterprises was believed to be difficult, however, a list of priority industries was first compiled (see Table 1.5.2-1) as the subject industries of the Study in order for the Study to be effectively and efficiently implemented. This selection was based on the importance attached to the industries by various government authorities in their economic and social development plans, industrial policies and export promotion measures.

As the Table shows, while many industries are the subject of promotion, the highest priority is given to the electric, electronic, machine and chemical industries.

Table 1.5.2-1 Key Product Lines Selected or Considered Promising by Government Authorities for Promotion

Products included in Ministry of Commerce export target list	Industrial products for export specified in the 6th NESDP	Product lines anticipated manufacture in Laem Chabang Export Processing Zone	Product lines promoted by the Industrial Finance Corporation of Thailand	Product lines selected for export promotion in 3-year programme	Products being exported by Japanese enterprises	Product lines considered promising by Japanese firm
	Processed agricultural products	Processed agricultural products	Processed foodstuff		Processed agricultural products	Processed foodstuff
Textile products; clothing	Textile products	Textile products	Clothing	Textile products; clothing		Textile products; clothing
Electrical, electronic products	Electrical, electronic products	Electrical, electronic products	Electrical, electronic products	Electrical, electronic products	Household electric appliances	Electrical, electronic products
Furniture, components; wooden products	Furniture, components; wooden products		Furniture; wooden products	Furniture		Furniture
Motor car components	Motor cars, components; industrial/agricultural engines; agricultural machinery	Motor car components; containers; ship repair; agricultural machinery		Motor car components	Motor car components	Motor cars, components; ships
Copper tubing; aluminium and bronze products		Machinery components				General machinery
Ball bearings	Metal products	Metal products	Metal products	Ball bearings	Ball bearings	
Chemical products	Chemical, rubber products	Rubber-related products	Rubber products	Chemical products		Chemical products
Jewels; precious stones; imitation jewels	Jewels; imitation jewels	Jewels; ornaments		Jewels		
Other products:- Footwear; gloves; travelling cases; plastic products; pharmaceuticals; lens; toys; artificial flowers; tiling	Other products:- Footwear, other leather goods; lens; toys; artificial flowers; tiling; pulp	Other products:- Footwear; cameras; binoculars; toys; handicraft; sporting goods	Other products:- Footwear; cameras; binoculars; toys	Other products:- Footwear; travelling cases; pharmaceuticals; eyeglass lens; sporting goods toys; artificial flowers	Other products:- Flat glass	Other products:- Flat and safety glass; construction; engineering

In the case of these high priority industries, the following specific products were given special attention.

Electrical Products:

Radios, Televisions, Refrigerators, Air-Conditioning Equipment and Parts, Refrigerator Compressors, Batteries, Electrical Wires and Cables

Electronic Products:

Integrated Circuits, Printed Circuit Boards, Electronic Parts, Office Automation Equipment, Computers, Computer Keyboards, Facsimiles, Copiers, Optical Fibre Cables

Machinery:

(1) Automobile Components:

Engine Components, Piston Rings, Disc Wheels, Exhaust Pipes, Spokes/Nipples/Rims for Motorcycles, Tools/Dies and Rubber Parts for Automobiles

(2) Agricultural Machinery and Components

(3) General Machinery: Machinery Assembly

Chemical Products:

Synthetic Resins, Pharmaceuticals, Caustic Soda, Chlorine, etc.

The actual responses of individual enterprises to management techniques and technologies, particularly standardization and quality control, depend on the company size, and technical cooperation with foreign enterprises (ratio of foreign capital might be a reference). Therefore, due consideration was given in the selection of the following companies to visit so that all the above-described factors affecting their responses to standardization and quality control be well balanced.

- Siam Steel Group (Motorcycle Components: Large, Japan)
- Kallawis Auto Parts Industry Co., Ltd. (Automobile Components: Large, Japan)

- Yanmer Thailand Co., Ltd. (Diesel Engines: Large, Japan)
- Mahajak Industry Co., Ltd. (Bolts and Nuts: Large, Japan)
- The Siam Kubota Diesel Co., Ltd. (Diesel Engines: Large, Japan)
- Siam Sanitary Ware Co., Ltd. (Sanitary Ware: Large, Japan)
- Hitachi Bangkok Cable Co., Ltd. (Wires and Cables: Large, Japan)
- Thai DNT Paint Mfg. Co., Ltd. (Paint: Medium, Large, Japan)
- Thai Asahi Glass Co., Ltd. (Glass for Automobiles: Large, Japan)
- Thai Gypsum Products Co., Ltd. (Gypsum Products: Medium, Japan)
- Hitachi Consumer Products Co., Ltd. (Fans, Televisions, Refrigerators, Motors Air-Conditioning Equipment, Well Pumps, Cookers, etc.: Large, Japan)
- Thai Toshiba Lighting Co., Ltd. (Fluorescent Lamps, Fluorescent Lamp Stabilizers: Large, Japan)
- The Siam Cement Co., Ltd. (Cement: Large, Local)
- The Siam Iron & Steel Co., Ltd. (Steel Products: Large, Local)

Note) Large : Large-scale Industry (more than 200 employees)
Medium: Medium-scale Industry (50 to 199 employees)

Other organizations visited included the following.

- SIWA Testing Inspection and Consulting Co., Ltd. for studying the testing capacity of a representative private testing and inspection institution.

- The Association of Thai Industry (ATI) for information on the extent of private industries' participation in the drafting of industrial standards and general opinions on the current industrial standardization and the testing/inspection and metrological systems of the Thai Government.

The Study was conducted by means of interviews, using previously distributed questionnaires.

1.6 Study Items

The following relevant items were studied in regard to industrial standardization and the testing/inspection and metrological systems in Thailand.

(1) Historical background (NESDB, DIP)

(2) Relationship to general economy of Thailand (NESDB, DIP)

(3) Industrial structure and relationship with industries (NESDP, DIP, BOT)

(4) Foreign trade structure (DIP, BOT)

(5) Instruction/training system (NESDB, BOI, BOT)

(6) Research and development system (TISTR, DSS)

(7) Certification system for industrial standards and commodities standards (TISI, TISTR, CSD)

(8) In-house standardization and quality control (TISI, BOT, TPA, Chulalongkorn University and those enterprises listed in 1.5.2)

(9) Testing/inspection and metrological systems (TISI, TISTR, DSS, CSD, TTC, DCR)

(10) Guidance for dissemination and information dissemination system (TISI, TISTR)

(11) Laws and regulations (TISI, TISTR, DCR)

(12) Incentive policies and measures (TISI, TISTR, DIP, MIPI, NESDB, NSO, BOI, IFCT, IEAT, Chulalongkorn University, Kasetsart University)

Note: The abbreviations in brackets indicate the institutions visited.

CHAPTER 2

REVIEW OF THE THAI INDUSTRY

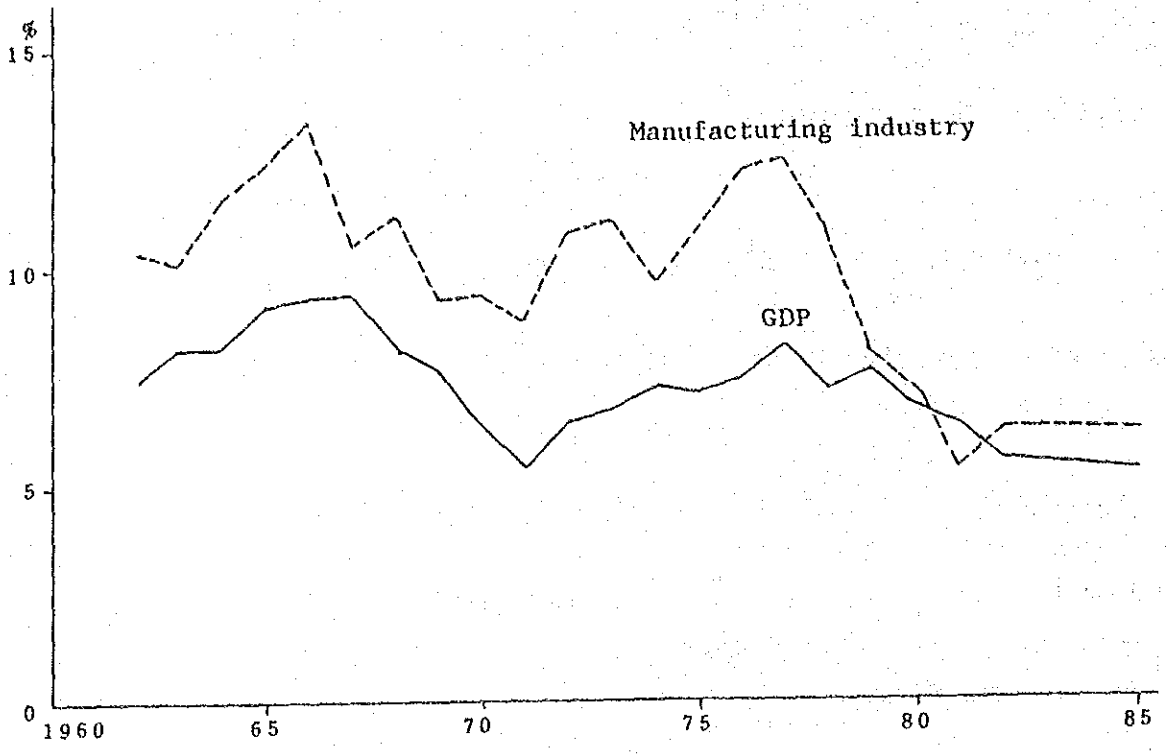
2. REVIEW OF THE THAI INDUSTRY

2.1 National Policy for Industrial Development

2.1.1 Progress of Thai Industrialization in Terms of Gross Domestic Product (GDP)

The starting point of Thai industrialization was the 1st National Economic Development Plan (NEDP), drawn up by the National Economic Development Board (NEDB), based on a report entitled "A Public Development Programme for Thailand" issued in 1959, and in corporating the results of a survey of Thai economy, undertaken by a mission sent from the World Bank.

This 1st NEDP was followed in the ensuing years by succeeding National Economic and Social Development Plans (NESDP), and today, the 6th NESDP is under way. During the period covered by these Development Plans, Thai economy can be considered to have progressed smoothly, despite the series of economic upheavals that marked this period --notably the two oil crises of the 1970's-- followed by the stagnation that is still affecting the world economy since the beginning of the 1980's. The country's economic progress is evidenced in the sustained growth recorded of gross domestic product (GDP) and of the manufacturing industry's production, as indicated in Fig. 2.1.1-1 in terms of 3-year moving averages. It is revealed from this figure that the GDP has consistently increased by 6 to 8 percent per year from 1960 to date. The importance of the part played by industrialization is evinced by the fact that the manufacturing industries have steadily maintained a level of growth higher than that of the overall GDP, with only one exception for the early 1980's, which reflected the world-wide business recession.



Source: NESDB

Fig. 2.1.1-1 Growth Rate of Thai Economy and Industry (3-year moving average)

The progress of industrialization can also be considered in terms of the relative shares contributed by the agricultural and manufacturing sectors of industry, as represented in Table 2.1.1-1. It is seen that the share contributed by the agricultural sector --which in the early 1950's had contributed roughly half of the GDP-- marked a consistent decline --from 40.2 percent in 1960 to 32.2 percent in 1970, and to 24.9 percent in 1980 and further to 23.2 percent in 1985. The converse growth of industry --particularly the manufacturing industry-- is evidenced in the share of 12.0 percent of 1960 almost doubling by 1985 to 20.8 percent, to rank almost side by side with agriculture, and constitute the leading factor in the growth of Thai economy since the early 1960's..

Thus, while the importance of agriculture must never be neglected in considering the future of Thai economy, the contribution to be expected of industry --and in particular the manufacturing industry-- requires to be accorded due attention.

Table 2.1.1-1 Shares Contributed to GDP by the Different Sectors of Economic Activity (Normalized to 1972 prices)

Sector	Share Percentage (%)					
	1960	1965	1970	1975	1980	1985*
Agriculture	40.2	36.1	32.2	30.4	24.9	23.2
Mining	1.2	1.7	1.7	1.2	1.6	1.6
Manufacturing	12.0	14.3	15.5	18.2	20.7	20.8
Construction	4.8	5.7	5.8	4.2	5.7	4.6
Services and others	41.8	42.2	44.8	46.0	47.1	49.8
Total GDP	100.0	100.0	100.0	100.0	100.0	100.0

*) 1985: Preliminary estimates

Source : "National Income of Thailand", published by NESDB

2.1.2 Policies Adopted in Past for Economic Development and for Promoting Industrialization

The plans and policies adopted by the Thai Government in the past for fostering economic development and industrialization can be considered to have undergone changes in 5 phases as indicated in Table 2.1.2-1.

The 1st phase extended from the end of World War II to 1960, during which industrialization was fostered under the Establishment of National Enterprises Act of 1953 and the Act on the Promotion of Industries of 1954.

The 2nd phase covered the decade from 1961 to 71, corresponding to the period of the 1st and 2nd NESDP's, during which, the industrial policy was to encourage private initiative for substituting imported goods by domestically produced articles.

Table 2.1.2-1 Five Phases of Economic Development and Industrialization Policy

Phase	Period	Economic Development Plans	Industrial Policy		Relevant Legislation
1	End World War II - 1960		Industrialization under government initiative		1953 - National Enterprise Act 1954 - Act on the Promotion of Industries
2	1961-71	1st NESDP (1961-66) 2nd NESDP (1967-71)	Encouragement of industrialization under private initiative	Modernization of productive equipment; Substitution of imported goods	1960 - Industrial Investment Promotion Act 1962 - Revision of above 1968 - Industrial Product Standards Act
3	1972-76	3rd NESDP		Promotion of export industries	1972 - Promotion of Investment Act 1972 (Declaration) - Alien Business Act - Alien Work Permit Act
4	1977-81	4th NESDP		Export industries favoured; Encouragement of agro-related industries	1977 - Promotion of Investment Act 1977 1978 - Alien Work Permit Act 1978 1979 - Revision of Industrial Product Standards Act
5	1982-86	5th NESDP		Aspiration toward quasi-industrialized nation	

Source: International Development Center of Japan

The 3rd phase coincided with the 3rd NESDP, from 1972 to 76, a period that was marked by multiplication of imports of capital goods as well as of raw material and intermediate products, brought about as a result of the encouragement given during the preceding period to industries manufacturing substitutes for imported goods, and which adversely affected the balance of payments. To overcome this setback, the Thai Government was obliged to modify its industrial policy to that of promoting exports.

The 4th phase lasted from 1977 to 81 - the period of the 4th NESDP. The promotion of export industries was continued, but was modified to give consideration to remedying the inequalities brought to the distribution of income by the preceding industrialization projects, and this NESDP was characterized by emphasis on rectification of the industrial structure, and on decentralization of industry toward the outlying regions.

Another sector promoted with emphasis during this phase was agro-industries, which were to contribute to acquiring foreign currency through utilization to best effect of the position already gained by the country for exportation of agricultural products.

The 5th phase is that of the 5th NESDP, which differs from the preceding Development Plans in background circumstances and basic concept: The discovery of natural gas in the Gulf of Siam opened up new prospects for industrialization based on heavy chemical industries, through utilization of this new natural resource for substituting hitherto imported capital and intermediate goods. With the 5th NESDP, Thailand aimed at the second stage of imported goods substitution, to aspire toward a quasi-industrialized nation, with production from manufacturing industry planned to exceed agricultural products in their contribution to GDP. The aim of the 5th NESDP is symbolized in the project for primary industry development in the Eastern Seaboard, featuring the promotion of heavy chemical industries.

2.1.3 The 6th NESDP and the National Policy for Industrial Deveopment*

The 6th NESDP Plan is characterized principally by the following 4 features:

(1) Keynote on readjustment and coordination: The aspiration towards extension in quantity and scale that had characterized the preceding 5-Year Plans has been replaced by advocacy of complementation in terms of quality. This is evidenced in such features as:

---

*) Source: Japanese Chamber of Commerce, Bangkok: Publication on outline of Thai economy (1986-87)

(a) Cautious management of national economy to govern the first half of the 5-year period, with priority accorded to adjusting economic balance

(b) Pursuit of a development pattern that will ensure enhancement of employment opportunities rather than of economic expansion

(c) Progress of production through diversification based on market research rather than by increased production of traditional articles

(d) Plodding, steady industrialization making best use of close-at-hand resources --agricultural products, abundantly available labour-- rather than directed towards heavy equipment industries

(e) Reliance laid on private enterprise rather than on Government initiative

(f) Priority accorded to projects of modest rather than large scale.

All the 10 Programmes taken up for implementation in the 6th NESDP --described further on-- emphasize without exception such realistic and practical aspects as enhancement of efficiency, improvement of quality, review of past work, effective participation. While such soberness was not absent from past 5-Year Plans, it is the first time that the keynote of adjustment has so thoroughly pervaded throughout the entire Plan.

(2) Plan worked out around programmes for solving problems calling for attention and not around individual projects drawn up by different Ministries, as was the case in past Plans. The 6th NESDP was drawn up by the National Economic and Social Development Board (NESDB, the central agency charged with planning), and hence, the guiding principle of coordination and unification by central authority underlies the entire Plan. The activities of different Government Ministries that tended in the past to lack coordination are to be properly harmonized for implementing the 6th Plan, to deal systematically with the envisaged problems calling for attention.

This evolution can be attributed to the successful unification of rural development programmes in the preceding 5th NESDP, when different development programmes, that had previously been administered independently by the Ministries of Agriculture, Public Health, Education and Interior were unified under the Rural Development Committee. Another representative instance of coordinated and unified programme initiated under the 5th NESDP is that for developing the Eastern Seaboard. This pattern of coordinated and unified approach has been applied throughout the 6th NESDP.

(3) Importance attached to the process of programme formulation through consensus of interested agencies: This is to facilitate the foregoing adjustment and unification, and thereby ensure smooth implementation of the different functions of economic readjustment. To this end, in the current 6th NESDP, the overall programme was matured in two steps: (a) Formulation of guidelines (October 1985), and (b) giving substance to the guidelines (September 1986).

(4) Flexibility given to the Plan and introduction of 4-year plan and annual programmes for the enhancement of the planning function of Ministries: In line with the concept of working out the Plan around programmes rather than projects, the respective Ministries have been charged with working out their own subprogrammes within the framework of the NESDP, with the co-operation of NESDB, and to link the resulting subprogrammes with the projects administered by the relevant Ministries.

The resulting projects will together constitute a 4-year plan of implementation, to be followed through in a series of annual programmes formulated to match the changes that will be seen in the economic environment, and to be endorsed by budgetary backing. The 6th NESDP is thus envisaged to be implemented with a larger portion of the planning function dispersed among the Ministries directly charged with its administration, and with close budgetary backing.

Consideration of the foregoing circumstances attending the 6th NESDP has led to the adoption of 2 major objectives, 3 strategies and 10 programmes to govern this plan, as indicated in Fig. 2.1.3-1.

2 Major Objectives

(1) Economic objective: To maintain an average annual growth rate of at least 5 percent, with emphasis accorded to (a) enhancing employment opportunities, and (b) striving for a more balanced distribution of income and of economical activity.

During the period to be covered, over 3.9 million newcomers are expected to join the labour force; also, the precarious trade balance and fiscal position calls for urgent remedy.

The annual economic growth of at least 5 percent referred to above is appreciably lower than the 7 percent attained during the 1st to 4th 5-Year Plans, but may still be considered quite enterprising on the current background of stagnant international business scene, and of the still lower level of economic growth actually achieved during the preceding 5th NESDP and by other ASEAN countries in recent years.

As indicated in Table 2.1.3-1, the current 6th NESDP envisages a firm growth of the manufacturing and construction industries, linked with recovering private investment and favourable progress of exports.

(2) Social objectives: To continue promotion of social development, for enhancing the quality of communal life, and for ensuring public order and equity, with due consideration accorded to compatibility with and to support of overall national development and conservation of desirable social values. The aim to be held in view for enhancing the quality of communal life is to satisfy basic human needs, and to diminish the disparity between urban and rural areas.

Table 2.1.3-1 Progress of Principal Economic Indices During the 4th - 6th National Economic and Social Development Plans

Unit: Percent, except as otherwise indicated

	4th NESDP (1977-81)*	5th NESDP (1982-86)**	6th NESDP (1986-91)***
1. Real economic growth (annual rates)			
(1) Gross domestic product	7.1	4.9	5.1
(2) Agriculture, forestry, fishery	3.5	2.9	2.9
(3) All other industries	8.5	5.5	5.7
(4) Manufacturing	8.7	5.6	6.6
(5) Mining	10.1	6.5	6.4
(6) Electric power	11.7	8.0	6.1
(7) Construction	9.5	3.6	5.1
(8) Services	8.2	5.6	5.3
2. Rise of consumer prices (annual rates)	10.6	2.7	2.3
3. Fiscal balance (In reference to nominal GDP)			
(1) Fiscal revenue	14.2	14.6	15.2
(2) Fiscal expenditure	17.5	18.2	17.3
(3) Fiscal deficit (budgetary)	3.3	3.7	2.1
4. Rate of population growth***	-	1.7	1.3
(1) Metropolitan district	-	2.7	2.5
(2) Provinces	-	1.4	0.8

*) Indices for 4th and 5th NESDP are values achieved.
**) Indices for 6th NESDP are target values set for the Plan.
***) Annual rate for ending year of relevant period.

Source: NESDB

3 Strategies, established with the view to achieving the 2 above Objectives

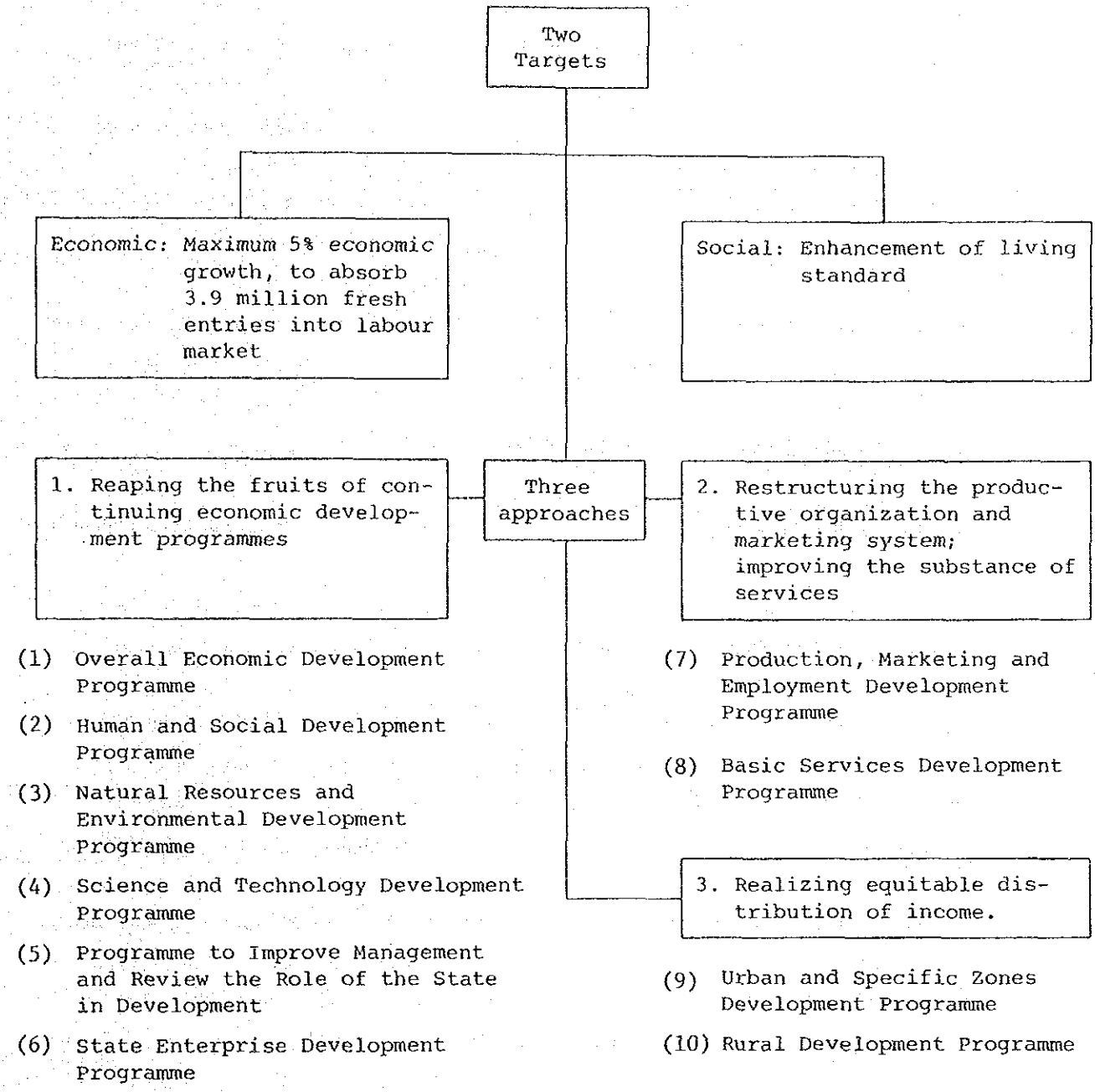
(1) Improving the efficiency of development: To raise the efficiency of the organization and procedures for implementing the development measures, in such terms as enhancement of personnel capability, better use of scientific and technical means, and reform of management in the public sector. In practical terms, this calls for such measures as readjustment of the roles played by Government and private sectors in the development efforts, and adoption in the public administration of once-through processing of a given subject matter.

This approach is to be implemented through the 6 Programmes indicated in Fig. 2.1.3-1.

(2) Reforming the industrial structure for production: To realize basic services --infrastructure serving industrial activities-- and an industrial structure for production that will ensure competitiveness in the international market for domestically manufactured products, and consequently higher income and increased foreign currency inflow, as well as new employment opportunities, through such means as diversification of product lines and new market outlets. The aim is to disperse risk, to reduce production cost, to improve the quality of products and services, and to accord higher importance to marketing activities.

This approach is to be implemented through the 2 Programmes also indicated in Fig. 2.1.3-1.

(3) Ensuring equitable distribution of the benefits of development: To have the fruits of the foregoing strategies shared as equitably as possible among the population, and consequently enhance the sense of social equity. The effect is envisaged to inure more particularly to the population in the lower income category both in urban and rural areas.



Source: "International Development Journal", published by The International Development Journal Co., Ltd.

Fig. 2.1.3-1 Basic Structural Concept of the 6th NESDP

This approach is to be implemented through the 2 Programmes further indicated in Fig. 2.1.3-1.

10 Programmes

The 10 Programmes for implementing the foregoing Objectives are indicated in Fig. 2.1.3-1, in relation to the relevant Objectives.*

Of these 10 Programmes, a relatively detailed presentation will be made on the 7th Programme covering production, marketing and end employment development; the remaining Programmes will be described only in outline.

(1) Overall Economic Development Programme

The key strategic tasks set for implementation during the 6th NESDP are:

(a) Elimination of the trade and fiscal deficits
(b) Promotion of savings
(c) Diversification of the industrial structure for production
(d) Enhancement of natural resources and environment
(e) Generation of new employment opportunities
(f) Increase of income; diminution of disparity between regions.

The broad targets set for managing the national economy are as set forth in Table 2.1.3-1. It is envisaged to direct the fiscal and financial policy towards reforming the industrial structure for production, so as to achieve an economic growth averaging at least 5 percent per year, to absorb the additional labour force, and to maintain a stabilized economy. Particular consideration is to be accorded to certain key lines of industry such as related to export and to tourism.

---

*) Source: Japanese Chamber of Commerce, Bangkok: Publication on outline of Thai economy (1986-87).

(2) Human, Social and Cultural Development Programme

This Programme aims at enhancing the quality of communal life and at developing human resources, through encouragement of participation in the Programme by private entities and individuals, paralleled by improvement in the efficiency of public services.

Priorities accorded in past Plans to expansion of basic social services --education, health, ...-- have brought their benefits, but have not served in eliminating social problems. For this reason, the 6th NESDP is planned around problems calling for solution --needs of community, of families, of the individual-- in contrast to the past approach from categories of social service --education, health, ...

(3) Natural Resources and Environmental Development Programme

This Programme aims at restoring the balance between development and conservation of natural resources and of the environment. The strategies adopted to this end are:-

a. To seek more efficient utilization of natural resources in the use of land, and thereby create new employment opportunities, through encouragement of reforestation for deriving additional economical benefit and for contributing to the number of water resources.

b. To seek improvement of land and enhancement of yield, through the establishment of a nationwide system for registering private land ownership --with issue of landownership certificates-- which should contribute to diminution of trespassing. Also, to establish a system for matching yield to fertility, and hence reduce soil deterioration.

c. To promote exploration and development of natural resources, through completion of nationwide aerial geophysical survey and

initiation of underground exploration in areas indicated to contain economically exploitable mineral resources. To promote more effective utilization of water resources, by encouraging underground water utilization at farm level, in areas where this is possible, and in other areas by promoting exploitation of small water sources for family and agricultural uses.

d. To prepare tools in the form of master plans and maps to serve in planning natural resources and environmental development --e.g. standard land maps for use by all Government agencies, master plans for national parks and animal preservation areas, for the economic utilization of coastal natural resources, and for studies to solve problems of dangerous substances.

e. To realize a unified system of administration governing natural resources and environment, through greater participation of local organizations.

(4) Science and Technology Development Programme

Little importance was given to the role of science and technology in the past; only in the 5th NESDP was this item taken up. In the 6th NESDP, it is accorded high priority, in view of its increasing weight for development. Envisaging a level equalling or surpassing the newly industrialized countries, the targets set are:

- To establish science and technology adequate as basis for enhancement of production and manufacturing capability.

- Utilize this science and technology to raise popular living standard, to improve competitiveness of industrial products in the world market, and to raise productivity as well as increase employment opportunities.

The means envisaged for attaining the above targets include the drawing up of effective programmes, transfer of technology from advanced industrial countries, and development of requisite human resources. Concrete measures representing these means comprise:-

a. To encourage science and technological systems that will permit their playing an increasing role in national development, through the promotion of branches that should serve as basis for future progress, and through development of human resources consistent with the future economic structure.

b. To support the development of science and technology, through establishment of the basic structure for their promotion, with amendment where necessary of current laws and regulations where they present impediments, and with development of the requisite institutional system.

c. To develop relevant human resources, through their effective utilization and capability enhancement, and through increased supply of qualified personnel in domains where they are in high demand.

d. To seek more effective national research and development, through the adoption of apposite policies; to support necessary research in domains calling for urgent development, such as genetic engineering, biotechnology, metallurgy and electronics, with allocation of requisite budget.

e. To enhance the effectiveness of technology transfer, so as to contribute to economic development and to enhancement of the domestic technological level.

f. To develop the requisite scientific and technical data and information system, with emphasis on establishing a network to usefully serve in planning national policies and in providing guidelines for planning

g. To support the role of the private sector in promoting science and technology, through tax incentives and other measures for encouraging investment in this domain.

(5) Programme for Improving the Administration of Development

Efficient administration of development programmes is of particular importance when the country is confronted with various restricting factors. In order for the Government to function fully and systematically, the 6th NESDP comprises a number of subprogrammes aimed at improving the administrative system. These subprogrammes aim at (a) eliminating redundancy and lack of co-ordination currently existing between different Government agencies, (b) improving the tools of development including communication, rules and regulations, and services provided by the State and (c) strengthening co-operation between the Government and private sectors.

(6) State Enterprises Development Programme

The number of State enterprises that exceeded 100 at one time was reduced to 70 by 1985, but even today the their scale and expenditures are considerable. The majority of these State enterprises employ personnel numbering more than 1,000. During the 5th NESDP, efforts were directed toward achieving higher self-support, through reductions in Government subsidy and adjustment of product and service prices, with target set at return on investment at least equalling the rate of interest borne by Government bonds.

In actuality, however, the total investment in State enterprises maintained their increase through the 5th NESDP --particularly in the energy, communications and transportation sectors (which came to represent 87 percent of the total investment at the end of the 5th NESDP)-- to almost double from ฿ 89 thousand million to ฿ 170 thousand million; the annual rate of investment increase averaged 20

percent during the 8 years to 1984.

Conversely, payments to the National Treasury have lowered from 73 percent of net profit during the 4th NESDP to 42 percent during the 5th. Delays in payment also have recently attained ฿ 6.5 thousand million, to create problems of cash flow.

A further problem calling for solution in State enterprises is that of human resources.

To resolve the foregoing difficulties confronting the State enterprises, a more efficient business management system requires to be introduced and their accounts rendered self-supporting; part of their operations should be transferred to private enterprise. Solution of the State enterprise problem should contribute very effectively to reducing the fiscal burden, in diminishing foreign debts and in enhancing competitiveness in the world market.

(7) Production, Marketing and Employment Development Programme

This Programme is designed to strengthen the production and marketing structures, to permit their more effective adjustment to the changing situation of world economy and trade. The problems besetting the background of this Programme are:

(a) Changes seen today in the world trade structure negatively affecting the country's exports of traditional agricultural products, and impairing foreign currency inflow as well as rural income: The traditional products are (i) rice, (ii) tapioca, (iii) sugar cane, (iv) tobacco, (v) rubber, and (vi) maize. These 6 products contribute 50 percent of total agricultural production and roughly 70 percent of agricultural product exports. As indicated in Table 2.1.3-2, production progressed during the 3rd to 5th NESDP's at dwindling rates of 7.1, 4.7, and 1.3 percent respectively, to drop further down to an

estimated figure of 0.5 percent during the 6th NESDP. What is more, the export prices of these products fell by 7.7 percent during the 5th NESDP, as indicated in Table 2.1.3-3.

The basic causes of the foregoing circumstances are:

a. A large number of countries becoming self-sufficient in food
b. Consumer taste in importing countries tending toward low-calorie diet, to diminish the demand for sugar
c. Decline in smoking for reasons of health
d. Technological innovations inducing conversion from natural to synthetic rubber
e. Protectionist trade policy on agricultural products introduced in the European Community members and other countries bringing about a decline of exports
f. Reactionary fall of primary product prices previously artificially sustained by price agreements.

Factors of basic nature such as enumerated above indicated that dependence can no longer be made on exports of traditional agricultural products, such as listed in Table 2.1.3-3.

(b) Levelling-off of industrial product exports to the U.S., the European Community and other industrialized countries. These difficulties are evidenced by the decline from 69 to 66 percent shown by exports to the U.S., the European Community and Japan between the 4th and 5th NESDP's. Another problem calling for attention is the narrow range of products to which key exports are currently limited: Packed tuna, artificial flowers and toys to the U.S., tapioca to Europe, rubber to Japan.

Table 2.1.3-2 Growth of Agricultural, Forestry and Fishery Sectors Between Beginning and End of 5-Year Plans

Unit: Percent

	3rd NESDP (1972-76)	4th NESDP (1977-81)	5th NESDP (1982-86)	6th NESDP (1986-91)*
1. Agriculture	6.0	3.9	3.1	2.6
(1) 6 Key products	(7.1)	(4.7)	(1.3)	(0.5)
(2) Other products	(4.6)	(2.4)	(6.8)	(6.0)
2. Stock farming	6.3	4.5	3.3	2.9
3. Fishery	3.4	3.7	1.6	2.3
4. Forestry	2.7	-2.6	0.5	-
5. Total	3.9	3.5	2.9	2.9

*) 6th NESDP: Values given for this period are estimates.

Source: NESDB

Table 2.1.3-3 Changes in Key Export Product Prices Between Beginning and End of 5-Year Plans

Unit: Percent change in reference to beginning of period

	3rd NESDP (1972-76)	4th NESDP (1977-81)	5th NESDP (1982-86)
Rice	36.2	15.0	-14.4
Sugar	31.9	9.8	-21.6
Tobacco	15.2	7.4	-1.0
Tapioca	13.6	11.8	-2.9
Maize	19.8	6.2	-2.4
Rubber	25.7	10.1	-1.9
Total	-	-	-7.7

Source: NESDB

(c) Unemployment, and in the rural areas, poverty: The number of wholly unemployed, which was 390 thousand in 1984, is expected to rise to 700 - 800 thousand by 1991. Added to this are the seasonally unemployed, estimated to have counted 3.8 million in 1984, and the partially unemployed counting 11 million. The problem of unemployment and underemployment affects particularly the agricultural population, and in terms of geographic distribution, the northeastern region.

To counter the foregoing problems, this 7th Programme sets forth three targets and four approaches. The three targets are:

(a) To reduce the trade and current account deficits respectively to 2.7 to 0.9 percent in reference to GDP by the end of the 6th NESDP, from the levels of 5.9 and 3.8 percent, respectively, recorded during the preceding 5th NESDP (see Table 2.1.3-4). This target is to be attained through annual increase of export earnings by 9.9 percent --a rate slightly higher then what was accomplished during the 5th NESDP-- and through similar increase of income from tourism by 7.4 percent.

(b) To alleviate unemployment, through creation of additional employment opportunities for 3.9 million during the 6th NESDP. The share of the agricultural sector is to be reduced from 70 to 65 percent, to shift those that are seasonally and partially unemployed to other sectors.

(c) To mitigate rural poverty and reduce disparities in income.

The four approaches are:

(a) Establishment of a production system oriented to sales --shift of concept from selling what is produced to producing what is sellable; enhancement of product quality

(b) Diversification of products --guidance to industry, including list of 199 promising export products, pertinent research and development, instruction and training in relevant technology.

(c) Market development --marketing research and development; marketing information system; diversification in quality/quantity/management/market; advertising; evaluation and follow-up

(d) Administrative reform for marketing and production --review of incentive policy; improvement of public information system.

The above four approaches are to be realized through 14 sub-programmes, to be financed by Government budget (Table 2.1.3-5).

In the light of the above four approaches, the foregoing three targets can be paraphrased as follows:

(a) Creation of new employment opportunities --the second target-- is to be brought about through diversification of products and restructuring the industry: To this end, the five categories of:-

- Agro-industry
- Machinery and electrical equipment manufacture, metalworking
- Services
- Regional industry
- Medium-size industry

are taken up as key industries to be promoted during the 6th NESDP.

(b) Increase of export earnings --the second target-- calls for diversification of agricultural products and for promotion of the agro and export industries. Other measures to be applied include improvement of pertinent public facilities and services to serve in reducing investment cost and enhancing export capability. Also, subsidies will support small and medium exporters in their marketing and information gathering activities.

Table 2.1.3-4 Trade Balance

Unit: Percent, except as otherwise indicated

	5th NESDP (1982-86)	6th NESDP (1986-91)*
1. Trade deficit		
(1) Average annual deficit (B million)	57.3	35.9
(2) In reference to Nominal Gross Domestic Product	5.3	2.7
2. Current account deficit		
(1) Average annual deficit (B million)	36.8	11.8
(2) In reference to Nominal Gross Domestic Product	3.8	0.9
3. Total exports (annual increase)		
(1) Nominal	9.0	9.9
(2) Real	8.8	7.4
4. Exports of goods (annual increase)		
(1) Nominal	7.6	10.7
(2) Real	8.0	8.1
5. Tourist revenue (annual increase)	12.2	7.4
6. Total imports (annual increase)		
(1) Nominal	3.3	9.3
(2) Real	3.3	4.5
7. Imports of goods (annual increase)		
(1) Nominal	2.9	9.5
(2) Real	3.3	4.6

*) 6th NESDP: Values given for this period are targets.

Source: NESDB

Table 2.1.3-5 Production, Marketing and Employment Development Programme

(7) Production, Marketing and Employment Development Programme

1. Measures for Producing to Sell	2. Measures for Diversifying Production	3. Measures for Developing Markets	4. Measures for Reorganizing Administrative Structure
(1) Programme for developing production oriented to sales	(1) Programme for diversifying articles produced	(1) Programme for diversifying exports	(1) Programme for aiding agricultural production
(2) Programme for readjusting agricultural production	(2) Programme for developing underdeveloped rural areas	(2) Programme for promoting tourism	(2) Programme for administrative reform and for revising the incentive scheme
(3) Development of technology for agricultural applications	(3) Programme for expanding metalworking industries		
(4) Development of agro-industries	(4) Programme for promoting provincial and small-factory industries		
	(5) Programme for improving tourist facilities and services		
	(6) Programme for conserving cultural arts		

(c) Promotion of tourist, finance, insurance and other service industries, including publicity in foreign countries, will contribute to increase of foreign exchange earnings and of jobs for urban educated unemployed. Other measures include conserving and developing regional tourist resorts and facilities, enhancing the quality of local handicrafts and souvenirs in tourist zones.

(d) Increase of family income and creation of jobs in rural areas is to be brought about through diversification of agricultural and industrial products. Extending the variety of crops for sale in market, expansion --or initiation as side-line-- of stock farming and forestry also will contribute to increasing family income.

(e) Diversification of industrial production will be focussed on industries that satisfy the criteria of:-

- Labour-intensive character
- Utilization of domestically available materials
- Application of unsophisticated techniques
- Contribution to alleviating rural poverty.

The resulting choice of industries is:

(i) Agro-industries
(ii) Machinery and electrical equipment manufacture, metalworking
(iii) Regional industries
(iv) Medium/small scale industries,

which industries are expected to contribute effectively to enhancement of income and employment. The measures to be adopted for promoting these industries comprise:

(i) Incentives
(ii) Instruction/training
(iii) Information service
(iv) Designation as strategic industry.

Agro-industries are classified into:-

- Industries utilizing rice, maize and similar crops available in abundance. Products will include starch and animal feed.

- Industries currently utilizing considerable quantities of imported agricultural products due to shortage of domestic raw material. These include processing of soybean, wood, cotton. The measures to be applied to this domain are:

(i) Enhancing the quantity and quality of domestic material sources, to lower dependence on imports
(ii) Strengthening the linkage between domestic supply by agriculture and demand by industry, to raise productive efficiency
(iii) Diversifying the products and enhancing value added in production.

- Industries currently hindered in development on account of insufficiencies in requisite technological capability or research and development, or in marketing. These include industries processing sunflower, vegetables, fruits, herbs, and also health foods. Acquisition of foreign technology through licences, and promotion of domestic research and development, as well as marketing efforts are called for in this domain.

- Machinery/electrical equipment manufacture and metalworking represent an industry towards which progress requires to be worked step by step. The first step is producing the final consumer article: This step has already largely been complet-

ed through encouragement of industries for supplanting imports.

The second step to be marked is machine component production: This can be accomplished when demand for the component comes to attain sizable lots. A typical instance is sewing machine needles: Even after clothing came to be exported, needles were wholly imported during a period; today they are manufactured domestically.

The third step to ensue thereafter is machinery manufacture, followed by metalworking. Electrical and electronic machinery represents another group of products also requiring to be manufactured. The three product lines of machinery, electric/electronic equipment, and metalworking are those promoted in the 6th NESDP.

In machinery, the most important product line is without doubt agricultural machinery --including engines for general use, pumps and accessories, tillers and cultivators. Other machines include engines for small lorries and for motor cycles, and television screens.

Upon some degree of progress being achieved in the above three product lines, the ensuing step calling for development should be casting and forging, which could well be the subject of the next 7th NESDP. The final step would be steelmaking --to come in the next 15 or 20 years.

(f) Increase of exports is to be sought by exploring the possibilities presented by selected 199 product groups picked out on the criteria of:-

- Ample utilization of domestically available raw materials
- Manufacture of products to serve other domestic industries, or else contribute significantly to generation of additional

employment opportunities.

The 199 product groups (see Table 2.1.3-6) are classified into the 14 categories enumerated below, comprising the number of product groups indicated between parentheses for each category:-

- Oil plants (6)
- Vegetables (33)
- Fibrous plants (7)
- Beans, cereals (5)
- Fruits (27)
- Other plants (11)
- Flowers (2)
- Seafood (23)
- Farm animals (3)
- Other animals (4)
- Herbs (27)
- Furniture (3)
- Wood (10)
- Industrial products (38).

The predominance of agricultural, forestry and fishery products in this list evidences the extremely high importance attached in the 6th NESDP to diversification of products in this domain.

The sales of these products is to be assisted by the Government in:-

- Marketing development, with supply of information on market demand, demanded quality/type/packaging, pricing, regulations
- Development/diffusion of products, packaging techniques, product evaluation
- Product quality improvement, follow-up studies for market share enhancement.

Table 2.1.3-6 Target Expansion Products and Marketing in 6th 5-Year Plan of NESDP

Classification		Names of goods
Oil plant	(6)	Sesami, sunflower, peanut, soybean
Food plant	(5)	Mung bean, white bean, a kind of bean, wheat, barley
Fabric plant	(7)	Kapok, reed, cotton, ramie, hemp, sorghum, red sorghum
Vegetables	(33)	Baby corn, garden pea, asparagus, tomato, bamboo shoot, cucumber, cowpea, onion, garlic, chili, ginger, white lettuce, lettuce, green lettuce, a kind of lettuce (pak guang tung), genus Loranthus (pak ka naa) Ipomoea, turnips, cabbage, large variety of cucumber, dishcloth gourd, momordica, yam bean, pumpkin, waxgourd, taro, sweet potato, a kind of mushroom, other kinds of mushroom, potato, celery, parkia
Fruits	(27)	Pomelo, oranges, mangosteen, papaya, mango, lemon, cashew nut, durian, lichee, grape, longan, banana, rambutan, custard-apple, water melon, rose apple, guava, jack fruit, a species of jackfruit, santol, monkey banana, a kind of banana, sapodilla, lanset, a similar species of lansat, strawberry
Others	(11)	Cocoa, job's tears, tobacco, coffee, betal palm, lotus seed, melon seed, linseed, nut grass, animal grass, animal beans
Flowers	(2)	Orchids & other kind of flowers
Herbs	(27)	Bastard cardamon, cardamon, betel pepper, pepper, species of herbs, yielding licorice, a species of herbs (tien gled hoi), cloves, long pepper, nutmeg tree, a species of tamarind, turmeric, alien ringworm bush, a species of herbs, a species of turmeric, a species of herbs (Gra plouw), a species of herbs (prai), a species of herbs (borapet), diospyros, safflower, thom apple, a herb of genus Hydrocotyle, a species of herbs, red roselle, a species of herbs (geg huey, dry its flowers and serve as green tea), parsley
Fishery	(23)	Sea-prawn, weed, tuna, a king of shells, ark shell, sea mussel, oyster, goby fish, squid, large prawn, snake-head fish, catfish, carp, a kind of fish whose origin is in Japan (pla nin), gourami, a freshwater fish of the genus Pangasius, eel, jelly fish, sankefish mullet, a kind of sea fish (pla garang), a kind of fresh-water fish (pla grabuog), abalone
Livestock	(3)	Meat-breed of ox and cow, water buffalo, goat-sheep
Others	(4)	Honey, snake, crocodile, wild boar
Furniture	(3)	Bamboo, pera rubber, rattan
Rapidly growth plants	(10)	A kind of lead tree (grathin-yak), another kind of lead tree (grathin-narong), a kind of pine tree, mangrove, casuarina, a king of pine tree large margosa, Sor, mahogany, the otaheits goose-berry
Industrial goods	(38)	Shoes, leather goods, toys, precious stone, & ornament, ready-made garment, canned & frozen aquatic animals, fresh & canned vegetable, & fruits, furniture & parts, electric circuit, plastic products, rubber products, steel pipe & tools, flowers & artificial flowers, wooden tools products, tiles, aluminium structures & parts, eye-glasses lense., automobile spare parts, bearings, electronic equipment, noodle, ethyl alcohol, wooden contraction equipment, air conditioner & equipment, Television & spare parts, ornament, gold with metal bowl material, packing industries, pulp, medical & cosmetic from herbs, handicraft souvenir, small size of agri-cultural equipment, vegetable & preserved fruits, flour & sugar products, dairy products, fruits juice, industrial engine, molding industry, agricultural engine parts

Source: NESDB

(8) Basic Services Development Programme

The term "basic services" covers public services --electric power, water and other utility supplies, refuse collection-- transportation, communication, and energy. Since the 1st NESDP, roughly 2/3 of the Government budget for development has been directed to this domain, to contribute largely to enhancing popular income and to creating employment. The improvements brought thereby to the basic services of the nation have not only contributed to development of production, marketing and exports, but also to dissemination of the benefits of development to outlying regions.

The domains that saw significant progress during the 5th NESDP were, notably:-

- Energy supply
- Public services
- Roads
- Aerial transportation.

There still however remained room for improvement and extension in such domains as:-

- Land and inland water transport
- Telephone system,

to the extent of presenting impediments to domestic and international trade.

The approaches adopted in the 6th NESDP to fill these remaining insufficiencies, and hence contribute to development of production and marketing, and to dissemination of the benefits of development to outlying regions --which are the original objectives of improving the basic services-- are:

(a) To let internationally prevailing level be attained in the quality of basic services requisite for readjustment of the national economic, trade, and touristic structure, and for development of urban, provincial and designated new economic zones; to ensure a co-ordinated system of services. Emphasis is to be laid in extending the service networks in keeping with the level of townplanning, to serve as catalyst in the dissemination and extension of economic activity to rural areas.

(b) To revise the structure of rate charged for the basic services, to ensure cost recovery and financial independence, with emphasis laid on equitableness of the rate structure --e.g. capital and running costs of services borne insofar as possible by direct beneficiaries. Direct State subsidy is to be discontinued for urban areas, with the exception of those specifically designated for assistance. The target to be held in view in revising the rate structure is to strike a balance between efficient utilization and effective development of resources. Charges for the use of main motorways are to be set with account taken of expected further progress of their utilization.

(c) To plan investments for extending the basic services envisaging transformation of management to a more business-like system, and with consideration given to ensuring equitable distribution of burden between central Government, State-owned enterprises, Provincial Governments, and private enterprises. Diminution of the burden on Government is to be sought by encouraging private investment in this domain; enhancement of the quality of service furnished is to be promoted through competition. Laws and regulations are to be revised as necessary for encouraging the participation of private initiative.

(9) Urban and Specific Zones Development Programme

Development of the economic infrastructure in metropolitan and outlying areas, as well as in the new economic zones is an essential strategy for ensuring future development to absorb the expanding urban population and to provide requisite additional employment opportunities. Urbanization is the inevitable consequence of the increasing weight coming to be carried by industry and services in Thailand's economic structure, with progress of industrialization. Unchecked development in this direction, however, could bring about excessive concentration of economic activities in the metropolitan district, to cause unwarrantable congestion and resulting economic loss.

To remedy this trend, the 6th NESDP has adopted a strategy of decentralization towards outlying regions, through development of provincial urban centres and of new economic zones. This strategy is expected to alleviate metropolitan congestion and permit more balanced economic development. Even with these measures of decentralization, however, the metropolitan district is expected to grow in population by 1 million, to reach 9.3 million by 1991, to rank among the 15 largest cities in the world.

(10) Rural Development Programme

This Programme is the most important among those taken over from the preceding 5th NESDP, with its aim of enhancing the general quality of communal life though increased income gained by the rural population and improved social services provided to them, and to permit more prompt and apposite actions to be taken in the face of the changing economic and environmental conditions.

The approaches adopted to attain the foregoing objectives are:

(a) To continue the area approach --i.e. seeking solution of problems through means matched to local circumstances and based on popular demand, through delegation of power to provincial authorities to permit their determining matters at their own level.

(b) To direct Government resources mainly towards the more underdeveloped and intermediate level areas (respectively comprising 5,737 and 35,514 villages), and to cover the progressing areas (11,621 villages) by encouragement of private investment.

(c) To emphasize co-ordination among government agencies as well as with and among the people; to seek enhancement of production, income and employment opportunities through emphasis on utilization of technology matched to particular local conditions.

(d) To encourage self-determination, by promoting the participation of the people and popular bodies in the making of decisions for solving communal problems.

The targets envisaged for the foregoing approaches are:

(a) Economic: To continue the efforts directed during the 5th NESDP towards reducing rural poverty, with priority accorded in the 6th NESDP to attaining self-sufficiency for food in the underdeveloped rural areas supporting a population amounting to 10 million; to promote enhancement of productivity, income and employment opportunities, through diversification of crops, application of apposite technical procedures in order to improve product quality and to reduce production cost; also, to consider creating employment opportunities in domains other than agriculture.

(b) Social: To work towards establishing self-reliance by eliminating areas lacking in requisite social services, and by diminishing disparities between regions --with emphasis on ensuring basic social services indispensable for living and for occupational security. In determining the form of participation by the private sector and in deciding the pattern of life such as the housing environment, to encourage self-determination by the relevant local community based on the criterion of providing the basic needs for communal life.

(c) Security: To solve problems of rural security, through harmonization of the national security policy with systems and processes of economic and social development.

The Thai government appears to be well aware that successful achievement of the 6th NESDP is contingent upon realizing industrialization, with practical solutions sought for the detractive consequences occasioned --on account of the still unfirm economic infrastructure-- in the course of industrial progress since the 1960's, including such setbacks as aggravation of trade balance, of disparities in the regional distribution of industrialization and of per capita income, insufficient absorption of labour by industry, urban overpopulation and pollution.

2.2 Current Status and Future Prospects of Thai Manufacturing Industry

2.2.1 Past Progress of Thai Manufacturing Industry and Changes Seen in Industrial Structure

The past changes in the national policy for promoting industrialization, presented in the preceding Section 2.1, have been reflected in actual progress of the Thai manufacturing industry and in the changes seen in the industrial structure, as discussed in what follows. This should provide an insight into the bases on which industrialization has been promoted, and into the resultant level which has been attained today.

The progress seen during the past 15 years in the total value added as contributed by the different categories of manufacturing industry is presented in Table 2.2.1-1. The figures in this Table substantiate the effective contribution to progress of national economy provided by the manufacturing industry, as observed in the preceding Section. The observation will here be further advanced to an examination of the particular categories that contributed most to progress of industrialization.

It is revealed from Table 2.2.1-1 that, in 1960, 60 percent of the total value added by all categories of industry was contributed by the 3 product lines of foodstuff, beverage and tobacco manufacture, but that this share of the 3 categories had lowered to 44 percent in 1970, to 31.5 percent in 1980, and further to 29.6 percent in 1985 (this last value being a preliminary estimate). Foodstuff alone --which used to be the staple national product-- contributing 42 percent in 1960, dropped to 15 percent in 1985. In contrast, textiles steadily rose their share during the same period from 4.6 to 15.1 percent, and electrical equipment from 0.6 to 2.0 percent.

Grouping the different categories of manufacturing industry in the product categories of (a) consumer goods, (b) intermediate goods, and (c) capital goods, the total share of consumer goods production diminished from 72.4 to 44.9 percent between 1960 and 1885, which was offset by an increase

from 20.1 to 38.4 percent of intermediate goods, and from 6.7 to 13.7 percent of capital goods. Of particular note is the marked shrinkage of the consumer goods share from almost 73 to less than 45 percent, to fall almost abreast of the rising intermediate goods.

Table 2.2.1-1 Progress of Shares Contributed by Different Categories of Manufacturing Industry

Unit: B million, normalized to 1972 prices

	1960		1970		1980		1985*	
I Consumer goods category	6,071	72.4%	12,384	53.1%	26,988	44.5%	35,425	44.9%
Foodstuff	3,528	42.1	4,798	20.6	8,598	14.2	11,926	15.1
Beverage	654	7.8	3,035	13.0	5,890	9.7	7,044	8.9
Tobacco	849	10.1	2,401	10.3	4,601	7.6	4,438	5.6
Apparel	631	7.5	1,093	4.7	5,566	9.2	9,075	11.5
Leather goods/footwear	26	0.3	232	1.0	315	0.5	528	0.7
Furniture	100	1.2	308	1.3	353	0.6	548	0.7
Printing/publishing	283	3.4	517	2.2	1,665	2.7	1,866	2.4
II Intermediate goods category	1,689	20.1	7,506	32.2	23,768	39.2	30,315	38.4
Textile	386	4.6	2,157	9.2	8,839	14.6	11,931	15.1
Wooden products	338	4.0	735	3.2	829	1.4	1,024	1.3
Paper products	13	0.2	171	0.7	959	1.6	1,180	1.5
Chemical products	562	6.7	1,478	6.3	5,035	8.3	6,969	8.8
Petroleum products	1	0.0	1,412	6.1	3,108	5.1	3,112	3.9
Rubber products	67	0.8	374	1.6	1,611	2.7	1,407	1.8
Non-metallic/mineral products	322	3.8	1,179	5.1	3,387	5.6	4,692	6.0
III Capital goods category	559	6.7	2,883	12.4	8,493	14.0	10,793	13.7
Base metals	29	0.3	392	1.7	710	1.2	673	0.9
Metal products	57	0.7	439	1.9	632	1.0	831	1.0
Machinery	38	0.5	534	2.3	1,102	1.8	1,550	2.0
Electric equipment	48	0.6	318	1.4	1,237	2.0	1,546	2.0
Transport equipment	387	4.6	1,200	5.1	4,812	7.9	6,193	7.8
IV Other categories	68	0.8	547	2.3	1,348	2.2	2,388	3.0
Total	8,389	100.0	23,320	100.0	60.597	100.0	78,921	100.0

*) 1985: Preliminary estimates

Source : NESDB

The foregoing observations well characterize the changes seen in the industrial structure accompanying the development of Thai industry. The observations will be further advanced in what follows to considerations of the factors that contributed to bringing about the progress and the changes in industrial structure, with a discussion of the basic structure of the Thai manufacturing industry.

2.2.2 Basic Structure of Manufacturing Industry

An aspect of the basic structure of the Thai manufacturing industry can be gathered from the number of Registered Factories as published by the Ministry of Industry. The figures are reproduced in Table 2.2.2-1 for the period from 1947 to date. During this period, the total number of Registered Factories increased from 1,154 to 86,165 as of end 1984. Of this number, 39,626 factories are classified in Table 2.2.2-2 according to the scale categories adopted in the Narongchai Report*, where scale factories employing 200 or more are classified as "large", and the lesser factories are further classified into "cottage" -- employing 1-9 --, "small" -- 10-49 --, and "medium" -- 50-199 --. Small and medium scale factories represent an overwhelming portion of 98.4 percent, of which 25,342 are cottage scale factories, representing 64 percent of the total number, followed by 11,532 (29.1%) small scale factories, and by medium scale factories numbering 2,111 (5.3%); large scale factories number only 641 (1.6%). The predominant portion of petty industry factories is thus evidenced.

In respect of providing employment opportunities, however, the small and medium scale factories provide work for only 58.8 percent of the total employed labour force, whereas the 641 large scale factories employ 373,014 --41.2 percent of the total labour force. Regrouped into (a)

---

*) Naronchai Report: Narongchai Akrassanne: "Small and Medium Scale Industries in Thailand (1982).

cottage/small scale and (b) medium/large scale factories, the smaller scale group (a) representing 93.1 percent in number of factories employs only 37.9 percent of the labour force, while the large group (b), representing 6.9 percent in number of factories, employs 62.1 percent of the working population. In terms of invested capital (fixed assets), the small scale group (a) accounts for 24.0 percent, and the larger scale group (b) 76.0 percent. Upon calculating the capital-labour ratio* evidence is obtained of the tendency of this ratio to lower with diminishing scale of factory, which is indicative of the labour-intensive character of the Thai manufacturing industry.

---

* Capital-labour ratio : (Invested capital)/(Number of employees)

Table 2.2.2-1 Number of Registered Factories

Year	No. of Registered Factories
1947	1,154
1950	1,561
1953	2,006
1955	2,528
1957	10,409
1960	16,007
1961	23,062
1962	24,557
1963	27,336
1964	28,756
1965	38,459
1966	41,081
1967	43,420
1968	45,318
1969	47,644
1970	50,535
1971	53,000
1975	44,135
1977	49,817
1978	60,296
1980	74,225
1982	86,015
1984	86,165

Source: Factory Control Division,
Ministry of Industry

Table 2.2.2-2 Structure of Manufacturing Industry -- As of 1984

Scale Category (Number of employees)	Number of Factories	%	Number of Employees	%	Invested Capital B million	%
Small/medium	38,985	98.4	531,737	58.8	83,108	45.7
Cottage (9 and less)	25,342	64.0	122,726	13.6	12,837	7.0
Small (10 - 49)	11,532	29.1	219,969	24.3	30,895	17.0
Medium (50 - 199)	2,111	5.3	189,042	20.9	39,376	21.7
Large (200 and more)	641	1.6	373,014	41.2	98,553	54.3
Total	39,626	100.0	904,751	100.0	181,661	100.0

Source: Data on Registered Factories, Industrial Provincial Office, MOI.

The 39,626 factories given in Table 2.2.2-2 will be further classified according to product line. The number of factories in each product line are cited in Table 2.2.2-3, for the 26 product lines into which division is made of the industry in the Thai Industrial Standard Classification. It is seen that, of the 38,985 factories in the small/medium scale group, the product line representing the highest number of factories is that of foodstuff (7,962 = 20.4%), followed by general machinery (5,057), metal products (4,686), wood and wooden products (3,034), transport machinery (2,196), motor repairing (2,174), printing and publishing (2,060), plastic products (1,445), non-metallic products (1,438), clothing (1,403). The above 10 leading product segments account for roughly 80 percent of the number of factories. Classified by product categories, 13,517 factories (representing 34.7%) in number manufacture consumer goods, 9,543 (24.5%) intermediate goods, 13.361 (34.3%) capital goods, and 2,564 (6.6%) other products, of which 2,174 are motor repair shops. It is notable that approximately the same number of factories produce consumer and capital goods. It may also be noted that in the large-scale size category, there are more than 100 factories producing textile, other relatively well represented product lines being clothing, tobacco, transport machinery, metal, chemical and rubber products, and electrical appliances.

The small/medium scale category is characterized by an approximately 40 percent share of foodstuff, wood/wooden products (largely sawmills), furniture, ceramic/non-metallic/mineral and rubber products/tobacco, and leather goods, most of which process materials produced domestically. Other product lines well represented include general machinery, metal products, transport machinery, and motor repair, these product lines being mostly associated with metalworking and machinery manufacture, and constitute roughly 40 percent of the number of factories. The steady rise seen of the share contributed by the capital goods category (product lines associated with metalworking, machinery) substantiates what was noted in the preceding Section (1), but their absolute total production is still relatively small, and can be considered still to be in the course of development.

Table 2.2.2-3 Numbers of Registered Factories in Each Product and Size Category -- As of 1984

Size Category	Cottage	Small	Medium		Total Med./Small	Large	Total
	(-9)	(10-49)	(50-99)	(100-199)	(10-199)	(200-)	
I. Consumer goods category	8,189	4,615	459	254	13,517	261	13,778
Foodstuff	5,270	2,382	200	110	7,962	114	8,076
Beverage	78	62	9	24	173	19	192
Tobacco	64	173	36	22	295	36	331
Apparel	210	988	138	67	1,403	55	1,458
Leather/leather goods	161	97	7	6	271	7	278
Footwear	107	94	6	4	211	9	220
Furniture	695	399	39	9	1,142	9	1,151
Printing/publishing	1,604	420	24	12	2,060	12	2,072
II. Intermediate goods category	4,970	3,670	607	296	9,543	250	9,793
Textile	342	693	121	80	1,236	119	1,355
Wooden products	1,774	1,017	184	59	3,034	19	3,053
Paper products	279	118	23	16	436	16	452
Chemical products	393	414	80	36	923	25	948
Petroleum products	10	9	5	1	25	4	29
Rubber products	401	249	50	40	740	25	765
Plastic products	930	462	35	18	1,445	9	1,454
Ceramic products	58	129	30	10	227	10	237
Glass products	4	22	9	4	39	6	45
Non-metallic/mineral products	779	557	70	32	1,438	17	1,455
III. Capital goods category	10,279	2,660	282	140	13,361	116	13,477
Base metals	29	93	26	18	166	9	175
Non-metallic products	194	102	7	5	308	4	312
Metal products	3,651	915	80	40	4,686	30	4,716
Machinery	4,206	776	58	17	5,057	9	5,066
Electric equipment	524	283	49	26	882	23	905
Transport equipment	1,644	463	58	31	2,196	37	2,233
Precise/chemical equipment	31	28	4	3	66	4	70
Other categories*	1,906	587	56	17	2,564	14	2,578
Total	25,342	11,532	1,404	707	38,985	641	39,626

*) Other categories: Include 2,182 motor repair shops

Source: Data on Registered Factories, Industrial Provincial Office, MOI.

The above fact is further evidenced by the predominant number of small scale factories constituting this category of industry: The 8 product lines in metalworking and machinery manufacture (basic iron and steel, nonferrous, metal products, general machinery, electrical equipment, transport machinery, precision/scientific equipment, motor repair) with 15,659 factories are distributed in number among 12,026 cottage scale (76.8%) and 3,047 small scale (19.5%) factories, these two scale groups accounting for 96.3 percent of the total number of factories; the medium scale factories number only 462 (3.0%) and large scale 124 (0.8%). The medium scale factories, still represent only an extremely meagre fraction, when it should constitute the nucleus in the case of a fully modernized industrial structure that relies extensively on subcontracted production by factories in this scale category. The consumer and intermediate goods categories fare better in this respect, with 713 and 903 medium scale factories representing 5.2 and 9.2 percent, respectively, of the total numbers of factories. The same trend is seen with the large scale factories, which represent only 0.8 percent in the metalworking/ machinery product lines, compared with 1.9 percent in the consumer goods, and 2.6 percent in the intermediate good categories.

The foregoing observations on the current basic industrial structure are directly indicative of the improvements required to be brought to this structure.

The following Table 2.2.2-4 presents in detail the structures of the industries in:-

- Foodstuff line, constituting the staple industry
- Three major product lines in the capital goods category

Table 2.2.2-4 Detailed Number of Registered Factories in Major Product Lines -- As of 1984

(Foodstuff)

Product Line	Number of Factories	%
Tapioca etc.	3,634	45.0
Pelletized essences	730	9.0
Ice manufacture	661	8.2
Bakery	279	3.5
Artificial dyestuff, flavouring	206	2.5
Meat	203	2.5
Biscuits etc.	162	2.0
Oil/fat	159	2.0
Cereal/rootcrops	151	1.9
Preserves	88	1.1
Other foodstuffs	1,803	22.3
Total	8,076	100.0

(Metal Products)

Product Line	Number of Factories	%
Architectural metal fittings	1,378	29.2
Small metal fittings	983	20.8
Springs, washers, rivets, metal piping etc.	596	12.6
Pressed metal products	391	8.3
Metal containers	347	7.4
Surface-coated metal products	322	6.8
Metal furniture	259	5.5
Unsheathed wiring/cabling etc.	107	2.3
Steel knives/tools etc.	101	2.1
Pipe fittings	92	2.0
Other Products	140	3.0
Total	4,716	100.0

(General Machinery)

Product Line	Number of Factories	%
Industrial machinery/components repair	3,109	61.4
Other non-electric machinery/ components/repair	653	12.9
Agricultural machinery/ components/repair	595	11.7
Special machinery/components/ repair	283	5.6
Metalworking machinery/ components	126	2.5
Metalwork tooling/jigging	75	1.5
Machine tools/components/repair	69	1.4
Office equipment/components/ repair	68	1.4
Woodworking machinery/ components/repair	33	0.7
Metal processing machinery/ components/repair	27	0.5
Other machinery	28	0.5
Total	5,066	100.0

(Transport Machinery)

Product Line	Number of Factories	%
Motor car/trailer components	1,098	49.2
Motor car/trailer manufacture/ repair	406	18.2
Motor cycle/bicycle manufacture/ repair	233	10.4
Motor cycle/bicycle components	181	8.1
Ship construction/repair	162	7.3
Ship fittings	94	4.2
Other products	59	2.6
Total	2,233	100.0

Source: Data on Registered Factories, Industrial Provincial Office, MOI.

The next consideration is the geographic distribution of manufacturing industries. The distribution of Registered Factories is presented in Table 2.2.2-5, in terms of the numbers of factories registered in Bangkok City, in the Bangkok Metropolitan District, in the 5 provinces surrounding the Metropolitan District, and outlying regions, and separately for the different factory scale categories.

It is seen that concentration around the Metropolitan District is the most prominent for the larger scale factories: The percentage of factories located in this region is 66.3 percent (931 in number) for factories employing 50 - 99, 68.7 percent (486) for those employing 100 - 199, and 72.4 percent (641) for large scale factories of over 200 employees. This concentration is less marked for the smaller scale factories: 63.5 percent (7,328) for factories of 10 - 49 employees, and 54.7 percent (13,854) for those employing 9 or less.

It is, however, to be noted that the relatively larger scale factories are more numerous in the surrounding provinces than within Bangkok City: 269 against 195 for above 200 employees, 268 against 218 for 100 - 199 employees. This is attributable to the increasing difficulty encountered in locating these factories within the City, on account of crowding and of pollution problems, as well as to the government policy of encouraging the dispersion of factories to the suburbs.

In the outlying regions, on the other hand, the predominant percentage of factories is of small scale: 69.4 percent employ 9 or less, 25.4 percent from 10 to 49, and only 4.2 percent 50 to 199, to compare with the corresponding figures of 60.1, 31.8 and 6.1 percent for the Metropolitan District.

To summarize, the basic geographical distribution of industry is characterized by a high concentration in and around Bangkok Metropolis.

Table 2.2.2-5 Geographical Distribution of Registered Factories of Different Scale Categories

Factory Scale Category	Metropolitan District	Bangkok City	Surrounding Provinces*	Outlying Regions	Total
Cottage (-9)	13,854 (60.1)	12,188 (63.8)	1,666 (42.1)	11,488 (69.4)	25,342 (64.0)
Small (10 - 49)	7,328 (31.8)	5,933 (31.0)	1,395 (35.3)	4,204 (25.4)	11,532 (29.1)
Medium (50 - 199)	1,417 (6.1)	794 (4.2)	623 (15.8)	694 (4.2)	2,111 (5.3)
(50 - 99)	931 (0.4)	576 (3.0)	355 (9.0)	473 (2.9)	1,404 (3.5)
(100 - 199)	486 (2.1)	218 (1.2)	268 (6.8)	221 (1.3)	707 (1.8)
Total smaller (9 - 199)	22,599 (98.0)	18,915 (99.0)	3,684 (93.2)	16,386 (98.9)	38,985 (98.4)
Large (200 -)	464 (2.0)	195 (1.0)	269 (6.8)	177 (1.1)	641 (1.6)
Total	23,063 (100.0)	19,110 (100.0)	3,953 (100.0)	16,563 (100.0)	39,626 (100.0)

*) Surrounding provinces: Samutpraharn, Nonthaburi, Pathumthani, Nakhonpathom, Samutsakorn

Source: Data on Registered Factories, Industrial Provincial Office, MOI.

The progress seen in the number of Registered Factories --given in Table 2.2.2-1, is presented in further detail in Table 2.2.2-6 for the last 5 years (1979-84), to give the figures separately for the different product lines. The increase seen in the number of Registered Factories during this period is 16,104, representing an average annual addition of 3,000 plus new factories.

Table 2.2.2-6 Progress in Number of Registered Factories in Different Product Lines -- 1979 to 84

	Product Line	Increase During 5-Year Period	Annual Growth (%)
I	Consumer goods category	5,089	48.0 %
	Foodstuff	2,343	31.9
	Beverage	89	78.0
	Tobacco	34	24.1
	Apparel	1,121	303.0
	Leather/leather goods	155	96.3
	Footwear	133	137.1
	Furniture	724	97.1
	Printing/publishing	490	30.0
II	Intermediate goods category	3,468	42.6
	Textile	406	36.5
	Wooden products	888	29.6
	Paper products	181	63.3
	Chemical products	178	19.5
	Petroleum products	3	13.6
	Rubber products	186	30.3
	Plastic products	541	52.3
	Ceramic products	93	47.9
	Glass products	7	15.2
	Non-metallic/mineral products	985	106.6
III	Capital goods category	6,060	59.9
	Base metals	36	19.9
	Non-ferrous	70	26.9
	Metal products	2,195	62.5
	Machinery	2,335	59.2
	Electric equipment	366	63.6
	Transport equipment	1,035	65.4
		23	35.9
IV	Other categories*	1,487 (1,380)	92.2 (114.0)
	Total	16,104	53.0

*) Other categories: Include 2,182 motor repair shops

Source: Data on Registered Factories, Industrial Provincial Office, MOI.

The increase, both in absolute number and in annual growth, is marked in the product lines associated with metalworking and machinery manufacturing, metal products, general and transport machinery (those taken up in Table 2.2.2-3), together with motor repairing, as well as those manufacturing goods being exported in increasing quantity --clothing, furniture, plastic and nonferrous- mineral products. The metalworking/machinery factories are increasing rapidly both in absolute number and in annual growth rate, to evidence the creation of a sound substratum on which the capital goods industry should be based. The small average size of these factories, however, will call for particular measures to be adopted to enhance the level of their equipment, production techniques, manufacturing technology and product quality, to assist them in constituting a firm basis on which to establish a modern industrial system relying on subcontracted manufacture.

Finally, a comparison is presented in Table 2.2.2-7 between the manufacturing and agriculture/forestry/fishery industries, in terms of employment, production and productivity. It is seen that the agriculture/forestry/fishery industries --constituting the mainstay of GDP-- still provided in 1980 72.3 percent of employment, but at productivity markedly lower than in the manufacturing sector employing only 5.6 percent of the working population, which is rapidly raising productivity, and enlarging the gap with the agriculture/forestry/fishery industries.

However, the high productivity presented by the manufacturing sector, viewed from the standpoint of providing employment opportunities, means that it provided correspondingly fewer jobs: Industrialization has so far failed to absorb the redundant labor burdening the rural areas, which have consequently not been enabled to raise agricultural productivity. Industrialization is a necessary condition for the development of Thai economy, but the sufficient condition of its contributing to modernization of the agricultural sector must not be overlooked.

The above observation provides a striking illustration of the progress currently taking place in the manufacturing industry.

Table 2.2.2-7 Comparison of Productivity between Manufacturing and Agriculture/Forestry/Fishery Industries

(Figures in parentheses: Percentages for relevant year)

	Employment (1,000 persons)			GDP* (฿ million)			Productivity = GDP/Total labour force (฿ 1000)		
	1960	1970	1980	1960	1970	1980	1960	1970	1980
Agriculture/forestry/fishery	11,332 (82.4)	13,202 (79.3)	16,821 (72.3)	28,227 (40.2)	48,332 (32.2)	72,784 (24.9)	2,491	3,661	4,327
Manufacturing	470 (3.4)	683 (4.1)	1,308 (5.6)	8,389 (12.0)	23,320 (15.5)	60,597 (20.7)	17,849	34,143	46,328
All industries	13,750 (100.0)	16,652 (100.0)	23,281 (100.0)	70,139 (100.0)	150,092 (100.0)	292,852 (100.0)	5,101	9,013	12,579

*) GDP: Values normalized to 1972 prices.

Source : "National Account in Thailand", NESDB

2.2.3 Current Status of Principal Manufacturing Industries*

In what follows, a further detailed analysis will be made of the current status of the industries in the 12 major product lines related to:

- 2.2.3.1 Foodstuff
- 2.2.3.2 Textile
- 2.2.3.3 Electric/electronic equipment
- 2.2.3.4 Motor cars
- 2.2.3.5 Motor cycles
- 2.2.3.6 Shipbuilding
- 2.2.3.7 Non-ferrous metals
- 2.2.3.8 Iron and steel
- 2.2.3.9 Chemicals
- 2.2.3.10 Petroleum refining
- 2.2.3.11 Pulp/paper.
- 2.2.3.12 Ceramics

2.2.3.1 Foodstuff

The foodstuff processing industry, developed hitherto in close association with popular dietary customs, has in recent years directed efforts also toward export, resulting in rapid increases in the exportation of such products as sugar, tinned tuna, fruit and other foods; and foodstuff today counts among the key export products of the country (Table 2.2.3-1). The staple products are currently: Condiments, edible oils, meat products, tinned food, confectionery, dairy products, alcoholic and non-alcoholic beverages, and tobacco. This product line contributes the largest share to GDP, and is further being accorded particular encouragement by the Government, for its providing an effective outlet for agricultural products, and for its promise of producing articles that are competitive in the international market. Instances of products envisaged are alcohol from molasses, condiments from tapioca, and animal food stock.

---

*) Source: Japanese Chamber of Commerce, Bangkok: Publication of outline of Thai economy (1986-87).

Table 2.2.3-1 Key Foodstuff Exports

Unit: ฿ million

Product \ Year	1980	1981	1982	1983	1984	1985
Tapioka products	14,887	16,446	19,752	15,387	16,600	14,969
Sugar	2,975	9,572	12,932	6,338	5,222	6,247
Tobacco leaves	1,371	1,739	2,546	1,791	1,638	1,580
Sea-food tins	1,619	2,140	3,186	3,962	5,858	7,347
Pineapple tins	1,432	2,039	1,993	1,871	2,846	3,292
Total	133,197	153,001	159,728	146,472	172,237	193,366

Source: Bank of Thailand, Quarterly Bulletin

Sugar is being manufactured by 45 enterprises which have produced in all 2.47 million tons during the 1984-85 business year (Table 2.2.3-2). Of this total, 1.7 million tons were exported, to constitute a stable export industry. The problems underlying this segment of industry are its dependence of production on weather conditions (cf. Table 2.2.3-3), the trend seen of recent years toward oversupply in the world market, and the imposition of an international agreement to limit sugar exports from Thailand of 1.2 million tons per year.

The product next in importance is tinned food: Pineapple, mango, sweet corn, asparagus, and mushroom count among the materials most processed for tinning.

Tinned fishery products also have expanded exports to the extent of sharing more than one third of the U.S. market for tinned tuna; tinned sardine, and bonito are among the other tinned seafoods coming to extend production and export, and which are expected to continue their rise.

Table 2.2.3-2 Sugar and Molasses Production

Unit: Tons

Product / Year	Cane, Crushed	While Sugar	Raw Sugar	Molasses
1978/79	20,244,328	514,820	1,280,365	1,058,586
1979/80	12,612,472	519,252	526,255	675,921
1980/81	18,651,652	682,353	1,000,293	1,028,650
1981/82	30,263,797	689,544	1,988,636	1,736,168
1982/83	23,916,344	825,333	1,385,947	1,316,100
1983/84	23,087,201	773,664	1,435,632	1,230,273
1984/85	25,053,107	900,103	1,568,266	1,351,116
1985/86*	26,000,000	-	-	1,404,000

*) Figures for 1985/86 are estimated

Source: Sugar Institute

Table 2.2.3-3 Sugar Cane Production

Item \ Year	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
Whole Kingdom Cultivation (rais)	2,926,786	3,857,000	3,645,323	3,606,584	3,423,875	3,443,000
Production (10^6 t)	19,853,657	30,200,000	24,407,406	23,869,400	25,055,026	24,776,000
Yield (kg/rai)	6,783	7,830	6,696	6,618	7,318	7,195
Northeast Provinces Cultivation (rais)	294,035	420,399	647,029	507,367	493,151	
Production (10^6 t)	2,187,213	3,152,908	4,626,719	3,111,259	3,326,988	
Yield (kg/rai)	7,439	7,500	7,151	6,132	6,746	
Northern Provinces Cultivation (rais)	366,109	441,546	562,124	619,452	562,841	
Production (10^6 t)	2,571,578	3,626,333	3,592,903	4,612,516	4,585,939	
Yield (kg/rai)	7,024	8,213	6,392	7,446	8,148	
Central Provinces Cultivation (rais)	2,266,642	2,995,055	2,436,170	2,479,765	2,367,883	
Production (10^6 t)	15,094,866	23,420,759	16,187,784	16,145,705	17,142,099	
Yield (kg/rai)	6,660	7,820	6,645	6,511	7,239	

Source: Office of Agricultural Economics, Ministry of Agriculture and Cooperatives

2.2.3.2 Textile

The textile industry --including clothing --recorded a production of ฿ 45.7 thousand million in 1985, representing a share of 22 percent of total manufactured products. Moreover, 52 percent of the textile manufactured was exported, representing 12 percent of all goods exported, thus contributing largely to foreign currency earnings.

The history of Thai textile industry has passed through the following stages:-

- 1950 to early 1970's	:	Growth and expansion
- 1971	:	Transition from industry for import displacement to one for export
- Around 1973	:	Expansion rush, followed at end 1973 by oil crisis, and sharp drop of border business, leading to a spell of recession
- 1978 - 80	:	Favourable turn resulting from series of measures to overcome recession, and improvement of general business activity
- 1981 - 83	:	Decline in 1981 of Cambodian border business, followed by stagnation of general business activity and fall in market price of textile products through sharpened international competition, with particularly severe effect on the textile industry possessed of excess production capacity; favourable turn seen in 1983
- 1984 to 85	:	Repeated relapse with tight-money policy adopted by Government to counter deterioration of trade balance; sharp recovery of exports following the Baht devaluation of end 1984 and rise of Yen beginning September of following year, to bolster textile exports.

As of 1986, the Yen settling to a high level has greatly favoured Thailand, and the export of Thai textile products continued its prosperity. Domestic consumption still remains stagnant with the depressed market for rice and tin, but sales of apparel are steady, and prospects for the Thai textile industry are currently very bright.

The factors that will influence the Thai textile industry in the coming years are:-

- Whether or not impediments to importation are presented by countries of destination
- Relative strength in competition with neighbouring exporting countries --Korea, Taiwan etc.
- Trend of China as a new textile exporting nation
- Variations in international currency exchange rates
- Continuing efforts on the part of Thai textile manufacturers to improve product quality and service.

The number of enterprises in the textile industry are said to total around 1,400, of which about 120 are members of the Thai Textile Manufacturing Association. Pertinent statistics relevant to the Thai textile industry are presented in Table 2.2.3-4.

Table 2.2.3-4 Installed Capacities for Textile Production

Item \ Year	1981	1983	1985
Polyester staple (tons/month)	4,100	4,900-5,200	5,800
Polyester filament (tons/month)	1,950-2,000	1,950-2,000	2,200
Polyester partially oriented yarn (tons/month)	200	350- 400	470
Nylon filament (tons/month)	1,260	1,450-1,500	1,500
Rayon staple (tons/month)	1,500	1,500	1,800
Spinning machines (1000 units)	1,542	1,609	1,830
Weaving machines (1000 units)	58	58	61
Knitting machines (1000 units)	32	33	38
Twisting machines (units)	(1980) 310	394	410

Note : Some above values are estimated.

Source: Bank of Thailand; Thai Textile Manufacturing Association

2.2.3.3 Electric/Electronic Equipment

Electric/electronic equipment manufacturers are said to number around 50 large scale and more than 250 medium/small scale enterprises. Their products include radio and television (both colour and black/white) receivers, radio tape-recorders, electric fans and ventilators, refrigerators and air conditioning units, cookers, electric irons, hair dryers, incandescent and fluorescent lamps, accumulators and dry batteries, electric motors and transformers, wiring material, telephone and audio equipment. Higher quality appliances such as video tape-recorders (compact discs and the like), washing machines, electronic ovens, toasters, mixers and other such appliances are still being imported (see Table 2.2.3-5). Still, a rapidly increasing portion of electric/electronic components are coming to be manufactured domestically, and in particular, those for household appliances, leaving only particular articles such as audio-visual components to be totally imported. The

Government is fostering enhancement of the ratio of domestic production by legislative measures for encouraging investment and other means, which have resulted in compressors - constituting the key component of refrigerators and air conditioning units - to start domestic manufacture in 1982. Plans are under consideration for similarly producing television screens, expected to be realized in 1989.

The annual rise in demand of household appliances had in recent years constantly recorded a level exceeding 10%, to attain a peak in 1984 following a reduction in the business tax; in 1984, however, the business recession starting with a devaluation of the baht directly affected sales, which registered a decline from the preceding year on almost all items. Business is slowly recovering since early 1986, and the demand for electric appliances can be expected to grow further with the progress of electrification and rise of national income (see Table 2.2.3-6).

Table 2.2.3-5 Spread of Electrical Household Appliances; Sales Trends; Market Demand

Item	Domestic Demand (a) (Estimated for 1982)	Imports (b)		Domestic Production (a) - (b)
		1981	1982	
Air-conditioning equipment	Ca. 100 thous. units	4,047	5,766	94,000 - 96,000 units
Refrigerators	300 thousand odd single-door models 40 thousand two-door models	7,611	4,557	332,000 - 335,000 units
Washing machines	Ca. 20 thous. units	14,807	14,031	4,000 - 5,000 units
Electric fans	Ca. 800 thous. units	15,248	332	785,000 - 800,000 units
Electric cookers	600 - 650 thous. units	73,885	66,232	10,000 - 30,000 units
Colour television	Ca. 400 thous. units	42,708	47,959	352,000 - 357,000 units
Black-white television	Aver. 130 thous. units	3,354	59,733	70,000 units
Video tape recorders	60 - 100 thous. units	73,885	66,232	10,000 - 30,000 units

Source: Japan Machinery Exporters' Association

Table 2.2.3-6 Electrical Household Appliances Produced (Estimated Quantities)

Item	Spread (% Households equipped)	Sales Trend	Market Demand (Forecast for 1984)
Air-conditioning equipment	Ca. 5%	Starting to sell	Ca. 100 thousand units
Refrigerators	Ca. 20% of all households; 40-50% of electrified households	Selling	300 thousand odd single-door models 40 thousand two-door models
Washing machines	3 - 5%	Selling slowly	Ca. 20 thous. units
Electric fans	Quite highly spread	Selling well	Ca. 800 thous. units
Electric cookers	Over 30% of all households; over 60% of electrified households	Selling well (rice being staple food)	600 - 650 thous. units
Colour television	Over 20% of all households; over 80% of electrified households	Selling	Ca. 400 thous. units
Black-white television		Levelling off	100 - 170 thous. (aver. 130 thous.) units
Video tape recorders	Ca. 3%	Selling	80 - 100 thous. units

Source: Japan Machinery Exporters' Association

For several some years, a number of U.S. manufacturers have established integrated circuit assembly facilities, to utilize the low cost of skilled labour. The assembled integrated circuits --100 percent exported-- are being manufactured at a rapidly increasing rate, and have come to rank among the leading articles of export. This example has been followed by a Japanese ball bearing manufacturer, who is reaping full benefit from the advantage for labour-intensive industries presented by Thailand, with the production of miniature bearings, computer keyboards, stepping motors and the like. Similar moves can be expected to multiply in the coming years, particularly with the sharp rise in yen value seen of recent, which has induced Japanese enterprises in many fields - including component manufacturers - to consider establishment of a production base in Thailand, to regain price competitiveness for their products.

In the domain of electrification the Electricity Generating Authority of Thailand - supplying electric power throughout the country - has raised its total generating capacity to over 6,400 megawatts, and is further extending it with two new thermal power stations under construction at Mae Mo in the northern region, and similarly three hydroelectric power stations - 80 megawatt each - at Chiew Larn in the south. The metropolitan district will be served by a 500 kV transmission line currently under construction. Plans for the future to the year 2000 include installation of floating power stations and application the combined cycle, in addition to further construction of coal-fired thermal and hydroelectric power stations.

Power distribution to the metropolis and to the provinces is ensured respectively by the Metropolitan and the Provincial Electricity Authorities, both actively engaged in modernizing their installations, with such measures as automation of the equipment for power distribution, and replacement of overhead transmission wires by underground cabling. Rural electrification is also being actively pursued. Further growth of electric power demand will inevitably accompany the current progress of industrialization and industrial restructuring, in readiness for which the authorities in charge of power generation and distribution are improving and extending their facilities.

Telecommunications is a domain that calls for large investments, and their financing compatible with the national budget will come to demand consideration. Currently the Telephone Organization of Thailand, together with the Communication Authority of Thailand, is engaged in improving the metropolitan telephone network and in extending the network to the provinces, with Japanese enterprises contracted for carrying out the work. Industrialization will increase the demand for modern means of communication, and telecommunications is a branch of industry that will not fail to grow rapidly in the future years. A new development in this connection is the introduction of mobile telephones installed on motor cars.

2.2.3.4 Motor Cars

The motor car industry started off with assembly of imported components, following radical amendment in 1962 of the Industrial Investment Promotion Act, accompanied by a series of incentive measures for fostering investment, and customs duty privileges. In 1972, it was decreed that at least 25 percent of domestically produced components be used in passenger car manufacture; buses and trucks were to be domestically produced in similar portion at the stage of engine and chassis/body manufacture. The importation of assembled motor cars also was permitted, however, and in 1977 almost 40 percent of the market was shared by imported cars, to leave the local manufacturers with their production equipment partly idling. This induced some U.S. enterprises to withdraw from local manufacture.

The foregoing circumstances led in 1978 to a ban on importation of passenger cars and large buses, and to a raise of customs duties on all motor cars and components. The portion required of domestic components and motor car assembly was raised in graduated steps during a period of 5 years starting from 1978 for passenger cars, and from 1979 for commercial vehicles.

The above measure was followed by precipitate plans for producing by 1987 with 70 percent domestic components, which led to some confusion and conflict with plans aimed at more steady nurturing of the motor car industry; the current policy, reached after consultation between the Government and private interests concerned, is the timetable shown in Table 2.2.3-7, where "compulsory items" refers for instance to the following 9 components specified as necessarily to be of domestic supply in the case of diesel engines for 1-ton class pick-up lorries:-

(1) Cams
(2) Idle gears
(3) Inlet rocker arms
(4) Exhaust rocker arms
(5) Idle shafts
(6) Connecting rods
(7) Cam shafts
(8) Cylinder liners
(9) Cylinder heads.

In pursuance of the Government policy of fostering the domestic production of engines for small vehicles (mainly lorries), 4 enterprises already have submitted proposals, which are currently under consideration by the Board of Investment. Implementation of this measure will result in the portion of domestic components in motor car manufacture attaining 80 percent.

The market in Thailand for motor cars has progressed as indicated in Table 2.2.3-8: After reaching a peak of 118,500 in 1983, the demand has consistently declined, and the figure for 1986 may possibly have dropped below 70,000 --the level of a dozen years ago-- and there is scant likelihood of rapid restoration. Local manufacturers are equipped for producing 120 to 140 thousand units a year, and are thus facing a serious setback.

There exist today 14 motor car assembly enterprises. Component manufacturers supply --principally to bus and lorry manufacturer-- such articles as radiators, mufflers, springs, brake linings, filters, seats and other

upholstery, accumulators, spark plugs and other electrical components. Tyres are being manufactured by 4 enterprises, catering to both four-wheeled vehicles and motor cycles, as well as tractors.

The most notable recent occurrence is the rapid and prominent rise of yen value, which has prompted Japanese manufacturers in this domain to seriously consider establishing facilities for production outside Japan, and Thailand has come to be considered among the most promising countries for locating such production facilities, on account of the availability of skilled labour at relatively low cost. A number of such Japanese enterprises have successfully proceeded with their plans.

The Thai Government is opportunely adopting positive measures to encourage the foregoing trends, and provided favourable conditions for further development, steady production and exportation of parts for the Japanese motor car industry is an amply realistic possibility.

Table 2.2.3-7 Regulatory Annual Increases of Domestically Manufactured Components in Motor Car Manufacture

	1986	1987	1988	1989	Mode of regulation
Passenger cars	47%	54%			Compulsory items (See Table 2.2.3-10)
Commercial vehicles	48%	53%	61%		Compulsory items
	67 items	+17 items	+18 items		
Engines				80%	Domestic manufacture

Source: Board of Investment

Table 2.2.3-8 Progress of Motor Car Market

Unit: Number of vehicles

Year	1980	1981	1982	1983	1984	1985	1986 (1-6)
Passenger cars	26,840	27,672	27,356	32,779	31,500	22,097	10,784
Commercial vehicles	62,361	62,372	63,830	85,732	82,049	63,125	26,503
Total	89,201	90,044	91,186	118,511	113,549	85,222	37,287

Source: Japanese motor car manufacturing circles in Thailand

Agricultural tractors and tillers are seeing rapid increase of demand with progress of mechanization. There currently exist about 10 enterprises assembling tractors, sharing half the domestic market, and more than 100 manufacturing tillers.

Diesel engines to power the machines are since 1980 being assembled by 2 enterprises, who by 1984 were using domestically manufactured components to 70 percent.

Diesel engines for motor cars also are coming to be produced in increasing number, and being assembled with increasing portion of domestically manufactured parts, as indicated in Table 2.2.3-9, reflecting the incentive measures adopted by the Government under the initiative of the Ministry of Industry.

Table 2.2.3-9 Diesel Engines for Agricultural Use

Unit: Diesel engine sets

Year	Capacity	Actual production	Supply imported CBU	Total	Demand
1977	0	0	73,662	73,662	71,896
1978	0	0	78,432	78,432	76,549
1979	0	0	80,183	80,183	73,471
1980	120,000	29,181	40,649	69,830	77,000
1981	120,000	101,576	24,677	126,253	85,400
1982	120,000	60,849	10,337	71,186	77,000
1983	120,000	40,886	8,546	49,432	76,000
1984	120,000	79,045	9,054	88,099	86,200
1985	133,000	75,660	6,791	82,451	70,000
1986	133,000	48,000 (estimate)	-	48,000	56,000

Source: BOI

Table 2.2.3-10
Compulsory and Optional Motor Car Components/Parts
to be Manufactured Domestically

1. Compulsory Components/Parts

Group			Components/Parts		Given Percentage
1.	Base engine	(1) Others	(1)	Oil level gauge	0.25
2.	Other engine component	(1) Cooling system	(1)	Radiator	0.76
		(2) Lubrication system	(2)	Oil filter	0.15
3.	Electrical component	(1) Charging system	(1)	Alternator	0.87
			(2)	Battery	0.50
		(2) Starting system	(1)	Starter motor	0.93
			(2)	Switch magnetic assy	0.25
		(3) Others	(1)	Horn	0.23
			(2)	Battery holder	0.07
4.	Wiring	(1) Wiring harness	(1)	Chassis wiring harness	1.00
			(2)	Sub wiring harness	0.50
		(2) Cable	(1)	Battery cable	0.08
			(2)	Body ground cable	0.07
5.	Exhaust system,	(1) Muffler	(1)	Muffler	0.90
			(2)	Exhaust pipe	0.50
		(2) Tail pipe	(1)	Tail pipe	0.55
7.	General chassis components	(1) Wheel & tyre	(1)	Wheel	2.00
			(2)	Tyre & tube	3.00
		(2) Other	(1)	Paint & thinner	4.50

Table 2.2.3-10 Continued - 1

Group		Components/Parts	Given Percentage
8. Trim panel soft trim	(1) Interior component	(1) Carpet & floor mat	1.00
	(2) Luggage component	(1) Jack assy	0.15
9. Seat	(1) Frame	(1) Seat frame	2.18
	(2) Cover	(1) Seat frame	1.44
		(2) Form & pad	0.88
10. Glass	(1) Glass door	(1) Glass doors	0.91
		(2) Windshield	0.75
12. Suspension	(1) Rear-suspension	(1) Rear spring (leaf or coil)	0.78
21. Convenient and accessory equipment	(1) Convenient accessory equipment	(2) Radio	2.00
Compulsory Components/Parts		TOTAL	27.20%

Table 2.2.3-10 Continued - 2

2. Components/Parts for Selection (Up to 26.8%)

Group		Components/Parts	Given Percentage
1. Base engine	(1) Engine assy	(1) Engine assy	4.00
	(2) Cylinder head	(1) Intake & exhaust valve	0.45
		(2) Valve spring	0.28
	(3) Cylinder block	(1) Engine piston	0.75
		(2) Piston ring	0.33
		(3) Connecting rod	0.22
		(4) Timing chain cover	0.13
	(4) Crank case	(1) Connecting rod bearing	0.21
		(2) Main bearing	0.29
		(3) Flywheel	0.45
		(4) Crank shaft pulley	0.21
	(5) Others	(1) Engine gasket	0.50
		(2) Engine mounting with bracket	0.25
		(3) Engine under cover	0.20
2. Other engine components	(1) Cooling system	(1) Radiator cap	0.04
		(2) Hose radiator & clamp	0.05
		(3) Fan shroud	0.10
		(4) Fan pulley	0.20
		(5) Cooling fan	0.10
		(6) Water reserve tank	0.10
	(2) Ignition system	(1) Distributor	0.50
		(2) Ignition coil	0.30
		(3) Spark-plug	0.02

Table 2.2.3-10 Continued - 3

Group		Components/Parts	Given Percentage
	(3) Inlet & outlet	(1) Oil & fuel pipe	0.02
		(2) Air filter element	0.03
		(3) Air filter housing	0.12
		(4) Exhaust manifold	0.45
	(4) Engine control	(1) Control cable	0.08
		(2) Oil & fuel pipe	0.02
	(5) Other	(1) Other bracket	0.05
3. Electrical components	(1) Charging system	(1) Regulator	0.20
	(2) Others	(1) Bracket	0.02
		(2) Motor wiper	0.31
		(3) Blade wiper	0.13
		(4) Cleaning tank	0.10
		(5) Battery tray	0.10
		(6) Washer nozzle & hose	0.04
4. Wiring	(1) Cable	(1) Spark plug cable	0.15
		(2) Fuse box	0.20
5. Exhaust system	(1) Other	(1) Bracket & clamp	0.05
		(1) Fuel pipe & tube	0.20
6. Fuel system	(1) Fuel line	(2) Fuel strainer	0.10
		(3) Fuel filter	0.04
	(2) Fuel tank	(1) Fuel tank assy	1.07
		(2) Fuel tank gauge	0.40
		(3) Fuel filter	0.04
	(3) Other	(1) Bracket & supporter	0.15

Table 2.2.3-10 Continued - 4

Group		Components/Parts	Given Percentage
7. General chassis components	(1) Wheel & tyre	(1) Wheel caps	0.50
8. Trim panel	(1) Hood component	(1) Sound proofing	0.01
	(2) Interior components	(1) Sound proofing	0.04
		(2) Headlining assy	0.36
		(3) Door trim	0.80
		(4) Sunvisor	0.25
		(5) Armrest	0.03
		(6) Cowl side trim	0.03
		(7) Pillar garment	0.02
		(8) Roof side inner & garment	0.05
		(9) Parcel shelf	0.11
		(10) Scuff plate	0.05
		(11) Trim room partition	0.03
		(12) Centre console	0.25
		(13) Handle door window regulator	0.10
		(14) Trim rear wheel house	0.03
	(3) Luggage components	(1) Sound proofing	0.01
		(2) Carpet & rubber mat	0.28
		(3) Spare wheel cover	0.05
		(4) Protector fuel tank	0.05
		(5) Tools and bag	0.10
	(4) Other	(1) Door weatherstrip	0.15

Table 2.2.3-10 Continued - 5

Group		Components/Parts	Given Percentage
9. Seat	(1) Frame	(1) Seat adjuster	0.15
	(2) Other	(1) Headrest	0.35
10. Glass	(1) Glass door	(1) Back window	0.75
	(2) Mounting parts	(1) Glass weatherstrip windshield	0.05
		(2) Glass weatherstrip back window	0.04
11. Lamps	(1) Exterior	(1) Turn signal lamp	0.10
		(2) License plate lamp	0.05
	(2) Interior	(1) Room lamp	0.05
12. Suspension	(1) Front suspension	(1) Front spring (leaf or coil)	0.74
		(2) Front strut axle	0.25
		(3) Front shock absorber	0.65
		(4) Front stabilizer bar	0.12
		(5) Front spring bumper	0.04
	(2) Rear suspension	(1) Rear shock absorber	0.65
		(2) Rear spring bumper	0.04
13. Brake system	(1) Front wheel brake	(1) Cover	0.10
		(2) Disc brake part	0.16
	(2) Rear wheel brake	(1) Shoe and lining	0.15
		(2) Brake drums and disc brake	0.18
	(3) Brake master cylinder	(1) Reservoir	0.58
	(4) Power brake booster	(1) Holder	0.02

Table 2.2.3-10 Continued - 6

Group		Components/Parts	Given Percentage
	(5) Brake line	(1) Brake tubes	0.03
	(6) Parking brake control	(1) Lever parking brake	0.05
		(2) Button & spring	0.01
		(3) Rod push	0.03
		(4) Cables parking brake	0.08
	(7) Others	(1) Bracket	0.03
		(2) Brake pipe	0.02
		(3) Brake pedal	0.15
14. Clutch	(1) Clutch	(1) Clutch disc	0.26
	(2) Clutch control	(1) Return spring	0.02
		(2) Clutch cable	0.62
	(3) Others	(1) Clutch pedal	0.13
		(2) Hose, vacuum	0.09
		(3) Bracket & connecting parts	0.13
15. Body	(1) Under body	(1) Rear panel	0.72
		(2) Firewall (dash panel)	0.78
		(3) Floor assy	1.50
		(4) Floor parts	5.00
		(5) Engine compartment assy	0.43
		(6) Other	0.36
	(2) Roof	(1) Roof assy	0.10
		(2) Rear window paneling	0.18
		(3) Front window	0.18

Table 2.2.3-10 Continued - 7

Group		Components/Parts	Given Percentage
	(3) Front fender	(1) Fender assy	0.15
		(2) Fender reinforcement	0.40
	(4) Door	(1) Door assy	0.20
		(2) Door reinforcement inner	0.58
		(3) Door reinforcement outer	0.55
		(4) Hinge & other	0.23
	(5) Front hood	(1) Hood assy	0.15
		(2) Bonnet frame	0.55
		(3) Hinge & other	0.15
	(6) Rear hood	(1) Hood assy	0.15
		(2) Finish trunk rr.	0.10
		(3) Hinge & other	0.15
16. Other body components	(1) Bumper	(1) Bumper front	0.55
		(2) Bumper rear	0.56
		(3) Other	0.02
17. Transmission	(1) Transmission Gear shifting Gear shift Outer control	(1) Knob	0.03
		(2) Lever	0.18
		(3) Boot rod	0.17
		(4) Tie rod	0.18
		(5) Pad	0.06
		(6) Support	0.05
		(7) Cup	0.07

Table 2.2.3-10 Continued - 8

Group		Components/Parts	Given Percentage
18. Steering	(1) Steering wheel assy	(1) Horn control cover	0.11
	(2) Steering column	(1) Steering column	0.33
		(2) Switch unit support	0.13
	(3) Steering col. cover	(1) Protection knob	0.17
20. Instrument panel control	(1) Instrument panel	(1) Glove box	0.15
21. Convenient and accessory equipment	(1) Convenient and accessory equipment	(1) Safety belt	0.50
		(2) Splash guard	0.20
Components/parts for Selection		TOTAL	39.99% *1

Remarks:

*1: Component/parts up to 26.8% shall be selected.

Source: BOI & NESDB.

2.2.3.5 Motor Cycles

Motor cycles are highly adapted to the road conditions of the country, and are widely used for going to work and to school, as well as for freight transportation.

As with motor cars, motor cycles are prohibited importation in assembled form since 1978, when also their components saw a raise of import duties; the required minimum proportion of domestically manufactured components to be used in assembly was raised to 70 percent in 1979. The engine is today about the only component that is still imported.

Motor cycles are being manufactured by 4 enterprises associated with Japanese firms; sales reached 348 thousand units in 1983. Demand steadily increased to 1980, but the ensuing years saw a decline to 262 thousand in 1985 (Table 2.2.3-11).

Preparation for domestic manufacture of engines is under way by the manufacturers, backed by the Government.

Table 2.2.3-11 Progress of Motor Cycle Market

Unit: Upper lines - vehicles,
lower lines - yearly percentage

Type	1981	1982	1983	1984	1985
Family	197,511 70%	221,147 66%	247,481 71%	214,428 68%	183,139 70%
Auto	86,623 30%	113,105 34%	100,928 29%	102,592 32%	79,222 30%
Total/T	284,134	334,252	348,409	317,020	262,361

Source: Japanese motor car manufacturing circles in Thailand

2.2.3.6 Shipbuilding

Information published by the Office of the Maritime Promotion Commission indicates that there currently exist 190 shipyards, notably in Bangkok and the surrounding localities of Samut Sakhon, Samut Prakan, Pathum Thani and in southern Nakhon Si Thammarat, as indicated in Table 2.2.3-12. Most of these shipyards build wooden fishing boats and small craft for river traffic, and very few are able to construct ocean-going vessels. Some shipyards have commenced building small pleasure craft and patrol boats in fibre-reinforced plastic.

The capacities of these shipyards are given in Table 2.2.3-13, which indicates that the yards are currently operating at only 1/5 of capacity. Ships up to 2,000 gross tons have been built in the past, but the tendency today is to rely on importation of second-hand vessels, and not making full use of domestic shipbuilding capability, on account of such ships being currently available in the international market at cheap price and at short notice.

Table 2.2.3-12 Locations and Number of Shipyards

	Location	Number		Location	Number
Central region	Bangkok	39	Eastern region	Trat	10
	Samut Sakhon	24		Rayyong	6
	Samut Prakan	18		Chanthaburi	4
	Pathum Thani	14		Sub-total	20
	Ayutthaya	9	Southern region	Nakhon Si Thammarat	14
	Samut Songkhram	8		Surat Thani	7
	Chon Buri	3		Songkhla	4
	Suphan Buri	3		Chumphon	4
	Nakhon Sawan	2		Ranong	4
	Nonthaburi	2		Phuket	4
	Nakhon Pathom	1		Pattani	4
	Rat Buri	1		Trang	2
	Chachoengsao	1		Satun	2
	Sub-total	125		Sub-total	45
	Total	190			

Source: Office of the Maritime Promotion Committee

Table 2.2.3-13 Aggregate Building Capacity of Shipyards; Number of Vessels Actually Built

Capacity category (Gross tons)	Aggregate capacity (Vessels/year)	Vessels actually built	
		In 1979	In 1983
80 and below	867	168	159
80 - 150	55	8	12
150 - 500	14	2	13
500 - 800	5	1	1
800 - 1,000	3	0	0
1,000 - 2,000	3	0	0
Total	947	179	185

Source: Bank of Thailand

The White Paper on the "Restructuring of Economic Relations between Thailand and Japan" issued in August 1985 by the Thai Government contains a call to Japanese shipyards to establish shipbuilding facilities in Thailand. The actual situation in respect of shipbuilding in Thailand, however, is that the Thai market for shipbuilding is still insufficient, despite measures for promotion adopted by the Government, and future for this industry are far from promising. This is due to such circumstances as given below, apart from external circumstances like the worldwide recession in shipping business and the restriction on trawling in the Gulf of Siam.

(a) Difficulties in material and component supply

The absence of domestic steelmakers and marine equipment manufacturers of adequate capability necessitates 90 percent of the material and components for building ships to be imported, with accompanying risk of delays in delivery.

(b) Taxation

Duties imposed on the imported materials and components raises ship construction cost; business and other taxes imposed on merchant ship operation undermines international competitiveness of Thai shipowners.

(c) Technological problems

The period required for building a ship is said to be double of what would be expected in an advanced shipbuilding country, notably on account of low productivity due to shortage of skilled workers and technicians; moreover the cost of training unskilled workers at the shipyards adds to the cost of ship construction.

The activities of the Shipbuilders and Repairers Association of Thailand appear to have been hampered in the past by the lack of solidarity shown by its members, to impede effective concerted action on Government, and useful exchange of information and views among shipyards. This circumstance has, in turn, delayed national standardization in the shipbuilding

branch of industry.

The measure adopted by the Government to alleviate the foregoing difficulties confronting the shipbuilding industry is to oblige the Government and State-owned enterprises to place their orders for new ships on domestic shipyards, unless the difference in quoted price exceeds 15 percent. This measure is considered to promise appreciable enhancement of the market for Thai shipyards, on grounds of the ample availability of cheap labour, and of the fact that 45 percent of the ocean-going fleet is over 25 years of age, and 97 percent over 11 years, and calling for renewal.

Another favourable factor is that less than 1/10 of the imported and exported goods are carried in Thai bottom, and demand for Thai-owned ocean-going vessels can be anticipated also to bolster the Thai market for shipbuilding.

The Office of the Maritime Promotion Commission is advocating the following measures for assisting the Thai shipbuilding industry, some of which have already been adopted, as noted above:

(1) Assistance to shipyards by Administration to maximum extent possible

(2) Exemption of import duty for materials and components required for ship construction

(3) Establishment in universities of departments specializing in naval architecture and marine engineering

(4) Placement of orders on Thai shipyards by Government and by State-owned enterprises.

Furthermore, the Board of Investment is encouraging private investment in shipyards through preferential measures for the financing of:

(1) Construction and repair of large vessels for international maritime transport

(2) Construction and repair of small vessels for international maritime transport

(3) Construction of craft in fibre-reinforced plastic

(4) Construction of vessels in ferrocement (reinforced concrete).

2.2.3.7 Iron and Steel

The domestic demand for iron and steel is estimated to have been 2.2 to 2.4 million tons (crude steel equivalent) in 1985. In terms of apparent per capita consumption, this corresponds to sum 40kg, to rank third among ASEAN countries --after Singapore and Malaysia. A notable difference from other ASEAN countries, however, is the absence of State-owned steelworks; the private-owned plants are generally small in scale, and confronted with the problem of competitiveness in the international market. The current status of the different categories of enterprise are as described below:

(a) Electric furnace operators

Relatively large-scale enterprises equipped with melting/slabbing/rolling lines, using scrap steel as material

(b) Rolling mill operators

Enterprises operating hot rolling mills, to process thick plate croppings, sheet bars and billets

(c) Secondary metalworkers

Enterprises processing steel plates, sheets, rods, surface-treated/magnetic/stainless steel sheets.

The product lines manufactured by these enterprises can be classified into:

(1) Welded piping
(2) Galvanized sheeting

(3) Tinplate
(4) Wire
(5) Welding rods and wires
(6) Other product lines --light sections, sheared plating, ...

Electric furnace operators currently number 8, equipped for producing 900 thousand tons per year of crude steel. Severe competition with rolling mill operators --who market much the same products-- and the decline in market demand have resulted in actual production limited to 510 thousand tons in 1985, and to 500 thousand (estimated) in 1986. Sales are largely limited to the domestic market, with such products as wire, rod and section sold to the construction industry. Some products are sold in the form of billets to rolling mill operators.

Rolling mill operators currently number roughly 30 (which had exceeded 60 at peak in 1983), ranging from major enterprises certified to use the TIS Mark to cottage-scale factories. Details of their actual conditions are difficult to grasp: Aggregate capacity is estimated at around 600 thousand tons per year, and to be currently operating far below half capacity.

Secondary metalworkers largely use imported materials. Plating and sheeting is imported to 100 percent.

Welded pipe manufacturers number 12 large enterprises, equipped to produce 640 thousand tons per year, and who are estimated to have actually produced about 350 thousand tons in 1985. Of this production, about 160 thousand tons were exported --to the U.S., Hong Kong, Australia, the Near East, Singapore and China.

Galvanized sheet is produced by 4 enterprises, with aggregate capacity of almost 230 thousand tons per year, the actual production in 1985 being slightly over 130 thousand tons. The market is almost exclusively for roofing, with a new outlet for ducting coming to be newly opened.

Tinplate is produced by 1 enterprise, which manufactured 90 thousand tons in 1985, to serve industries packing seafood, pineapple, milk,... The

first two articles are almost wholly exported.

Wire manufacturers are said to number several dozen, among whom there are 11 major enterprises that produced some 120 thousand tons in 1985, to serve in the manufacture of nails, netting, wire rope and large variety of other products.

Welding rods and wires are being produced by 7 enterprises with an aggregate capacity of almost 27 thousand tons, and actually producing 14 thousand tons in 1985.

The Government is promoting and protecting the iron and steel industry through such measures as prohibiting in principle the import of all products that can be procured domestically, limiting the importation of other products through raised import duty, and in some cases through special import charges, but no other restriction is imposed on importation.

2.2.3.8 Nonferrous Metals

In respect of refining, tin is smelted into metal, and mostly exported. A plant for extracting tantalum and other rare metals from tin slag --the first plant its kind in Asia-- was constructed on Phuket Island, but in June 1986, when it was all but ready for operation, the plant was set on fire and destroyed beyond repair by a mob that had decried environmental pollution and impediment to the tourist trade. A study is under way on possible reconstruction with Thai Government aid.

Zinc is refined in the first large zinc smeltery in the ASEAN region, completed in January 1985. The refined zinc is filling domestic demand and also exported in part.

With the exception of tin, the metalworking industry is operating largely on imported material. Aluminium is processed into wiring, sheeting and wrapping, and into kitchenware and architectural fittings; zinc is used for galvanizing and for making electric batteries, lead for motor car

accumulators, copper for wiring, and tin for tinned steel plating.

Imports of metal ingots and other nonferrous materials have progressed as indicated in Table 2.2.3-14. Import of zinc is seen to have dropped very significantly with production started on the smeltery referred to above.

Table 2.2.3-14 Imports of Nonferrous Ingots for Processing

Unit: 1,000 tons

Metal	ANNUAL IMPORTS				
	1981	1982	1983	1984	1985
Aluminium	49	52	68	49	45
Zinc	40	34	35	45	14
Lead	12	11	19	14	9
Copper	6	6	11	16	19

Source: Department of Customs, Ministry of Finance

2.2.3.9 Chemicals

The Thai chemical industry has finally emerged from nurturing stage, with the steady rise of production in terms of both quantity and range of products as it may be seen from Table 2.2.3-15.

Table 2.2.3-15 Progress of Chemical Product Manufacture

	1980	1981	1982	1983	1984
Petrochemicals (1,000 kl)	3,369	8,588	8,506	8,840	8,600
Detergents (100 t)	84.6	78.4	84.3	86.9	-
Fertilizer (ditto)		-	-	-	-
Sodium silicate (ditto)	19.2	20.2	-	-	-
Sulphuric acid (ditto)	54.2	39.5	-	-	-
Hydrochloric acid (ditto)	72.6	87.4	-	-	-
Caustic soda (ditto)	62.7	67.7	-	-	-
Sodium glutamate (ditto)	8.7	-	-	-	-
Cement (ditto)	5,400	6,300	6,700	7,300	8,300
Petrochemicals (฿ million)	14,534	17,541	15,808	13,282	14,395
Chemicals (฿ million)	9,170	10,982	12,119	13,329	14,476
Rubber products (฿ million)	3,062	3,122	2,969	3,271	3,605

Source: Ministry of Industry

The products currently produced include caustic soda, chlorine, hydrochloric acid, acetylene, oxygen, nitrogen carbon dioxide and other basic inorganic chemicals, as well as some basic organic chemicals such as common synthetic resins and fibres, and detergents. The synthetic resins are all produced from imported monomer, and the range of polymer products is still restricted. The petrochemical industry also depends on imported materials --in such forms as toluene, xylene, caprolactam and terephtalic acid-- for conversion into polyester, nylon and other synthetic fibre resins, which fibres are produced. Thus, synthesis of plastic material is being performed only by a limited number of enterprises, but plastic moulding is undertaken by very many enterprises producing a vast variety of moulded articles and fibres, to constitute a well-established down stream industry for petrochemical products. The enterprises, however, are mostly of small scale and are faced with an over-competitive market.

In respect of the scale of operation of the basic chemical industry, taking the example of caustic soda, annual production, which had amounted to 70,000 tons in 1980, attained in 1986 120,000 tons (in terms of 50 percent sodium oxide equivalent). Imports of caustic soda are steadily diminishing. Comparing the size of market with chlorine, while the manufacture of polyvinyl chloride monomer --which in industrialized countries accounts for the largest consumption of chlorine-- is not yet started, the domestic demand for chlorine is rising. This can be ascribed to increasing consumption of chlorine and hydrochloric acid by the pulp and paper industry and by sodium glutamate manufacturers. This rising demand for cautic soda and chlorine is being met by existing manufacturers with expansion of production facilities and by new manufacturers entering business, to ensure an annual rise in production of around 6 percent for caustic soda and 6 - 8 percent or even more for chlorine. This rate of growth is twice that of already industrialized countries.

Chemical fertilizer is furnished in the form of compounded product prepared from imported ingredients, to satisfy roughly half the domestic demand, the remainder being imported already compounded.

The pharmaceutical market amounted to ฿ 12.5 thousand million in 1982, showing an annual growth of more than 10 percent. The market was supplied to 20 percent by imports, the remaining 80 percent being furnished domestically.

Soap and detergent production amounted respectively to 230 and 100 thousand tons in 1983. This is not a rapidly growing market, and the domestic manufacturers are faced with severe competition from imported products. Notable other products are alcohol from molasses, sodium glutamate and l-resin for compound animal feed from tapioca, paint, printing ink and adhesive. A project is under way for producing assorted animal feed material from tapioca.

Projects envisaging future development of the chemical industry --currently pursued under Government initiative-- include the utilization of Gulf of Siam natural gas --already being utilized for electric power