No.42

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

(SUMMARY)

DECEMBER 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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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 recognized 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

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* 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 (TISI), Ministry of Industry, 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.

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 development 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 for 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.

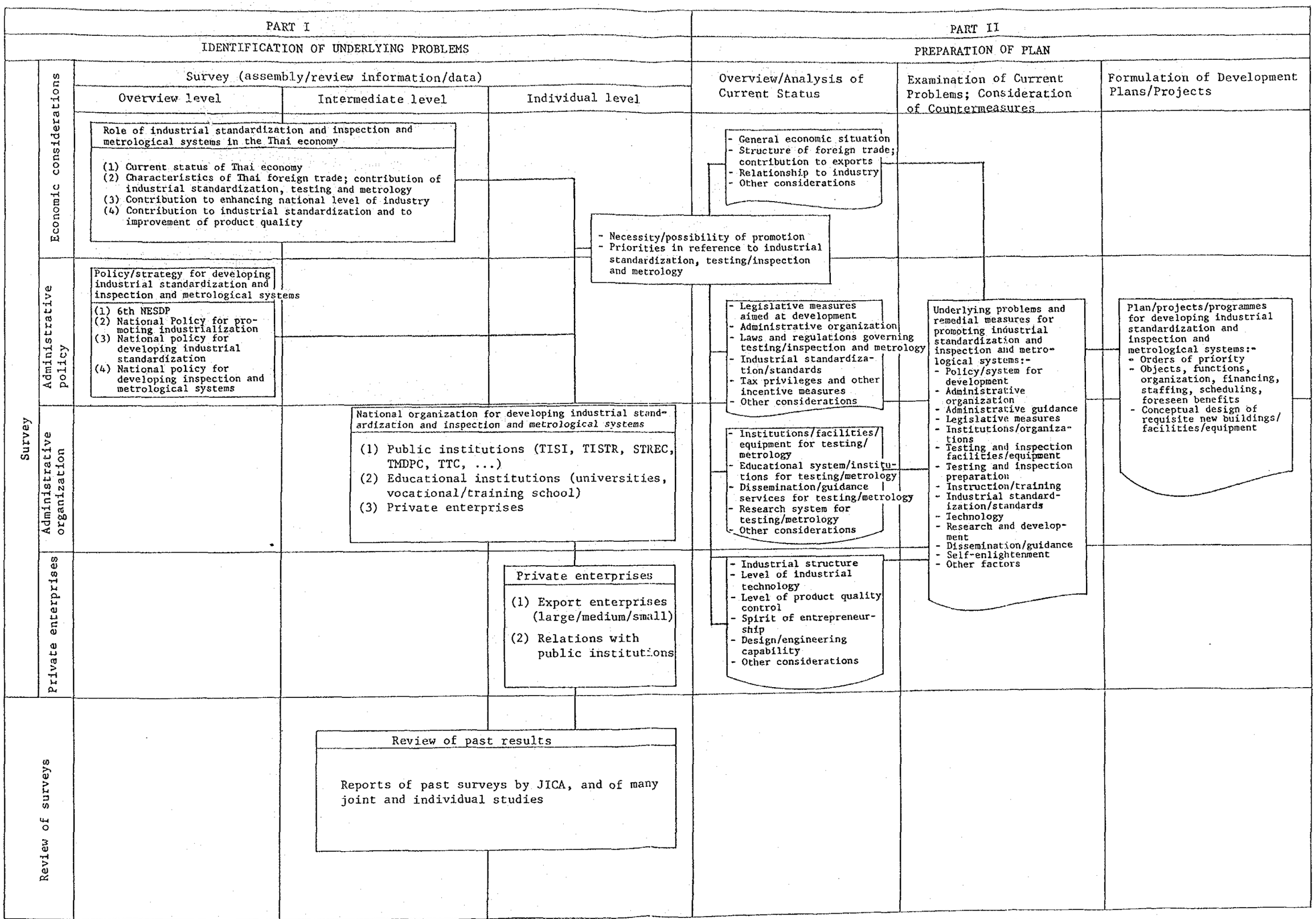


Fig. 1.3-1 Study Flow of Programmes for Developing Industrial Standardization and Inspection and Metrological Systems

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).

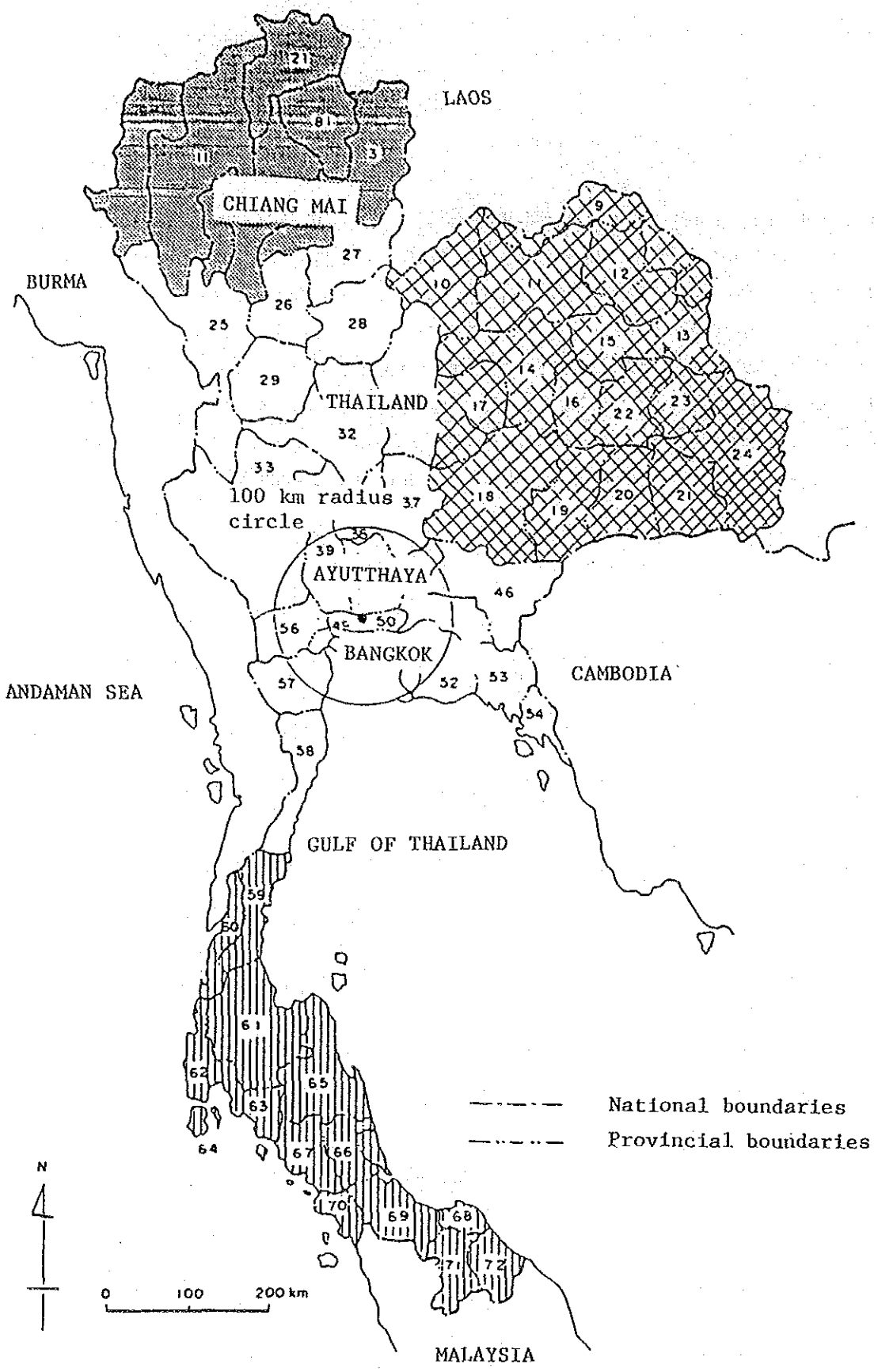


Fig. 1.4-1 Geographical Area of the Study

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.

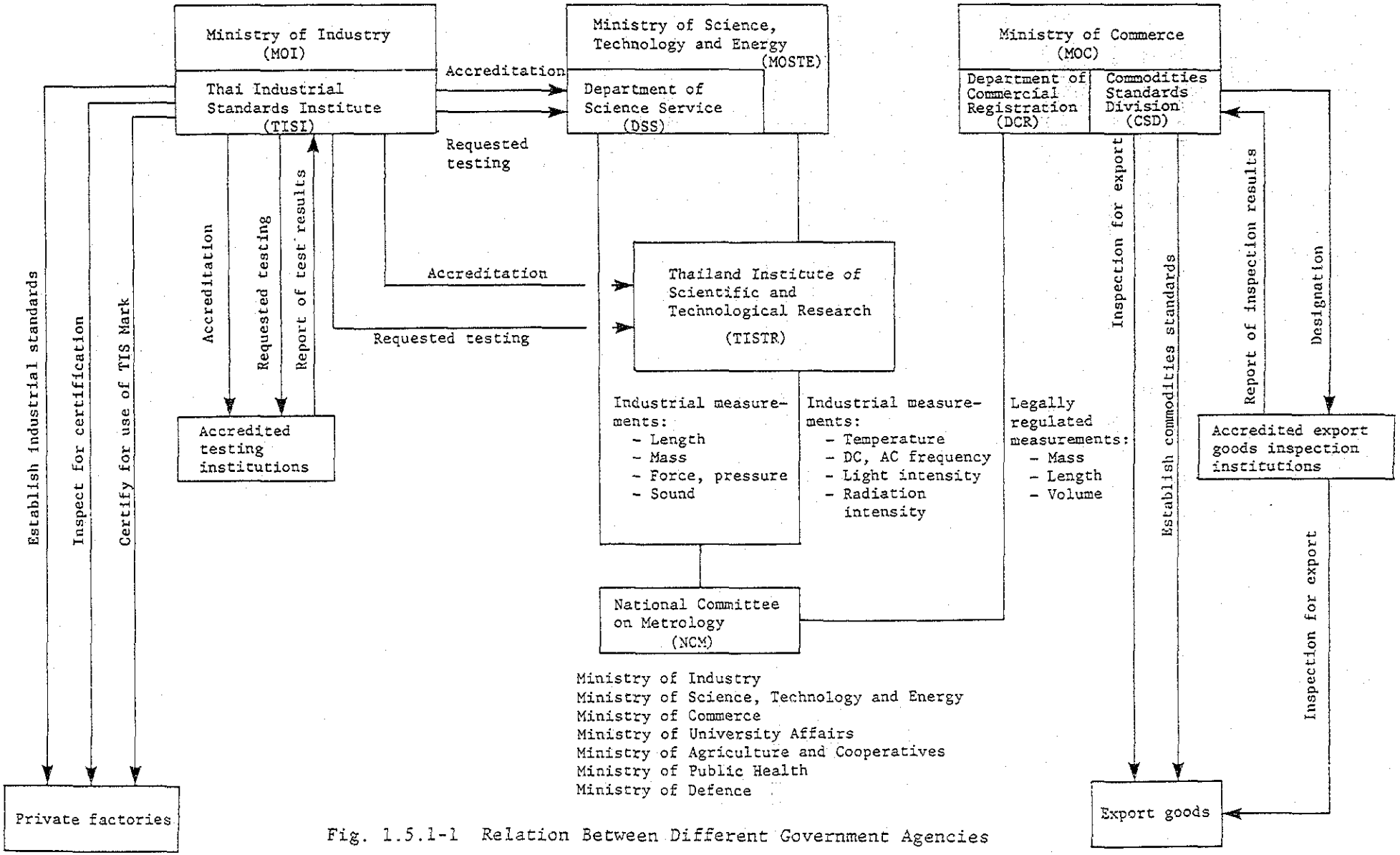


Fig. 1.5.1-1 Relation Between Different Government Agencies Administrating Industrial Standardization, Testing/Inspection and Metrology

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

The past progress of Thai national policy for industrial development can be considered to have passed through six distinct phases, as indicated in Table 2.1-1.

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.

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 (1982 to 86) 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 on the Eastern Seaboard, featuring the promotion of heavy chemical industries.

The 6th NESDP (1986 - 1991) --corresponding to the 6th phase-- has been planned to follow up the 5th NESDP terminated in September 1986. The key problems envisaged for solution in this Plan are poverty and unemployment in the outlying regions, for which 10 Programmes are set forth, covering such essential factors as economy, human resources, social services, scientific and technical development. Target overall annual economic growth rate is set at 5 percent, only slightly above the average actually attained in past years: The rate for the agricultural sector is set at the conservative level of 2.9 percent --unaltered from the preceding period-- but that for the industrial sector is set at the notable level of 6.6 percent. The resulting enhancement of economic activity is envisaged to create 3.9 million new employment opportunities, to reduce the unemployment rate to 3.1 percent; and with annual increase of population estimated to be held to 1.7 percent, the per capita income is to be raised from the current ฿ 21 thousand (approx. US$807) to ฿ 28 thousand (approx. $1,077) by 1991. During the same period, the rate of inflation is to be held down to 2.3 percent, as compared with 2.7 percent recorded during the preceding 5th NESDP.

The 6th NESDP is characterized by a keynote of aspiration towards qualitative supplementation through readjustment rather than quantitative extension, and the policy governing industrial development is framed with emphasis on marketing, with diversification of products and the industrial

structure held as target.

Consideration of marketing means a change of course from one of selling produceable commodities to that of producing saleable commodities, with improvement of product quality and extension of industrial standards in order to establish a productive system that matches market demand, by means of which to effectively penetrate the international market.

The manufacturing industry --a priority sector for promotion-- has its development target envisaging-- not the heavy and chemical industries as in the preceding 5th NESDP-- but the more down-to-earth segments such as agro-industry, mechanical/electrical equipment manufacture and metal-working. Also, industrialization of the outlying regions, and promotion of small and medium scale enterprises is another item accorded priority in the Plan. The diversification of products and of the industrial structure --referred to earlier-- should further contribute to raising popular income and increasing employment opportunities.

Table 2.1-1 Six 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 Standards Act
5	1982-86	5th NESDP		Aspiration toward quasi-industrialized nation	
6	1987-91	6th NESDP		Diversification of products and of productive structure	

Source: International Development Center of Japan (Phase 1 - 5)
Japanese Chamber of Commerce, Bangkok (Phase 6)

2.2 Current Status and Future Prospects of Thai Manufacturing Industry

The Thai industry is currently transforming itself from one of consumable to intermediate, and further to capital goods manufacture --as indicated in Table 2.2-1.

It is revealed 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 summed-up share of consumer goods production diminished from 72.4 to 44.9 percent between 1960 and 1985, 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 two-thirds to less than 44.9 percent, to fall almost abreast of the rising intermediate goods.

Table 2.2-1 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

It is seen from Table 2.2-1 that the key policy of the Thai Government has been to retain agriculture as a staple basis of national economy, while on the other hand according highest priority to the development of manufacturing industries: With further measures for expanding domestic demand and for accumulating managerial and technological capability, the manufacturing industry should not fail to consolidate its footing with the establishment of a widening network of supporting enterprises furnishing materials, components and services, to pave the way towards an export-oriented industry. A representative instance is the textile manufacture: It was originally a typical import displacement industry: However, in about 10 years exports came to exceed imports; today this industry bears the largest share of export goods, even exceeding rice.

In envisioning the future path of Thai industrialization, the next move should be towards enhanced use of domestically available raw materials and components, to provide additional outlets for these materials and components, and at the same time raise the value added of product, with secondary and further processing. The segments of industry that had hitherto extended their production to meet the growing domestic demand would then be further expanding to serve the world market. Typical products that can be expected to follow this path are those of the agro-industries and the more technology-oriented industries like machinery and electrical equipment manufacture, metalworking and electronics --where products from relatively small-scale enterprises can be expected to find outlets for exports.

Another promising line is the transfer into Thailand of industries that come to be decreasingly tenable in the more industrialized countries on account of high labour cost. The attractive advantages offered by Thailand in the world market as a country for implanting bases for production --a labor market not locking in workers capable of flexibly adapting to new and higher skills, extensive land available for factory installation, abundant raw materials-- should not fail to draw many foreign enterprises seeking to establish factories abroad. This should generate new demands for skilled labour, and to this end, continued efforts should be directed towards raising the general technical level of the country for

industrial production.

Envisioned in this light, the future of Thai industrialization should bring about extension in the range of exportable goods, from agricultural to agro-industrial products --to bring higher value added-- and further to products of ever wider variety --including those involving modern processing techniques. Signs of progress in this direction can already be discerned in the successful establishment by the Industrial Estate Authority of the industrial estates --including an export processing zone-- namely Bang Poo, Bang Phlee, Bang Chan, Lat Krabang and Northern Industrial Estate, as well as Laem Chabang and Map Ta Phut on the Eastern Seaboard.

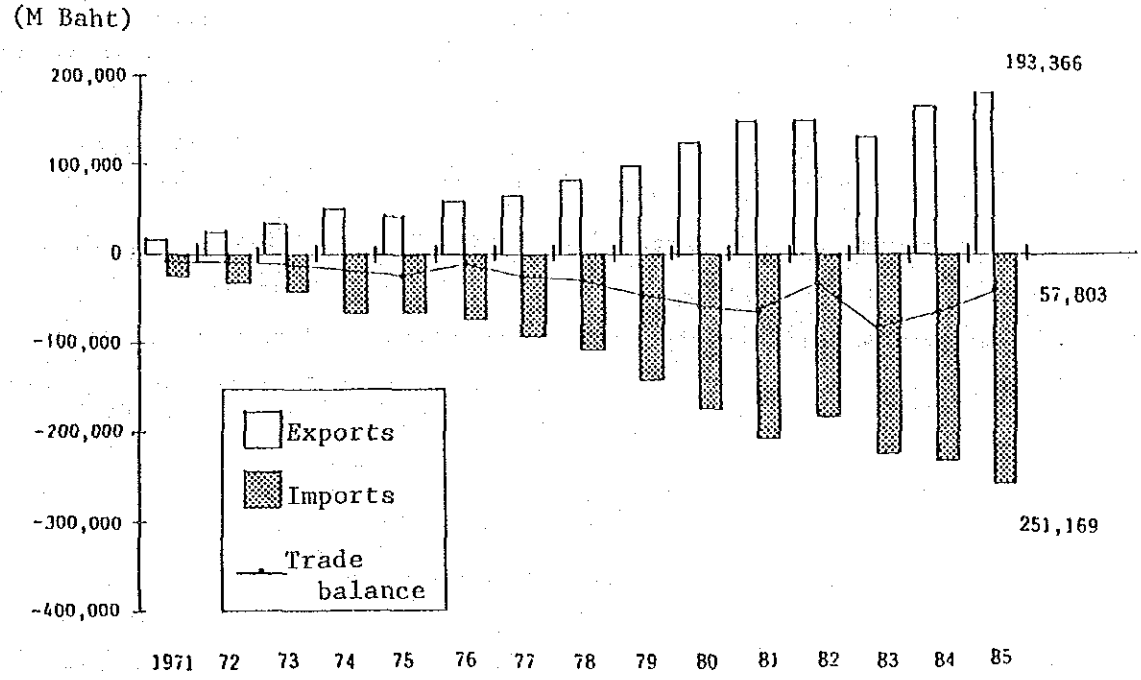
2.3 Future Prospects for Exports

The balance of trade has progressed as indicated in Fig. 2.3-1. The traditional stable export articles are rice, tapioca, crude rubber, sugar, and other primary products; capital goods like machinery, iron and steel, chemicals, together with consumer goods, are being imported, as in the case of all developing countries.

The total external trade has steadily risen for both imports and exports, but the balance is chronically in the red, despite the notable improvement seen of recent years in exports of industrial products including textiles and integrated circuits. The increase in imports is due to the growing demands generated by consumers, and by the rapidly expanding domestic industry calling for imported equipment and materials. This is typical of an industrializing nation which has not yet completed transformation of its economic structure from dependence on agriculture to reliance on manufacturing industry.

Current staple exports are agricultural products, whose share is expected to follow a long-term falling trend. Against this, imports will have to cover materials and capital goods needed by the expanding manufacturing industries during some years. Also for some time, imported capital

goods will further be required to equip the industries utilizing the Gulf of Siam natural gas. Moreover, continued increases will have to be expected of energy consumption, with the rising standard of living.



Source: Quarterly Bulletin, Bank of Thailand

Fig. 2.3-1 Progress of Trade Balance

The export product lines currently selected --or considered-- for encouragement by the Government, determined from survey visits are as described below.

(a) Export targets for 1987 set by the Ministry of Commerce
(b) Industrial products for export specified in the 6th NESDP
(c) Product lines anticipated manufacture in the Export Processing Zone at Laem Chabang during the 6th NESDP
(d) Product lines promoted by the Industrial Finance Corporation of Thailand
(e) Product lines selected for promoting export to Japan and other countries in a 3-year programme
(f) Product lines being exported by Japanese enterprises, given in data obtained from the Japanese Chamber of Commerce, Bangkok
(g) Product lines considered promising by Japanese firms
(h) Product lines subjected in past to export certification and specified for eventual future export certificate applications.

The substance of the foregoing survey is summarized in Table 2.3-1.

The future prospects for a nation's exports will evidently be largely governed not only by the policy of the particular nation but also by circumstances affecting the business of neighbouring countries; and in the case of Thailand, also by the nature and amount of investments in Thailand of foreign capital. Be that as it may, the country's future exports should develop around the products currently being fostered to replace imports: These products should be steadily extended in range, supported by a widening circle of supporting industries, to constitute the backbone of Thailand's export activity.

Table 2.3-1 Key Product Lines Expected for Thai Exports in the Next 5 Years

Machinery:-	
(1) Motor components	Car engine components, including piston rings; disc wheels; exhaust pipes; for motor cycle spokes, nipples, rims; tooling, dies for motor manufacture; rubber parts
(2) Agricultural machinery, components	
(3) General machinery	Machinery assembly, including manufacture of cast/forged/machined components; bearings
Electrical machinery	Radio/television sets; refrigerators; air conditioning equipment; compressors; batteries/accumulators; wiring/cabling
Electronic equipment	Integrated circuits; electronic components/circuitry; office automation equipment; computers, computer keyboards; facsimile sets; copying machines; optical fibre
Chemicals	Synthetic resins; pharmaceuticals; caustic soda; chlorine

CHAPTER 3

CURRENT STATUS AND PROBLEMS OF INDUSTRIAL STANDARDIZATION, TESTING/INSPECTION AND METROLOGY IN THAILAND

3. CURRENT STATUS AND PROBLEMS OF INDUSTRIAL STANDARDIZATION, TESTING/INSPECTION AND METROLOGY IN THAILAND

3.1 Promotion Policies of the Thai Government

The importance of both expanding and improving industrial standardization and the inspection and metrological systems in Thailand was particularly recognised in the 5th 5-Year Plan (1982 - 1986) and this recognition is more pronounced and specific in the current 6th 5-Year Plan (1987 - 1991). Namely, emphasis has been placed on the following 3 points in view of promoting industrial activities and technologies.

(a) Promotion of R & D activities for technologies to make the most effective use of the natural resources, such as land and water resources, aiming at the improvement of agricultural productivity.

(b) Promotion of the utilization of Thailand's natural resources and the addition of high values to mining and manufactured products, promotion of studies on the material science and treatment/processing technologies for mining products and the acquisition of independent technologies to foster export-oriented industries.

(c) Promotion of energy conservation technologies to facilitate energy saving with the following specific measures.

(1) Establishment of "Technology Transfer Centre".

(2) Strengthening of the TISTR in view of it taking a leading role in R & D activities.

(3) Improvement of the standards, inspection and quality control systems to improve Thai product quality in view of ensuring international competitiveness. Reinforcement and upgrading of the TISI for this purpose in view of Thai products conforming to the standards of other countries.

(4) Increase of R & D investment

The 6th 5-Year Plan was prepared based on the achievements and shortcomings of the 5th 5-year Plan and 3 approaches were introduced to achieve the economic and social targets, i.e. (1) reaping the benefits of the continuing economic development programmes, (2) restructuring of the production structure and the market system and improvement of the contents of the services and (3) realization of an equitable income distribution.

To contribute to the realization of the above, the present study is expected to achieve the following.

(1) Ensurance of the quality reliability of Thailand's industrial products in the international market.
(2) Promotion of industrial standardization.
(3) Consolidation and improvement of the testing, inspection and metrological technologies.

Refer to Fig. 1.5.1-1 for the relation between the administrative organizations in Thailand.

3.2 Related Laws and Regulations

3.2.1 Industrial Product Standards Act

Originally enforced in 1968, the Industrial Product Standards Act was revised in 1979 and has the following objectives.

(1) Improvement of the reliability of manufactured product quality.
(2) Promotion of exports in the international market.
(3) Ensurance of the equitability of commercial transactions.
(4) Protection of the safety and interests of consumers.
(5) Development of the manufacturing industries.

(a) Outline of the Act

(1) Determination of Standards for Mining and Manufactured Products

Not only industrial products but also processed agricultural, forestry and marine products, pharmaceutical products and chemical fertilizers are subject to Thai Industrial Standards. In fact, TIS cover all products for which standardization is deemed necessary from the national viewpoint.

(2) Certification

All products for which industrial standards are determined will be subject to the certification scheme, if display of standards mark on the products is required. The competent Minister has the authority to designate these standards as being compulsory whenever deemed necessary.

(b) Thai Industrial Standards Institute (TISI)

The Thai Industrial Standards Act is under the jurisdiction of the Ministry of Industry (MOI) and is enforced by the TISI, a department of the Ministry of Industry, which has the following powers and duties.

- To prepare and publish standards.
- To carry out the certification activities.
- To promote the implementation of standards.
- To represent Thailand in the international organization for standardization.
- To be responsible for international food standardization activities in Thailand and to cooperate with joint FAO/WHO food standards programmes.

3.2.2 Export Commodities Standards Act

The Export Commodities Standards Act was originally enforced in 1960 as the Export Standards Act, 1960 for the purpose of ensuring Thailand's export product quality. It was, however, amended to its present form on April 30, 1979.

(a) Outline of the Act

(1) Designation of Commodities and Establishment of Standards

Based on the understanding that the standardization of product quality is an absolute necessity to improve the quality of export commodities and for the promotion of exports, the competent Ministry has the authority to designate the commodities to be standardized, establish commodity standards, designate the customs office to handle designated export commodities, issue quality (inspection) certificates and set inspection fees, etc.

(2) Exporters of designated export commodities must meet the requirements specified in the Act and must receive a certificate of registration from the Commodity Standards Division of the Ministry of Commerce. Furthermore, exporters must submit the designated commodities for inspection to a designated customs office at the time of export. The commodities must bear the specified mark indicating they have passed inspection and must be accompanied by a quality certificate. Export inspection is conducted by the Commodity Standards Division, its branches or designated inspection laboratories. The quality certificate is also issued by the Commodity Standards Division.

(b) Commodity Standards Division

The Exports Standardization Act is under the jurisdiction of the Ministry of Commerce (MOC) and is enforced by the Commodity Standards Division, a division of the Ministry of Commerce, which has the following functions.

- Acts as the secretariat of the Commodity Standards Committee and assists the standards preparation sub-committees in the preparation of draft standards.
- Examines exporters of designated products and designated inspection laboratories and registration thereof.
- Together with its branch offices, carries out actual inspection.
- Receives claims directly from parties of export contracts concerning the inspection results submitted by inspection laboratories.

3.2.3 Other Laws and Regulations

In addition to the Industrial Product Standards Act and the Exports Standardization Act, various laws and regulations are enforced in view of protecting the public in line with industrialization.

(1) System under Food Act B.E. 2522
(2) System under Drug Act B.E. 2510: 2nd Amendment B.E. 2516, 3rd Amendment B.E. 2522
(3) System under Poisonous Article Act B.E. 2510: 2nd Amendment B.E. 2516
(4) System under Fertilizer Act B.E. 2518
(5) System under Consumer Protection Act B.E. 2522

3.3 Current Status and Problems of Standards

3.3.1 Thai Industrial Standards

Industrial standards are established, amended or revoked by the authority of the Industrial Standards Council as stipulated in the Industrial Product Standards Act while the actual work is carried out by the Technical Committees and the Standardization Division of the TISI.

Industrial standards are established or amended in line with the following.

(1) To satisfy the requirements of organizations related to industry, economy and technologies in Thailand and other requirements concerning the living conditions of the Thai people.

(2) To meet the immediate requirements of the Thai economy.

(3) To obtain national consensus as far as possible.

(4) To protect the interests of both manufacturers and consumers.

(5) To ensure the optimum national economy.

(6) To promote the progress of more effective economic activities, leaving room for the improvement of methods to carry out more efficient and effective economic activities.

(7) To make periodic reviews and amendments of standards according to technological progress and changes in the national economy in order to update them.

(a) Established Standards

The establishment of industrial standards in Thailand was first initiated in 1970 and a total of 653 standards have so far been established. The current new standard establishment capability is some 100 standards/year. The number of TIS classified by industrial fields is as given in Table 3.3-1. There are relatively many

standards relating to the chemical, food and consumer product industries. With regard to the mechanical engineering and electric/electronic industries, however, while a fair number of standards have been established, standardization in these industries is still, in general, in the initial stages.

Table 3.3-1 Established Industrial Standards by Fields

Field	'70-'71	'72-'76	'77-'81	'81-'86	Total (%)
Chemical	1	15	22	38	76 (11.6)
Mechanical engineering	-	14	42	32	88 (13.5)
Agricultural products	-	3	15	14	32 (4.9)
Plastic & plastic products	-	8	6	6	20 (3.1)
Electrical engineering	5	15	18	14	52 (8.0)
Consumer products	3	21	17	26	67 (10.3)
Pulp & paper	-	3	10	6	19 (2.9)
Metallurgical	-	18	21	19	58 (8.9)
Civil engineering & construction materials	-	18	10	22	50 (7.7)
Architectural	1	20	4	13	38 (5.8)
Textiles	1	13	2	9	25 (3.8)
Non-metallic products	-	3	9	23	35 (5.4)
Food	2	34	20	20	76 (11.6)
Electronics/ Communications	-	1	-	4	5 (0.8)
Others	-	1	4	7	12 (1.8)
Total	13	187	200	253	653 (100)

(b) Outline of Industrial Standards

The TIS mostly consist of standards for industrial products but also cover those products which are classified under agricultural standards in Japan (JAS). The standards can be classified into the following categories in view of their contents.

(1) Kind, type, shape, dimensions, manufacture, supply, grade, components, performance, durability and safety of industrial products.

(2) Manufacturing process, design, drawing, usage, materials for industrial products and safety of manufacturer.

(3) Packing method, wrapping method or binding method, materials thereof, kind, type, shape and dimensions of wrapping materials and containers.

(4) Methods of experiment, analysis, evaluation and testing of industrial products and measuring methods for containers and dimensions.

(5) Technical terms, abbreviations, symbols, codes, colours, numbers and units relating to industrial products.

(6) Others, including definitions under ministerial regulations.

(c) Diffusion of Industrial Standards

Established by the TISI, the Standardization Promotion Division is making great efforts in view of the diffusion and public relations (PR) of Thai Industrial Standards. The targets of the measures taken by the TISI are as follows.

(1) Diffusion of the recognition of TIS among the general public (diffusion and PR activities through publications and the mass media, etc.)

(2) Encouragement of the acquisition of the arbitrary TIS mark.

(3) Encouragement of the procurement of products bearing the TIS mark by government and public organizations.

(4) Expansion of the scope of compulsory standards.

(d) Problems Relating to Industrial Standards

In view of the current status of Thai industry, the following problems can be pointed out in regard to industrial standards.

(1) The current speed at which standards are established cannot provide the timely establishment of standards in line with the significant progress of Thai industry in recent years, including the advancement of foreign companies in Thailand. This standardization lag could cause a dissociation from the actual conditions of industry, creating confusion.

(2) The current system appears inadequate for the development of appropriate standards which reflect the level of Thai industry.

(3) In regard to the establishment of industrial standards, although people who have knowledge of foreign and international standards are required, they are not readily available at present. The level of domestic products is, therefore, not sufficiently understood in relation to the level of foreign products.

(4) Under the present industrial standards, the same stipulations (relating to testing method, etc.) are applied for such different objectives as the assurance of quality and the assurance of

safety, etc. When the establishment of standards is intended in the face of diverse products, the objectives of the new standards must be clearly understood and appropriate provisions vis-a-vis these objectives must be incorporated in the standards.

(5) Direct quotations from foreign or international standards do not fully reproduce the original standard, causing problems in regard to the actual application.

(6) Although the wide use of industrial standards has been actively promoted by the TISI, industrial standards are not sufficiently referred to at the factory level.

3.3.2 Commodity Standards

Draft commodity standards for those commodities subject to export inspection are prepared by the Draft Preparation Sub-Committees. These draft standards are submitted to the Commodity Standards Committee for examination and subsequently become effective after approval by the Ministry of Commerce. Commodity standards have so far been established for 12 items which are also subject to export testing/inspection and it is expected that 7 more standards will be introduced in the near future.

In the case of tapioca products which are also subject to industrial standards, attention is paid to avoiding a duplication of standards by adopting the industrial standards in question as commodity standards.

3.4 Current Status and Problems of Certification and Inspection Systems

3.4.1 Certification System Based on Industrial Standards

All products covered by product standards (approximately 540 standards), which account for some 80% of industrial standards, are subject to the certification system based on industrial standards. Of these, 28 product standards are subject to compulsory certification in view of consumer safety, public welfare and/or economic effects, etc. The remainder are subject to voluntary certification. Another 19 product standards are planned to be placed under the compulsory certification system by the end of 1987 and the number of compulsory standards is expected to further grow in the future.

(a) Certification Procedure - Marking Programme

(1) The necessary documents are submitted to the TISI by the applicant. The TISI examines the documents and then visits the applicant's factory to inspect the processes, quality control and product testing equipment, etc. in accordance with the pertinent standard and the specified procedure and takes samples for testing.

(2) The TISI sends the samples to a designated testing laboratory for testing.

(3) The TISI evaluates the capability and the appropriateness of the quality control in the factory concerned based on the factory inspection and sample testing results.

(4) If the TISI finds the capability and quality control of the factory to conform to the standard based on the evaluation described in (3) above, it submits a report to the Industrial Product Standards Council and the applicant is granted certification (licence) after approval by the Council.

(5) The TISI carries out factory inspections 3 or 4 times in the first year of the factory being granted certification in order to check the product quality records and the quality control of the factory. Products bearing the TIS mark are sometimes sampled for testing purposes. In the second and subsequent years, the frequency of factory inspections is determined based on the results of the inspections conducted in the first year.

(6) Once a year or so, the TISI buys products bearing the TIS mark sold on the market for inspection purposes.

Apart from the scheme mentioned above, TISI also carries out Product Registration Programme which is used only when TISI product standards has not been published. Either relevant international or foreign national standards, or government specifications are used.

(b) Problems of Certification System

The certification system, including the inspection system, consists of product inspection, quality control inspection, regular factory inspection after certification approval and market sampling inspection regardless of whether the product concerned is subject to either compulsory or non-compulsory (voluntary) certification.

In regard to the export inspection system, inspection systems based on commodity standards have been established for each designated export inspection item pursuant to the relevant Act. Since the number of subject items is small, problems of duplicated inspection have not yet arisen under the present inspection systems.

When the increase of the export inspection items is intended in the future, however, industrial standards and commodity standards should be coordinated and appropriate measures taken to avoid the duplicated application of the inspection systems.

3.4.2 Export Inspection System

12 items are currently subject to compulsory inspection, including agricultural products which are exported in large volume, silver products and silk products, etc.

(a) Inspection System

Inspection is carried out in 2 stages. The first stage is conducted prior to loading on ship while the second stage is conducted after loading on ship for the purpose of collaborating the test results of the first stage.

7 designated inspection organizations are duly registered at the Ministry of Commerce, including 2 organizations overseas. Registration is made for each designated item in view of the capacity and facilities required on the part of inspection organizations and the validity of registration is 1 year.

(b) Problems of Inspection System

As the export inspection system has been systematically prepared, including the registration requirements for exporters and the qualification requirements for designated inspection organizations, and as its application is flexible in that the quality criteria which are part of export contracts are given priority over commodity standards which are considered to be the minimum requirements, it is working as a realistic system. However, when the increase of the subject items is intended in the future, as much conformity as possible should be achieved between commodity standards and industrial standards.

3.5 Current Status and Problems of Testing

3.5.1 Current Status of Industry Relating to Industrial Standard Testing

(a) Classification by Type and Scale of Businesses

The great majority of factories relating to industrial standard testing are small to medium size factories with less than 50 workers.

(b) Classification by Area

In general, a large number of small and medium size factories of the manufacturing industry are concentrated in the metropolitan area.

While manufacturers should conduct the testing under industrial standards themselves, as well as promote quality assurance and quality control, most of their equipment investment is for manufacturing equipment and no investment is made for inspection/testing equipment. Given this situation, it is difficult to expect each factory to have its own inspection/testing equipment/facilities and to carry out its own inspection/testing.

3.5.2 Industrial Standard Testing

(a) Number of Industrial Standard Testing

The number of applications for testing under industrial standards has been steadily increasing, from 3,489 in 1984 to 4,141 in 1985 and further to 4,952 in 1986 with an average annual increase of 700 - 800 in the last 3 years.

In terms of industrial fields, applications for testing from the chemical, mechanical engineering, electric, metal, civil engineering, architectural, non-metal and food industries have been steadily

increasing. Although the number of certified factories slightly increases every year, they only account for a mere 3% of the total factories registered as of 1986, showing the diffusion of the certification system to be making slow progress.

(b) Suggested and Actual Lengths of Testing

As shown in Table 3.5-1, the actual length of testing generally exceeds the length of testing suggested by the TISI. Regardless of compulsory or non-compulsory testing, more than 25% of the testings conducted under industrial standards require more than 90 days.

Tests to determine product conformity with the relevant standards are generally completed in about 30 days in Japan and North America. In comparison, the testing length in Thailand is fairly long. When the actual testing length far exceeds the suggested testing length, companies are forced to revise their production schedules or business deals, making the efficient use of resources, labour and facilities difficult. The effect of testing delays on compulsory certification items is particularly severe as their legal production is impossible without certification.

Table 3.5-1 Actual Testing Length for Items Where Suggested Testing Length is Approx. 30 Days

TIS No.	Category	Product	Suggested length	Actual max. length	Ratio	Actual mean length	Mean ratio	
11	Electric	PVC insulated cables and flexible cords	30	300	10.0	193	6.4	*
23	Electrical	Ballast fluorescent lamps	20	186	9.3	106	5.3	*
30	Chemical	Nitrous oxide for medical purpose	30	66	2.2	66	2.2	*
196	Mechanical	Automotive safety glasses (laminated)	28	261	9.3	261	9.3	*
293	Electrical	PVC insulated aluminium cables	30	288	9.6	189	6.3	*
309	Consumer products	Mosquito coils and sticks	30	39	1.3	34	1.1	*
369	Mechanical	Safety helmets for road users	30	127	4.2	127	4.2	*
496	Non-metallic	Lacquer thinner	20	34	1.7	30	1.5	*
520	Non-metallic	Automotive nitrocellulose lacuer thinner	30	39	1.3	29	0.97	*
531	Consumer products	Plastic containers for sterile pharmaceutical products	35	79	2.3	66	1.9	*
539	Chemical	Carbon dioxide for medical use	30	35	1.2	35	1.2	*
540	Chemical	Oxygen for medical use	30	85	2.8	85	2.8	*
64	Electrical	Copper conductors	25	177	7.1	177	7.1	
86	Electrical	Aluminium conductors	35	232	6.6	165	4.7	
92	Electrical	Table-type fans	30	141	4.7	112	3.7	
118	Electrical	Automotive low voltage cables	29	89	3.1	89	3.1	
226	Electrical	Polyester enamelled copper wires	22	53	2.4	53	2.4	
254	Mechanical	Bicycle frames	28	72	2.6	72	2.6	
300	Mechanical	Track pins	25	456	18.2	456	18.2	

* indicates a compulsory standard.

Source: TISI

(c) Designated Testing Laboratories

(1) Designation of Testing Laboratories

The TISI has designated a total of 49 national organizations, national testing laboratories and other public bodies as designated testing laboratories to which the necessary testing is entrusted in view of the inadequate testing facilities of the TISI.

The TISI classifies the industrial standard testing items into chemical mechanical engineering, physical, biochemical and others and designates the testing laboratory for each standard. This designation is based on the technological level and equipment of the subject laboratory and some laboratories are not designated to conduct certain testing items of a single standard.

Of the 49 testing laboratories, the DSS and TISTR are comprehensive laboratories while the other laboratories conduct testing of a limited scope. Between 1984 and 1986, only 22 laboratories conducted industrial standard testing, presumably because of the limited testing capacity due to the original assignments. In view of the above, there were some cases in these 3 years of the TISI requesting non-designated laboratories to conduct industrial standard testing.

(2) Problems of Designating Testing Laboratories

The criteria for designating testing laboratories are currently under examination. However, as far as the prepared draft standard is concerned, the proposed criteria lack concreteness and the following can be pointed out.

a. There is an absence of provisions on the qualifications required by testing staff.

b. There is an absence of provisions on the minimum testing equipment and facilities required by designated testing laboratories, as well as provisions on the maintenance/control of testing equipment, including its calibration.

c. Uniform interpretation of the standards and detailed rules for test procedures, etc. should be established in view of achieving fair and accurate test results from multiple testing laboratories.

(3) Testing Equipment and Number of Tests Handled

The provision of equipment is unsatisfactory in view of the volume of testing required, constituting a factor in the prolongation of the testing length. Although the investigation could not cover all the testing laboratories, it can be said that some equipment is too old or obsolete to meet the level required by the standards. In addition, the quality of the equipment, including measuring accuracy, is also questionable. The testing equipment of the TISI is limited to chemical analysis equipment for the inspection of tapioca products and standard development.

(4) Test Demand Prediction and Testing Equipment

Assuming that the number of tests increases by 700 per year, an additional set of testing equipment for each test item should be adequate considering the duplicated test items of similar standards.

(5) Manpower, Education and Training

76.8% of the technical staff engaged in industrial standard testing at designated testing laboratories (other than the TISTR) have either a bachelor's degree or a higher educational qualification. Their specialised fields, however, are somewhat biased to chemical analysis, including those for food, biochemistry and pharmaceutical related fields. The number of

staff should, therefore, be increased in the electric/electronic, metal and mechanical engineering fields where the demand is expected to far exceed the handling capacity of the current staff level.

At present, the TISI does not provide designated testing laboratories with any technical training relating to industrial standard testing. Although the TISI is aware of the necessity to provide such training, TISI engineers lack the capability of acting as training course instructors.

The establishment of a qualification system for technical staff is necessary to upgrade the technical staff engaged in industrial standard testing and to improve the testing reliability, in addition to efforts to secure the long service of technical staff at testing laboratories.

3.5.3 Tests Conducted by TISTR for R & D Purposes

(a) Roles of TISTR

The TISTR is engaged in activities relating to R & D with the following powers and objectives.

(1) To cooperate with other agencies, regardless of them being either government or private agencies, in activities relating to scientific and technological research and the utilization of the research results.

(2) To provide for and maintain the national physical standards for the purpose of measuring various quantities and qualities.

(3) To collect and propagate scientific and technological information.

(4) To cooperate with other countries, organizations or other foreign agencies in scientific and technological activities.

(b) Entrusted Tests and Applicable Standards

Not only Thai industrial standards but also foreign and international standards are used by the testing laboratories in Thailand. However, while the R & D efforts necessitate a great amount of reference work concerning standards and the criteria of various fields, the testing laboratories have so far failed to arrange these standards, criteria and related documents for easy reference.

(c) Transition of Income from Requested Tests

The income from requested tests amounted to some 3 million bahts in 1985, almost doubling the figure for 1981.

(d) Current Status of Testing Equipment/Facilities and Testing Capabilities

The testing equipment/facilities of the Testing and Standards Centre (TSC), which actually carries out requested tests, mainly consists of such basic instruments as voltmeters, ammeters and multi-meters, etc. and there is a lack of special equipment. In addition, much of the equipment currently owned by the TISTR is inappropriate for the requested test items due to deterioration and/or lack of adequate capabilities. Furthermore, the calibration of the equipment is also inadequate.

(e) Manpower, Education and Training

The TISTR/TSC currently employs 49 staff members, 28 of which are college/university graduates. The number of staff should be increased in the electric/electronics and mechanical engineering fields where the test demand is expected to grow in the future. No specific problems are encountered at present due to the availability of well experienced staff. A systematic educational training system must be developed, however, in view of the number of unexperienced staff increasing due to new recruitment.

3.6 Current Status and Problems of Metrological Standards

3.6.1 Current Status of Legal Metrological System

(a) Outline of the Law of Weights and Measures

The Law of Weights and Measures was enacted in Thailand on December 17, 1923 in order to ensure the implementation of appropriate metrology, mainly in commercial areas, for the unification of metrological units and the establishment of a registration system for manufacturers of weighing and measuring instruments and an inspection system for such instruments to ensure the supply of accurate instruments.

(1) Metrological Units

Thailand became a member nation of the Convention of Meter in 1912 and, in principle, uses metric units although those units customarily used for many years are also officially recognized as legal metrological units. Metrological units in Thailand are defined for 5 kinds of values, i.e. length, area, volume, mass and capacity.

(2) Manufacture, Import, Sale or Repair of Weighing and Measuring Instruments

a. Any person wishing to carry out the business of manufacture, import or sale of weighing or measuring instruments must apply to the Minister of Commerce for a licence to do so.

b. The scope of weighing and measuring instruments covers "Weighing Instruments", "Measuring Instruments of Length" and "Measuring Instruments of Capacity or Volume".

(3) Verification of Weighing and Measuring Instruments

a. There are 2 types of verification, i.e. initial verification and secondary verification.

b. All weighing and measuring instruments to be used in business transactions, etc. must bear the verification mark to show they have been subjected to verification at the initial stage and have passed the verification test.

c. Repaired weighing and measuring instruments cannot be returned to their original owners or offered for sale unless they have been subjected to the secondary verification and have passed the verification test.

d. All manufacturers, importers and repairers of weighing and measuring instruments must have a private mark which must be registered and affixed to the instruments prior to their submission for verification.

e. Verification is conducted to verify whether the 1) type, 2) construction and material and 3) tolerance of the instruments conform to the requirements set forth in the Law and regulations.

f. Those registered in regard to weighing and measuring instruments and traders using the instruments are subject to inspections twice a year and premise inspections when deemed necessary.

(b) Legal Metrological Institution

The Weights and Measures Division, Department of Commercial Registration of the Ministry of Commerce is responsible for the enforcement of the Law of Weights and Measures. The Division employs 185 people and consists of the General Affairs Section, Registration Sub-Division, Standards Sub-Division, Verification Sub-Division, Inspection Sub-Division and 23 provisional branch offices. The Division is also responsible for the safe keepof the Prototype of the Kilogramme and the Prototype of the Meter provided to Thailand under the Convention of Meter.

3.6.2 Problems of Legal Metrological System

Although no specific problems are seen in the current legal metrological system consisting of the business registration system and the verification system, etc. for the weighing and measuring instruments stipulated in the Law of Weights and Measures, the following items should be examined in accordance with the recent development of Thai society, economy and industrial technologies.

(a) Metrological Units

In terms of the metrological units employed, Thailand is currently lagging behind the international trend where the definition of Meter has been revised, new international units adopted and the scope of each metrological unit is narrowly defined.

(b) Legal Weighing and Measuring Instruments

At present, legal weighing and measuring instruments have been introduced for length, mass and volume. This scope of the legal metrology is rather limited in view of the expanding scope of legal metrology in recent years.

(c) Standard Metrological Instruments

Explicit provisions to secure accuracy by means of regular calibration and the designated accuracy for standards used for the verification or inspection of weighing and measuring instruments are not found.

(d) Qualifications and Training of Verification Officers

Explicit provisions concerning the qualifications of verification officers or a training system to raise their capability are not found.

3.6.3 Current Status of Industrial Metrological Standards

(a) National Committee on Metrology (NCM)

Thailand had no central organization for the establishment, maintenance or provision of national standards and the responsibility for metrological standards was previously divided among different ministries. In 1985, however, the National Committee on Metrology was founded as the highest decision-making organization for metrological standards to coordinate the different ministries.

(1) Structure of the NCM

The NCM consists of members which are representatives (vice-ministers) of 7 ministries, including the Ministry of Science, Technology and Energy, Ministry of Industry and Ministry of Commerce, and the Permanent Secretary of the Ministry of Energy who acts as the Chairman.

(2) Functions of the NCM

The Sub-Committee on Metrology and the Sub-Committee on Accreditation are both under the jurisdiction of the NCM. The primary function of the former is the collection of data on metrological standards and that of the latter is the accreditation of the responsible organizations for primary standards, i.e. national standard.

(b) Arrangement of National Metrological Standard

The allocation of the responsibility for the maintenance and control of national metrological standards in Thailand has been readjusted and reconfirmed with the recent establishment of the NCM. Accordingly, organizations assume the responsibility for the maintenance of national standard for specific quantities. In deciding the new responsibilities for these organizations, the NCM used their historical backgrounds and present equipment and technical levels as judgement criteria.

The allocation of the responsibility for the maintenance and control of the metrological standards in Thailand is given in Table 3.6-1.

Table 3.6-1 Table of Metrological Standards in Thailand

Standards Unit	Prototype & primary standard	Secondary standards	Working standards
Length	DSS	DSS, TISTR	DSS, MOC
Mass	MOC, DSS	DSS, TISTR	TISTR, MOC
Electric			
DC, Low Frequency	TISTR (Japan)	TISTR, DSS	TISTR, DSS
High Frequency	TISTR (Japan)	TISTR, DSS	TISTR, DSS
Temperature	TISTR (Australia)	TISTR, DSS	TISTR, DSS
Volume, Flow	DSS	MOC	MOC
Pressure	DSS	TISTR	TISTR
Force	DSS	TISTR	TISTR
Density		TISTR	TISTR
Viscosity		TISTR	TISTR
Hardness		TISTR	TISTR
Acoustics	DSS	TISTR	TISTR
Photometry	TISTR (Japan)	TISTR	TISTR
Non-Ionizing Radiation	TISTR	TISTR	TISTR
Ionizing Radiation			AEP
Standard Gas			

Source: TISTR

AEP : Office of Atomic Energy for Peace

DSS : Department of Science Service, Ministry of Science, Technology & Energy

MOC : Ministry of Commerce

TISTR : Thailand Institute of Scientific & Technological Research

Note 1: The underlined institutions will be responsible for maintenance and control of metrological standards in the future

Note 2: The country in bracket is providing metrological standards to Thailand.

(c) Organizations for Maintenance and Control of National Metrological Standards

At present, both the TISTR and the DSS play central roles in the maintenance and control of national standards.

(1) TISTR

One of the TISTR's authorized duties is the establishment of national scientific standards aimed at the measurement of quantities and qualities of various kinds and the maintenance and control of such standards. The Testing and Standards Centre (TSC), a division of the TISTR, is currently engaged in the maintenance and control of national standards for electricity (AC and DC), thermometry, photometry and non-ionizing radiation.

(2) DSS

Although the maintenance, control and provision of metrological standards are not directly stipulated as being the responsibilities and functions of the DSS, it is stipulated by the NCM that the DSS is responsible for the maintenance and control of national standards for mass, length, pressure/force and acoustics in view of the present possession of standards and the technical capability of the DSS.

3.6.4 Problems of Industrial Metrological Standard

(a) NCM

The authority ascribed to the NCM and its organization is still unclear, partially because of its relatively new foundation. Accordingly, it seems that the NCM is not sufficiently functioning as the highest decision-making organization for metrological standards.

(b) Arrangement of National Metrological Standards

The current status of metrological standards is far from sufficient in terms of the present industrial, scientific and technological levels and the levels expected to be reached in the foreseeable future.

3.7 Current Status and Problems of Metrological Calibration

The current condition and problems of the calibration services provided by the TISTR are as follows.

3.7.1 Equipment

(a) Electric Quantities

(1) The provision of electric standard equipment and calibration equipment is of a satisfactory level for conducting ordinary precise measurements.

(2) The scope of the calibration services is quite extensive, ranging from standard battery resistors which constitute the basic units of electricity, and AC voltage and current to power.

(3) The length required for calibration is relatively short at approximately 1 week to 10 days.

(4) There are few standard cells and resistors and some of them have unstable operating characteristics.

(5) There are also few secondary and lower standards.

(6) The provision of the equipment required for the expansion of the scope of measurement is inadequate and not systematized.

(7) The maintenance conditions of standards (resistors) are unsatisfactory.

(8) There is no environmental testing facility (variable temperature-humidity chamber).

(9) Very little calibration equipment is available for the high frequency range.

(10) The are of the laboratory appears inadequate in view of the present provision level of equipment and its use.

(11) There is no sealed room which is required for the measurement of high frequency electric equipment. In addition, the thermostatic test room lacks a 24 hour temperature control despite this being indispensable for highly accurate electric measurements.

(b) Thermometry

(1) The fixed point systems specified in the IPTS-68 and the thermometric measuring standards are currently provided.

(2) The number of calibration services conducted in the one year period between 1985 and 1986 increased by 78% compared to the previous one year period.

(3) The subjects of calibration are mostly those instruments used in the field and the demand for high accuracy is low.

(4) The measuring equipment for the temperature range below 0°C is inadequate as a low temperature setting vessel and platinum resistance thermometers, etc. are not provided. The anticipated increase of the demand in the future cannot be met by the present equipment.

(5) The present thermometric test room is rather small and should be enlarged.

(6) The separation of the test room and the measuring room is inadequate and the test room is small.

(c) Photometry

The present standard of photometry at the TSC is appropriate in terms of the equipment and technological levels. The standard room, however, is small and should be enlarged.

(d) Mass

(1) One set of standard weights (25 pieces ranging from 10mg to 1kg) is used as the mass standard. These standard weights are equivalent to the secondary standard in view of their calibration accuracy.

(2) Secondary standards are not traceable to the kilogramme prototype held in Thailand.

(3) Buoyancy correction equipment is not available.

(4) Precise equi-ratio balances with a scaling capability exceeding 1kg are not provided, making it impossible to calibrate weights heavier than 1kg.

(5) The number of standard weights is insufficient.

(6) Reference weights of 20kg are not provided.

(7) The number of calibration balances for standard weights is insufficient.

(8) Specific gravity balances and platform balances, etc. are not provided.

(9) There is no division/multiplication technology for the calibration of weights.

(10) The measuring environment is poor due to the fact that pressure meter and length tests share the same room.

(e) Length

(1) The length standards and related equipment in possession are micrometers, height gauges, vernier calipers and dial gauges and

the provision of end measure and line measure standards is inadequate.

(2) Straight and tape measure standards are not provided.

(3) There is very little shape and dimension measuring equipment.

(4) The comparators necessary for the calibration work are not provided.

(5) There is very little large industrial measuring equipment and precise measuring equipment.

(6) There are very few angular standards and peripherals.

(7) Test rooms specifically for precise measurement are not provided (constant temperature/humidity rooms, etc.)

(f) Pressure - Force

(1) Only 3 types of proving rings for 5, 10 and 50t forces and some loading weights (1 - 20 kg) are available and the hydraulic force standard machine necessary for the calibration of force gauges is not provided.

(2) The deadweight piston gauges necessary for the calibration of pressure gauges are not provided.

(g) Volume - Flow Rate

No standards or related equipment are available for the measurement of volume or flow rate.

(h) Radiation

While the necessary equipment is currently being acquired to establish the standard, the present level of provision is still low in view of conducting calibration.

(i) Acoustics - Vibration

No relevant equipment is currently available and the technological level is low.

3.7.2 Manpower, Education, Training and Others

The technological level of certain divisions of the TISTR is already adequate to respond to the requirements of the industrial circle.

In order to cope with the anticipated increase of the calibration demand for high precision measuring instruments in the future, the recruitment of engineers with expertise in each field concerned is indispensable. In addition, training courses for engineers should be established and the necessary funds secured.

3.7.3 Problems and Countermeasures toward Future

(a) Precise Measurement Automation System

Instruments using the electronic measuring technology are widely used for the automatic measurement of various electric quantities, ranging from DC to low and high frequency ranges. This, however, initiates the problem of training engineers to use these instruments.

(b) Clear Determination of Traceability System

While it will be necessary for Thailand to depend on the supply of national electric standards from overseas until Thailand becomes capable of establishing the said standards by item through the upgrading of the technological capabilities, the clear determination of the traceability of the basic units and the faithful implementation of the traceability system is imperative.

(c) Improvement of Standard Equipment

The electric standard measuring instruments and systems currently in the possession of the TSC are not necessarily systemized. A measuring system should be introduced to respond to the expansion of the calibration range and other needs in the future.

(d) Environment of Standard Room

Special air conditioners to maintain the basic units of the metrological standards should be provided.

(e) Recognition of Need for Metrological Calibration

While the demand for calibration services is showing a tendency to increase, the absolute number of requests is still small and the instruments subject to calibration mainly consist of low accuracy instruments. This is simply a reflection of the situation where many of the manufacturers do not feel a necessity to control and calibrate their measuring equipment.

3.8 Current Status and Problems of Quality Control

3.8.1 Outline

The TISI has already improved the certification system with the expectation of the positive implementation of quality control by the private sector. Many foreign capital companies are also making considerable efforts to improve product quality. In the case of export-oriented companies, the sense of quality control is extremely strong since ensuring product quality over a certain level constitutes a precondition for exports. Interest in quality control is also growing among manufacturers of domestically marketed products, particularly large manufacturers. However, the introduction of quality control at a factory level is still far from satisfactory.

3.8.2 Quality Control Promotion Activities

(a) Promotion by TISI

The TISI is promoting the introduction of the quality control system in the private sector through the interpretation of national standards and the application of these standards to the certification system. Namely, the TISI examines whether an appropriate quality control system is established in a factory so that products are steadily produced with strict conformity between the in-house standard and the applicable national standards. Even after the certification mark has been granted, the TISI often carries out follow-up inspections to verify conformity. The targets of the TISI's quality control guidance are small to medium size companies. However, the diffusion of quality control to these companies is difficult due to the low degree of recognition of the merit of quality control. The number of acquisitions to the certification mark, however, tends to be steadily increasing, showing the slow but steady progress of the TISI's efforts.

(b) Promotion by Other Organizations

In addition to the TISI, the following organizations are also engaged in the promotion of quality control in Thailand.

(1) Thailand Management Development and Productivity Centre (MOI)

(2) Thai/Japan Technology Promotion Association (TPA)

(3) QC Association

(4) Thai Management Association (TMA)

(5) QC Headquarters

Of these, the TMDPC and the TPA are very actively engaged in promotion activities. The training provided by the former is mainly conducted from the management viewpoint. There are 4 courses, each lasting for about 5 days. The latter first established a QC course

in 1982 and since then has been providing practical training mainly for middle management and supervisors.

3.8.3 Problems in the Promotion of Quality Control Practices

In view of the current activities of the organizations engaged in the promotion of quality control practices in Thailand, the following problems can still be pointed out.

(a) There is a lack of appropriate teaching materials.

(b) There is a shortage of capable instructors.

(c) The implementation of QC education at a shopfloor level appears difficult and, therefore, has not been adequately conducted.

(d) The provision of QC education throughout an entire company is seldom seen.

(e) The concept of QC circle activities is fairly spread among plants with 200 workers or more but not in smaller plants.

CHAPTER 4

PROGRAMME FOR DEVELOPING INDUSTRIAL STANDARDIZATION, TESTING AND METROLOGY

4. PROGRAMME FOR DEVELOPING INDUSTRIAL STANDARDIZATION, TESTING AND METROLOGY

The underlying problems and remedial measures for developing industrial standardization, testing and metrology are recapitulated in Fig. 4, at the end of this Chapter. In this Figure, a number of development programmes are proposed for remedying the problems identified through site survey, to be implemented at levels of Government, of private industry, and jointly between government and private industry levels, as well as at levels of individual enterprises and of the entire ASEAN Region.

The different programmes are described in what follows.

Legally regulated metrology is a matter involving the law, and is moreover only remotely related to the purpose of the present Development Programmes, which is contribution to enhancing the level of Thai industry and to promoting exports: It is thus considered appropriate to limit advice to be presented in the domain of legally regulated metrology to what is of relevance to the national metrological standard quantities and system.

A Programmes for Implementation at Government Level

Programmes for implementation at government level include those for:-

- Encouraging preparation of drafts for National Industrial Standards to be drawn up on private initiative
- Promoting move for drafting/amending criteria for accrediting testing institutions
- Promoting increase in the number of metrological standards; extending the metrological system
- Promoting testing and research for developing industrial standardization
- Disseminating and promoting in-house standards and quality control

- Promoting extension and reinforcement of the capability of testing institutions
- Extending and strengthening metrological standards and metrological instrument calibration service
- Promoting reinforcement of instruction and training to enhance manpower
- Promoting establishment of industrial associations for different product groups and products
- Promoting dissemination of industrial standards

The substances of the above programmes are as described below.

4.1 Encouraging Preparation of Drafts for National Industrial Standards to be Drawn up on Private Initiative

The drafting of industrial standards --the essential starting point for developing industrial standardization-- calls for promotion through such means as:

(a) A strategic approach to the question of drafting industrial standards

(b) As practical measures for expediting the drafting of industrial standards:-

- Enlist active participation and collaboration of eligible industrial associations and other groups from the drafting stage
- Promote pertinent surveys and studies --i.e. survey, testing and research for assembling the basic data required for drafting industrial standards

4.1.1 Strategic Approach to the Question of Drafting Industrial Standards

In order to pursue such a strategic approach to the question of drafting industrial standards, the essential factor should be to organize a system

that would effectively reflect in the national policy the true needs felt by industry.

To this end, the industrial Product Standards Council should profit by having its membership reconstituted with a larger representation from industrial and academic circles, so was to have the interests of manufactures, equipment uses and commodity consumers equitably reflected in the Council's deliberations.

The Industrial Product Standard Council thus reconstituted to effectively reflect the needs of industry should then proceed to determining the principles to govern a long-term programme for establishing national industrial standards, and the schemes for putting the principles into practice.

The principles to be determined should include:-

(a) Basic and commonly applicable standards, for strengthening the industrial infrastructure:

    (1) Basic elements of standardization --common technical terms/ symbols/testing methods

    (2) Standards conducive to enhancement of material/component durability, reliability and other performance indices

    (3) Standards conducive to enhanced interchangeability among products/components/materials, and other factors that contribute to rationalization of productive processes

    (4) Standards conducive to smoothing the physical distribution of products from manufacturer to consumer.

(b) Standardization conducive to extending exports

(c) Standardization conducive to extention of the industrial domain in keeping with technological innovations

(d) Standardization conducive to enhancement of the quality of life

(1) Standards conducive to enhancing the safety and durability of consumer goods

(2) Standards conducive to enhancing the health and safety of the people, and to protection of the environment

(3) Standards related to medical care, welfare, housing, transportation and other factors directly affecting the communal environment

(4) Standards conducive to economizing the consumption of natural resources and energy.

4.1.2 Setting Up the System for Drafting Industrial Standards

If a suitable private body does not exist, or is not deemed qualified in capability, the Government should promote enhancement of industrial standard drafting capability through reinforcement of the existing body or through establishment of a new body that should group together enterprises engaged in a relevant line of industry or in the manufacture of relevant products. In doing this, the Government should undertake relevant testing work within the public institutions, and otherwise assist the drafting work with technical information.

With particular respect to standards requiring to be urgently established without waiting for spontaneous private initiative, and which call for preliminary survey and study that could better be undertaken by appropriate private body, Government subsidization should be provided in the form of grants to cover part or whole of costs incurred for drawing up a tentative standard by a designated drafting body.

This practical system should operate with consideration given the following principles:

(a) Standards to be subsidized for drafting should be those that are both:-

(1) Of such substance as to call for preliminary surveys/studies/ testing which could more suitably be undertaken outside government institutions, and/or

(2) Of nature to require establishment without delay

(b) The bodies to be entrusted with the drafting of a standard under this system should be in a position to gather and properly reflect the requirements and desires of relevant interests, and further, either:-

(1) Possess the documentation, data and information necessary for drafting the standard, even if not equipped with testing facilities, or

(2) If testing is indispensable for the drafting work, be equipped with the requisite testing facilities

(c) The items to be specified in the draft standard and other pertinent information necessary for proper drafting should be indicated.

(d) The time limit of submitting the draft should be indicated.

4.2 Promoting Move for Drafting/Amending Criteria for Accrediting Testing Institutions

It is advised to draw up general criteria for the accreditation of testing institutions based on the guidelines issued by the International Electrotechnical Commission (IEC) and the International Standardization Organization (ISO), to be supplemented by detailed individual criteria for

application to different domains of technology and to different industrial standards, in reference to which to reinforce and enhance the capability of existing testing institutions.

The general and the detail criteria referred to above should both contain requirements governing at least the items of:

(a) Nature of testing institution

(b) Range of responsibilities to be undertaken in respect of testing service

(c) Obligation of maintaining secrecy

(d) Quantity and specifications of testing equipment available

(e) System of equipment calibration

(f) Number and qualifications of testing personnel

(g) System of testing personnel instruction and training.

Following accreditation, periodical inspections should be made of the institutions, and any insufficiencies revealed should be demanded correction, in order to have the institutions maintain their accredited level at all times; guidance should be given to encourage incessant enhancement of their level of capability.

Implementation of this Programme should contribute effectively to remedying such shortcomings as noted in §3.5 of :-

- Having to entrust testing to non-accredited institutions, on account of ambiguities in criteria governing accreditation and of insufficient exercise of authority

- Incapability of testing institutions to undertake all the test items required by applicable industrial standard

- Low testing efficiency, on account of inadequate testing facilities and equipment

- Excessive waiting time demanded for results to be obtained on requested tests, on account of concentration of requests on certain testing institutions.

4.3 Promoting Increase in the Number of Metrological Standard; Extending the Metrological System

It is advised to establish without delay a national metrological system matched to national circumstances and needs, and to foreseen progress of industrialization, with the extension of coverage by primary national metrological standard, through the creation of new primary standard as necessary and with the institutions responsible for their management and maintenance clearly designated.

In implementing this programme, coordination of the metrological system at State should desirably be promoted. Moreover, all relevant institutions should possess a clear understanding of their mutual relations and functions, in order to realize traceability to a single national primary standard by all metrological standard, both industrial and commercial.

Implementation of this Programme should contribute effectively to remedying such shortcomings as noted in §3.6 and §3.7 of:-

- Insufficient availability of metrological standard

- Incompletely established national metrological standard

- Ambiguities in the responsibilities of different institutions for managing and maintaining the metrological standard

4.4 Promoting Testing and Research for Developing Industrial Standardization

For promoting the development of industrial standards, it is advised to take the following:

(a) Entrusting specific testing and research work to institutions accredited by TISI or to universities, with whole or part of the incurred expenses borne by TISI in the form of grant for study.

(b) Subsidizing relevant studies already being undertaken by eligible private research institutes (through grants for study or other measures).

In implementation of this Programme should contribute effectively to remedying such shortcomings as noted in §3.3 and §3.5 of:-

- Lag behind the needs of industry seen in the current status of development of industrial standards

- Inadequacies in the testing and research facilities required for such development.

Implementing this Programme, in view of the fact that the grants and subsidies will require to be of substantial amount in order to ensure effective work, they should be limited in number to cover solely subjects of top priority in reference to the national economy and to public health and safety.

4.5 Disseminating and Promoting In-House Standards and Quality Control

In order to cope with the problems cited in §3.8, for disseminating and promoting in-house standards and quality control, it is advised to adopt the following measures:

(a) Preparation of teaching materials for enterprise-wide quality control promotion

It is considered that the promotion of enterprise-wide quality control practice would be extremely effective in solving the problem of product quality. The determining factor for success in this action is instruction and training. While ideally, training courses should be organized separately with curricula matched to top management, middle management, shop-floor superintendents and workers, it would be practical to begin by preparing teaching materials for courses envisaging personnel to spearhead in-house quality control practice --i.e. in-house standardization and quality control leaders-- and the quality control staff to engage in direct action of quality control dissemination within their enterprises.

Another basic factor for successful enterprise-wide quality control dissimination is to awaken a spirit of participation among the workers, and to this end it should be effective to encourage small group action for promoting quality control.

(b) Dissemination of quality control practice among small enterprises

For effectively disseminating quality control practice among small enterprises, it is advised to select a limited number of enterprises calling for improvement of product quality, on the criterion of contribution towards exports or towards enhancement of the health and safety of the people, for administration of instruction and training to their personnel with the view to raising their level of quality control. Also, financial assistance should advisably be provide for the acquisition of necessary production and testing equipment.

(c) Talks on successful cases of quality control practice

A very effective measure for disseminating quality control practice among private enterprises is the organization under public sponsorship of talks given by people from other enterprises that have

successfully gained mared benefits from the introduction of quality control practice.

4.6 Promoting Extension and Reinforcement of the Capability of Testing Institutions

It is advised as measure for extending and reinforcing the capability of testing and research institutions.

(a) To have existing institutions periodically and systematically recruit testing personnel in specified domains of specialization, to match expected demands for testing: to provide them with instruction and training in accordance with an established programme that should include courses of instruction abroad and instruction by foreign experts.

(b) To have existing institutions regularly renew the testing equipment and to systematically acquire new equipment, to meet the progressing demands of developing technology and the enhancing requirements of industrial standards continuously raised in level, to regularly and correctly recalibrate the installed testing equipment, to improve the reliability of test results.

(c) To set up an establishment to serve as national centre for industrial standard testing.

(d) To set up an establishment to serve as national centre for industrial testing and research, and for metrological standard and calibration service.

Implementation of this Programme should contribute effectively to remedying such shortcomings as noted in §3.5 of:-

- Excessive workload burdening the testing institutions
- Insufficient and outdated testing facilities and equipment
- Available equipment not matching the demands for testing
- Inadequate accuracies ensurable with available equipment
- Insufficient availability of documentation on international and foreign standards
- Ditto of technical documentation
- Inadequate maintenance and calibration of metrological standard and equipment.
- Shortage of proficient testing and research personnel

The measures set forth under the headings (a) and (b) above --relating to existing institutions-- would be required to be implemented without affecting the continuing work being carried on by the institutions, and for this reason, the current problem of excessively long waiting time for results to be obtained from requested certification tests --with further increase of demand for such tests expected in the coming years-- could not possibly be solved through such measures.

This is why it is advised to complement these measures by newly setting up a national centre for industrial standardization testing, proposed under the heading (c) above.

The centre for industrial testing and metrological calibration --proposed under the heading (d)-- is of equal importance and urgency, for enhancing the nation level of technological capability.

4.7 Extending and Strengthening Metrological Standards and Metrological Instrument Calibration Service

It is advised to proceed with the establishment of metrological standard and with extending/strengthening the service for calibrating the standards and measuring instruments, in view of their indispensability for enhancement of industrial product quality and for the development of industry, since these factors constitute the basis of industrial technology.

To this end, it is further advised to establish national metrological standards for each quantity, with the national primary standard occupying the apex of the traceable pyramid, and with secondary, working and other standards of respectively adequate accuracy ensured through modern calibrating equipment of adequate accuracy. Such equipment should advisably be stored, maintained and operated in a properly conditioned environment of constant temperature, humidity and other conditions.

Implementation of this Programme should contribute effectively to remedying such shortcomings as noted in §3.6 and §3.7 of:-

- Inadequacies in the established national metrological system
- Insufficiencies in the numbers and accuracies of the various metrological standards and equipment covering different quantities and grades of accuracy.

The foregoing measures should further contribute to:-

- Answering with additional equipment the increasing demand for calibration service
- Providing the techniques and facilities to serve as basis for extending --in both technical capability and equipment --the coverage of national metrological standards

4.8 Promoting Reinforcement of Instruction and Training to Enhance Manpower

(a) In-house standardization and quality control

Training programmes should advisably be planned as a first priority for generating instructors to engage in training enterprise personnel to become "in-house standardization leaders" and "quality control leaders" --who will spearhead in-house standardization and quality control, respectively, within their enterprises-- and "quality control staff" --to be charged with front-line quality control practice.

Training of the instructors should follow a curriculum that includes the subjects set forth below:

(1) Instruction for those to become in-house standardization leaders:-

- General notions of in-house standardization
- Procedure for advancing in-house standardization
- Compiling and arranging in-house standardization
- Practical application of in-house standards
- Harmonization of in-house standards with national and international industrial standards,

With a view to enabling the instructors to impart to their trainees the capability of leading enterprise-wide activities for the promotion of in-house standardization.

(2) Instruction for those to become quality control leaders:-

- Introduction, promotion, development and stabilization of enterprise-wide quality control practice
- Organization, implementation, instruction in enterprise-wide quality control practice

- Improving enterprise-wide quality control practice
- Quality assurance and reliability.

With a view to enabling the instructors to impart to their trainees the capability of leading enterprise-wide activities for the promotion of quality control.

(3) Instruction for those to become quality control staff:-

- Notions of statistics
- The seven standard tools for quality control
- Organizing and promoting small-group activities for furthering quality control
- Improving quality control practice.

(b) Testing, metrology

It would be desirable to plan for rapidly extending school education --particularly in the technical disciplines-- to enrich the layers of technically trained manpower in Thailand.

In view of the fact, however, that school education in testing and metrology will call for considerable lead time, and that graduates of schools are not provided with the practical knowledge and skills to immediately engage in productive work, it is advisable to reinforce the technical instruction and training functions of existing institutions such as TISI and TISTR, to provide for their accepting trainees from private enterprises.

To this end, training courses of set form should advisably be repeatedly organized, with curricula devised separately for trainees with different objectives and of different levels.

Examples of the subjects to be included in such curricula are set forth below for the various courses.

(1) Testing techniques course:-

- Elementary notions of testing
- Principles of testing/measuring equipment, their manipulation
- Interpretation of standards
- Practical exercises in testing
- Analyzing test results
- Compiling test reports: points to be heeded.

(2) Metrological techniques course:-

- Elementary notions of measurement and of the management of metrological standards
- Principles of measuring instruments; measuring techniques
- Technical aspects of establishing metrological standard; their maintenance and supply.

Implementation of this Programme should contribute effectively to remedying such shortcomings as noted in §3.5 of:-

- Insufficiencies in the number and proficiency of testing and metrological personnel
- Mismatching of the fields of specialization between available and demanded personnel

4.9 Promoting Establishment of Industrial Associations for Different Product Groups and Products

Important measures such as promoting dissemination of industrial standardization and quality control to can in many instances be effectively implemented through or with the collaboration of industrial associations in relevant industrial circles. The effect of combining the efforts of interested enterprises, and the spirit of solidarity fostered through the establishment of such associations should positively serve in furthering such actions as the drafting of tentative national industrial standards

--as referred to in §4.1-- and the establishment of joint testing institutions --as referred to further on in §4.14.

4.10 Promoting Dissemination of Industrial Standards

In order to further promote the dissemination of industrial standardization, as noted in §3.3, it is advisable to adopted the following measures.

(a) Stronger support for promoting TIS Mark commodity sales

To establish a permanent showroom for TIS Mark commodities, in a locality convenient for visiting comumers and users, not domestic but also from abroad.

(b) Industrial standardization awards

Among other measures that might be adopted as incentive for promoting industrial standardization, a system that should not fail to have marked effect is that of according public recognition through the granting of commendatory awards, to be conferred by the Minister, or by the Secretary General of TISI --in accordance with the degree of merit-- to enterprises and individuals noted for meritorious service to individual enterprises (which should already be licenced for TIS Mark), to industry, to the nation and/or to the society at large, in the matter of industrial standardization.

The honour conferred by the award might further be supplemented by priority or other privileges given for exhibiting at the TIS Mark showroom.

B Programmes for Implementation at Private Industry Level

The programmes that would aptly come under this heading include those already cited under the foregoing sections of :-

- Promoting establishment of associations for developing testing
- Promoting establishment of associations for developing metrology
- Promoting establishment of industrial associations for different product groups and products
- Promoting establishment of joint private testing laboratories.

4.11 Promoting Establishment of Associations for Developing Testing

It is advised to establish an association grouping together specialized private testing laboratories and enterprises, with a view to developing industrial testing.
The activities of such an association should include:

(a) Assembly and exchange of technical information, including foreign standards and codes

(b) Surveys conducive to improvement of testing techniques

(c) Development of in-house testing techniques; compilation of testing manuals

(d) Assistance in drawing up in-house standards.

National and public testing institutions would be expected to participate in the activities of the association, with guidance and advice provided either as sponsoring member or as interested outsider.

The cost of establishing and running the association should in principle be covered by membership fees, but until the association is firmly set on foot with the number of members grown to a sizable level, apart of the

expenses might have to be subsidized by government.

Implementation of this Programme should contribute effectively to remedying such shortcomings as noted in §3.5 of:-

- Shortage of proficient testing personnel
- Shortage of testing facilities at the disposal of enterprises
- Insufficient knowledge in industry of domestic, foreign and international industrial standards
- Insufficiently available relevant technical information
- Lack of testing and inspection manuals in enterprises.

4.12 Promoting Establishment of Associations for Developing Metrology

It is advised to establish an association grouping together manufactures of measuring instruments, institutions providing metrological calibration service and pertinent enterprises, with a view to:

(a) Assembly and exchange of foreign documentation and technical information concerning metrological standard and calibration

(b) Surveys and studies for improving the techniques used in calibrating metrological and measuring instruments and in determining instrument accuracy

(c) Development of techniques used in metrology and industrial measurements and in the calibration of instruments

(d) Assistance in the compilation of manuals on industrial measurements and instrument calibration

(e) Dissemination of metrology-mindedness.

National and public testing institutions would be expected to participate in the activities of the association, with guidance and advice provided either as sponsoring member or as interested outsider.

The cost of establishing and running the association should in principle be covered by membership fees, but until the association is firmly set on foot with the number of members grown to a sizable level, part of the expenses might have to be subsidized by government.

Implementation of this Programme should contribute effectively to remedying such shortcomings as noted in §3.6 and §3.7 of:-

- Shortage of proficient metrological and measuring personnel
- Insufficient interest and knowledge in industry concerning metrology and measurement
- Insufficiently available relevant technical documentation
- Lack of manuals on industrial measurements and instrument calibration.

4.13 Promoting Establishment of Industrial Associations for Different Product Groups and Products

Reference to this programme has already been made under §4.9 for the programme to be implemented at Government level. The guidance and support of Government and other public institutions will of course be indispensable for their establishment, but once established, the associations should promptly proceed to organizing themselves for undertaking on their own initiative various activities beneficial to the member enterprises. The activities should centre around such pursuits as exchanges of information, obtaining the consensus of the industrial circles on promotional schemes, arrangements for joint testing, selection of subjects for joint research and development, assembly and processing of statistical data, as well as arrangement for joint procurement and marketing.

4.14 Promoting Establishment of Joint Private Testing Laboratories

It is advised to promote the establishment of joint private testing laboratories by manufacturers and exporters, with the participation of private testing and inspection institutions, with a view to undertaking such activities as:

(1) Requested testing

(2) Instruction and training in testing techniques

(3) Unifying the interpretation of industrial standards; compiling unified testing manuals

(4) Making available to enterprises the use of testing facilities and equipment.

In implementing this Programme, the cost of establishing and running the joint laboratories should, in principle, be covered by contributions from member enterprises, but the considerable sums involved should call for government support and guidance in funding. The same applies to operating and equipment renewal expenses, which should in principle be covered by membership fees and charges for requested tests and for use of laboratory facilities, but until the laboratories are firmly set on foot with the number of members grown to a sizable level, apart of the expenses might have to be subsidized by government.

Implementation of this Programme should contribute considerably to remedying such shortcomings as noted in §3.5 of:-

- Shortage of capital at the disposal of private enterprises to spare for enhancing the quality and quantity of their testing equipment
- Inadequate maintenance and calibration of measuring instruments in industry,

through testing facilities of the joint laboratories being properly managed and maintained, and made freely available to member enterprises.

The foregoing measures should further contribute to:-

- Alleviating the current overloading of public testing institutions with requested testing work
- Alleviating the waiting time for test results to be obtained.

C Programmes for Implementation at Joint Government-Private Industry Level

4.15 Joint Private Administration of Programmes

All the programmes enumerated in the preceding sections for implementation respectively at levels of Government and of private industry call for co-ordination and collaboration of the other level, whichever the level under which the programmes are initiated. This applies particularly to the activities referred to under §4.4, 4.5, 4.6, 4.7, 4.8 and 4.10 for implementation at Government level.

D Programmes for Implementation at Individual Enterprise Level

Programmes that might be promoted under this heading include:-

- Promoting Establishment of co-operative associations and similar bodies
- Promoting enhancement of technological and management capability.

Details are set forth in what follows.

4.16 Promoting Establishment of Co-operative Associations and Similar Bodies

Private enterprises engaged in similar lines of industry should seek to pool their resources through the establishment of co-operative associations, for rationalizing management and enhancing productivity. Such pooling of means should alleviate problems of financing and staffing --which could be particularly acute in the case of the smaller-scale enterprises.

The activities to be undertaken by the associations should include:

(1) Co-ordination of interests among member enterprises: assembly and dissemination of technical information

(2) Co-operative buying

(3) Mutual use of testing facilities/equipment; establishment of joint testing laboratory

(4) Joint undertaking of market research and development, and of publicity

(5) Joint planning and implementation of personnel instruction and training programmes

(6) Facilitating and guaranteeing loans.

4.17 Promoting Enhancement of Technological and Management Capabilities

All the foregoing measures set forth as programmes for implementation at levels of Government or of industrial associations will bear fruit only upon the individual enterprises constituting the Thai industry coming to interest themselves in actively taking apart in the programme activities and regularly practicing the measures that are recommended.

For this reason, it is advisable to have the following measures put into practice by the individual enterprises:

(1) Having enterprise personnel participate actively in seminars and training courses on business and administrative management

(2) Setting up standard procedures, manuals and other in-house working standards, as well as adopting enterprise-wide quality control practice and other measures, with the view to establishing a system for enhancing product quality and for stably manufacturing products of uniform high quality

E Programmes for Implementation at ASEAN Regional Level

4.18 Promoting Regional Co-operation

The ASEAN nations are directing their efforts towards achieving the purpose of their Association through promotion of region-wide economic exchanges. For the economic development of member countries, significant importance is presented by technological exchanges, which cannot proceed without proper establishment of basic prerequisites including industrial standardization, quality control practice, adequate testing facilities, a reliable metrological system, and accurate calibration service.

With progress of trade between the member nations, there will be a widening variety and an increasing quantity of goods exchanged between Thailand and the other member nations, and this will without doubt raise mounting among these nations of necessity of adopting common industrial standards and of unifying the means of providing quality assurance.

It is to be hoped that development of industrial standardization, testing and metrology in Thailand through implementation of the proposed projects will lead eventually to widening exchange of persons between members countries, as well as other measures of technical cooperation conducive to the spread of industrial standardization, testing and metrology in the ASEAN Region.

		CURRENT STATUS	COUNTERMEASURES	*
INDUSTRIAL STANDARDIZATION	1	Increasing need for industrial standards	Promote participation of private sector in drafting industrial standards	G + P
			Strengthen testing capability to enable drafting industrial standards	
	2	Insufficient diffusion of industrial standards	Implement activities for dissemination	G+P +E
			Encourage sales of TIS Mark products	G+ P
CERTIFICATION SYSTEM	3	Inadequate, outdated certification test facilities available at TISI and accredited institutions	Extend test facilities at relevant institutions	G
	4	Inadequate outdated test facilities at private enterprises	Extend test facilities at relevant enterprises	G + P
QUALITY CONTROL SYSTEM	5	Inadequate system of production control in private enterprises	Promote dissemination of in-house standards and quality control in private enterprises	G + P + E
	6	Shortcomings in education system	Introduce instruction in production/quality control at school level; train qualified instructors	G + E
TESTING/INSPECTION SERVICE	7	Insufficient, inadequate, outdated facilities for testing industrial and export products	Extend/renovate relevant facilities	G
	8	Equipment for testing industrial and export products remaining uncalibrated	Develop and implement adequate calibration system	G + P
	9	Insufficient number and inadequate proficiency of staff charged with testing	Establish qualification system	G
	10	Inadequate testing techniques	Establish instruction/ training system/establishments	G + P + A
			Extend chances for personnel to be attend instruction courses at home and abroad	
			Draw up manuals prescribing test/inspection procedures	
			Set up a Testing Institution Committee	
	11	Clear definition of criteria for accrediting testing institutions	Establish criteria governing accreditation; strengthen authority over administration of testing requested to accredited institutions	G
METROLOGY/CALIBRATION SERVICE	12	Insufficient number of metrological standards	Increase the number of metrological standards	G
	13	Inadequately organized system of metrological standards	Promote proper establishment of adequate metrological standards	G + P
			Promote establishment of traceable metrological system	
			Strengthen and extend functions of National Committee on Metrology	
	14	Insufficient popular awareness of the importance of metrology and calibration	Implement activities for dissemination	G + P
			Organize seminars and instruction courses	
			Establish organizations for promoting metrology-mindedness	
	15	Inadequate maintenance and calibration capability of institutions entrusted with metrological standards	Extend and modernize calibration equipment for metrological standards of different precision grades	G
	16	Power environmental conditions of laboratories entrusted with metrological standards and calibration	Increase laboratory space	G
			Enhance control accuracy of constant-temperature, constant-humidity chambers	
	17	Insufficient number and inadequate proficiency of staff charged with accurate measurements	Establish instruction/ training system/institutions	G + P + A
			Extend chances for personnel to be attend institution courses at home and abroad	
			Draw up manuals prescribing measurement procedures	

*		DEVELOPMENT PROGRAMMES
G	1	Encouraging preparation of drafts for National Industrial Standards to be drawn up on private initiative
	2	Promoting move for drafting/amending criteria for accrediting testing institutions
	3	Promoting increase in the number of metrological standards; extending the metrological system
	4	Promoting testing and research for developing industrial standardization
	5	Disseminating and promoting in-house standards and quality control
	6	Promoting extension and reinforcement of the capability of testing institutions
	7	Extending and strengthening metrological standards and metrological instrument calibration service
	8	Promoting reinforcement of instruction and training to enhance manpower
	9	Promoting establishment of industrial associations for different product groups and products
	10	Promoting dissemination of industrial standards
P	11	Promoting establishment of associations for developing testing
	12	Promoting establishment of associations for developing metrology
	13	Promoting establishment of industrial associations for different product groups and products
	14	Promoting establishment of joint private testing laboratories
G + P	15	Long-term target: Administering the activities 4, 5, 6, 7, 8, 10 above under joint government-private management
E	16	Promoting establishment of co-operative associations and similar bodies
	17	Promoting enhancement of technological and management capabilities
A	18	Promoting regional co-operation

	DEVELOPMENT PROJECTS
1	Establishment of development centres for industrial standardization, testing and metrology :- - Industrial Standardization Testing and Training Centre - Industrial Metrology Testing Service Centre
2	Establishment of joint private testing laboratories

* Meanings of symbols

G: Government level

P: Private industry level

E: Individual enterprise level

A: ASEAN regional level

Fig. 4 SUMMARIZED PRESENTATION OF MEASURES FOR DEVELOPING INDUSTRIAL STANDARDIZATION, TESTING AND METROLOGY IN THE KINGDOM OF THAILAND

CHAPTER 5

OUTLINE OF THE PLANS FOR IMPLEMENTING INDIVIDUAL PROJECTS

5. OUTLINE OF THE PLANS FOR IMPLEMENTING INDIVIDUAL PROJECTS

The preceding Chapter set forth advisable programmes proposed for developing industrial standardization, testing and metrology at levels of government, private industry etc. It is strongly advised to let all and every relevant institution actively undertake the measures set forth in the different Programmes, and in this connection it should be effective to plan and implement the measures in the form of organized projects systematically coordinating and bringing out to best effects the individual efforts directing the manpower, financial and material resources towards developing the envisaged system of industrial standardization, testing and metrology effectively throughout the nation.

In consideration of the underlying problems set forth in Chapter 3 and the remedial measures proposed in Chapter 4 with indication of their relative urgency and consequential benefits, and with account further taken of the current circumstances in respect of administrative organization, technical level and available facilities and equipment, the 2 projects set forth below are advised for adoption and implementation:

(1) Establishment of development centres for industrial standardization, testing and metrology

(2) Establishment of joint private testing laboratories

The relations holding between the two projects, and the consequential benefits to be expected from their implementation are presented diagrammatically in Fig. 5.0-1.

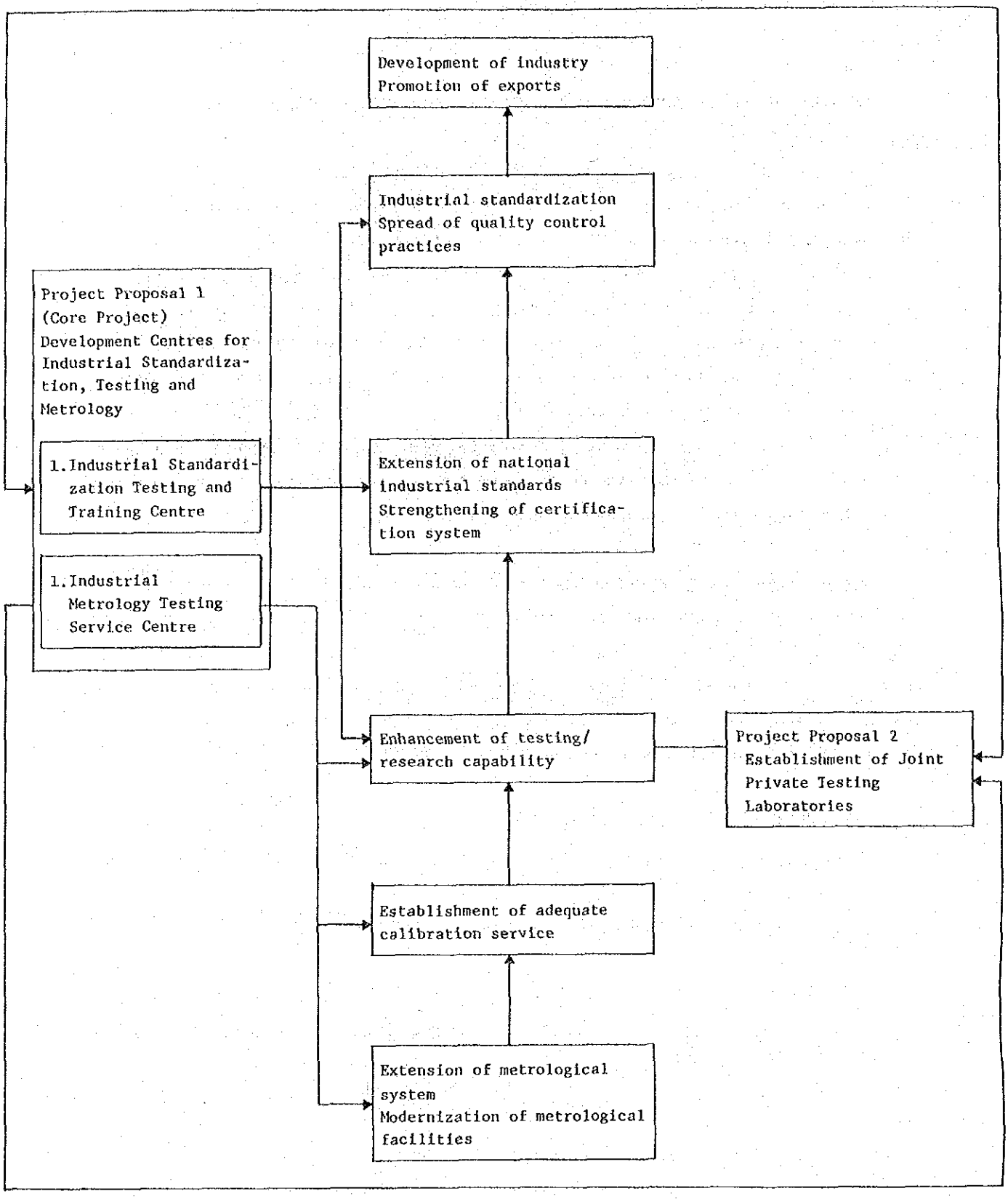


Fig. 5.0-1 Role of the Two Proposed Projects in the Overall Scheme for Promoting Industrial Standardization, Testing and Metrology

5.1 Project Proposal 1 - Development Centres for Industrial Standardization, Testing and Metrology

5.1.1 Background of proposal

In Chapter 3, there were presented the results of site survey and analysis on the current status and underlying problems relevant to the system of industrial standardization, testing and metrology in Thailand, and 18 programmes were proposed for developing the system in question. Some of these programmes can promise results through active independent implementation, while certain others are of a nature that will require mutual coordination for enhancement by reciprocal effect.

Advisable measures for solving the problems referred to above relevant to industrial standardization, testing and metrology, with the aim of industrial development and export promotion, and with due account taken of the current status of industry as presented in Chapter 2, prove to be the following, selected on the criteria of urgency, consequential benefits and the actuality of current technical capability and equipment.

(1) Enhance capability for drafting industrial standards

(2) Enhance capability for certification testing

(3) Extend testing facilities and equipment necessary for drafting industrial standards, for certification testing, and for providing pertinent guidance to private industry in improving product quality

(4) Reinforce guidance provided to private industry by public institutions for improving product quality

(5) Extend coverage of metrological standards and of measuring instrument calibration service

(6) Enhance level of metrological standards and capability of metrological calibration

The most practical and effective measure for approaching the targets enumerated above should be to extend and reinforce the equipment and capability of TISI -- serving as national centre for industrial standardization -- and TISTR -- the legally accredited national authority for industrial metrology and relevant research/development activities.

(1) Undispersed efforts directed on the two institutions for reinforcing testing, metrological standard and calibration facilities and equipment should enhance investment efficiency and maximize effective utilization of the installed equipment.

(2) The two institutions in question are already undertaking relevant operations, and are aptly staffed for assuming the envisaged function, provided a certain extent of reinforcement with additional personnel and technical instruction/training is accorded for their reinforcement.

(3) Industrial enterprises are strongly demanding elimination of the current excessive delays in the execution of certification tests and tests on request, as well as extension of coverage by metrological standards.

(4) Improvement of product quality and extension of the metrological system are essential prerequisites for Thai industrial development and export promotion, and to this end a strong and able leadership by public institutions is more than ever called for.

For this reason, a project advocated to be a accorded first priority is to set up:

(1) Industrial Standardization Testing and Training Centre, to be operated by the Thai Industrial Standards Institute, Ministry of Industry, for promoting industrial standardization, including certification services and quality control promotion

(2) Industrial Metrology Testing Service Centre, to be operated by the Thailand Institute of Scientific and Technological Research, Ministry of Science, Technology and Energy, for extending and promoting the metrological system, excluding legally designated measurements.

5.1.1.1 Grounds for advocating the establishment of two separate Centres

(a) Distinctly differing functions

The mission of TISI is to serve as the centre for developing industrial standards, as ultimate authority for administering TIS Mark certificates, and as the mainspring for quality control promotion. The Institute disposes of testing equipment and personnel to contribute toward multiplication of TIS Mark factories, and toward consequent diffusion of industrial standardization.

TISTR, on the other hand, has the mission of promoting overall enhancement of the nation's industrial level through research and development, as well as technical assistance in developing industrial standards (including certification testing).

The two Institutes thus are strongly independent of each other in their missions and functions, and furnish private industry with technical guidance and services of distinctly differing nature and technological level: TISI centres around quality control, and TISTR around research and development.

(b) Size of buildings

As it will be given further on, the required floorage for the Centres should amount to some 10,000 square metres, which is excessive for economical maintenance if accommodated within a single building, in such aspects as central air-conditioning, power supply, waste water treatment and other requisite facilities. Two buildings are thus necessary, to respectively house the two Centres.

(c) Operation of the Centres

The Centres are to be operated respectively by TISI, forming part of the Ministry of Industry, and TISTR, a semi-governmental establishment controlled by the Ministry of Science, Technology and Energy. Administration of the Centres would call for a proper arrangement between the relevant Ministries concerning the upkeep of the two Centres, if the two centres were housed in a common building.

The establishment of two separate Centres as designated above is thus advocated on the grounds of their different and independent functions, of convenient size and scale of buildings and facilities, and of differing modes of operation.

5.1.1.2 Necessity of constructing the two Centres simultaneously

High expectations are attached to the two Centres for the roles they should play in enhancing the quality of industrial products and based thereon to promote exports.

Currently, excessively long periods are required for completing tests required for conformity with industrial standards, to the extent of resking its becoming an obstacle to industrial development: Establishment of the Industrial Standardization Testing and Training Centre is an urgent matter for solving this impediment.

Of equal urgency is the establishment of the Industrial Metrology Testing Service Centre, in that efficient functioning of an effective calibration service is premised upon availability of adequately trained specialists, upon firm establishment of the metrological system and upon development of methods adapted to national needs and circumstances, all of which call for considerable lead time. In the domain of testing also, rapid increase is expected of demands for the Centre's testing services to meet the needs of industry in their research and development efforts.

5.1.1.3 Conditions assumed for determining the size of the 2 Centres

(a) Industrial Standardization Testing and Training Centre

From the past record, as detailed in Section 3.5 certification tests conducted for conformity with industrial standards were estimated to increase at a rate of 700 -- or 3,500 in 5 years. The personnel and facilities necessary for the Centre to adequately cope with this increase in workload were estimated to derive the size of the envisaged buildings.

(b) Industrial Metrology Testing Service Centre

(1) Metrology

a) Metrological standards are to be created and maintained covering:

- Density
- Viscosity
- Hardness
- Surface Roughness
- Roundness
- Volume
- Flow rate
- Sound
- Vibration

b) Coverage of metrological standards is to be extended in the domains of temperature and electricity, and relevant standards managed and maintained.

c) Calibration services have currently barely been begun, so it should be difficult to precisely estimate future trends in workload. It was assumed from the records of the past 3 years that it would markedly increase from year to year. In consideration of the limits to serve capacity, the annual growth of workload was set at 20 percent. As a long-term trend, however, it can be foreseen that the rate of increase should eventually settle down to perhaps 10 percent per year, with a traceable system of metrology coming to be established in the individual enterprises, which would relieve the pressure on requested calibration.

(2) Testing

The testing workload is estimated at 8 percent annual increase.

The personnel, equipment, and the buildings to house them are determined on the basis of the foregoing assumptions.

5.1.2 Industrial Standardization Testing and Training Centre

5.1.2.1 Functions and activities (refer to Table 5.1-1)

In consideration of the foregoing circumstances, and with the aim of contributing to enhancement of industrial standard drafting capability, to effective operation of the certification system, to strengthening of capability for technical consultancy services provided to private manufacturing enterprises, and to extension of testing capability, the Industrial Standardization Testing and Training Centre is to fulfill the functions and to undertake the activities indicated below.

(a) Testing samples for development of drafts of industrial standards and for certification.

(b) Instruction and training of personnel: Provide instruction and training to personnel in private enterprises for enhancing their level of capability in quality control practice.

(c) Enhancement of testing techniques: Provide instruction and training to personnel in private enterprises for enhancing their level of testing capability.

(d) Consultancy services for industrial standardization, quality control and testing, preceded as necessary by factory surveys, to be provided to enterprises applying for TIS Mark certification, to those actively furthering in-house standardization, and to others desiring enhancement of in-house testing capability.

(e) Planning: Studies on the method best adapted to national needs and circumstances for promoting quality control.

(f) Technical information and dissemination services: Supply of pertinent information concerning industrial standardization, quality control and testing; compilation and circulation of bulletins and other publications.

(g) Testing on request: The Centre will dispose of the testing facilities described further on, to conduct tests necessary for drafting industrial standards and for certification, as well as chemical analyses and performance tests on request from private enterprises, to aid in their efforts in product quality improvement.

Selecting the tests to be performed at the Centre, priority should be accorded to those necessary for drafting compulsory standards and for compulsory certification, by reason of:

(1) Such compulsory items being established in close relation to ensuring safety, or to prevention of harmful effects on the national economy, industry and welfare.

(2) Currently enforced compulsory items being those that govern key components and mass-produced articles for which strong promotion of standardization is considered effective for enhancing the national level of industry through promotion of standardization.

(3) Industrial production activities being seriously hampered by the delays in compulsory certification tests, causing slowdown of production, idling of resources, manpower and equipment.

Table 5.1-1
Functions and Scope of Activities of
Industrial Standardization Testing and Training Centre
in Successive Phases of Development

Functions	Scope of Activities in Successive Phases of Development		
	Phase 1 (1st-5th Year)	Phase 2 (6th-8th Year)	Phase 3 (9th-11th Year)
(A) Testing samples for development of drafts of industrial standards and for certification	Perform tests in relation to Compulsory Standards	Extend scope of tests in relation to Voluntary Standards	Extend scope of testing based upon International and Foreign Standard
(B) Personnel training	Admit personnel from private enterprises for training in in-house standardization and quality control for factories manufacturing Compulsory Standard products	Extend admittance to personnel from enterprises applying for TIS Mark under Voluntary Standard	Further extend admittance to include personnel from all enterprises
(C) Enhancement of testing capability	Assimilate and enhance techniques for basic and applied testing	Extend application to new products and new methods, as well as to tests conforming with international standards	Same as left
(D) Technical consultancy services	Undertake visiting guidance and consulting services for factories manufacturing Compulsory Standard products	Same as left Extend scope to factories desiring application of Voluntary Standard	Same as left Further extend scope to include all factories applying for test
(E) Planning	Study method best adapted to Thailand for promoting quality control	Experiment with application of the method thus studied	Improve the method
(F) Information service	Compile study/survey reports; issue pamphlets/bulletin	Same as left	Same as left
(G) Testing on request	Accord priority to public institutions, also enterprises manufacturing Compulsory Standard products	Extend scope of tests to factories manufacturing of Voluntary Standard products	Further extend scope of tests to include all factories applying for test

5.1.2.2 Organization and personnel

(a) Organization

The Industrial Standardization Testing and Training Centre should, advisably present an organization such as presented in Fig. 5.1-1.

(b) Staffing schedule

The scaffing schedule for each phase would be as given below.

(1) Administration Division

During the initial Phases 1 and 2, 2 senior/intermediate and 1 junior official could suffice to staff this Division, to be increased by 1 each in both grades during Phase 3, to cope with the increasing administrative work.

(2) Training Division

For undertaking the practical work of promoting industrial standardization and quality control, as well as associated work, 4 senior/intermediate and 2 junior officials would be necessary for this Division in Phase 1, to be increased by 1 each in both grades during Phase 2 for training in standardization, and by further 2 in the senior/intermediate grades in Phase 3, to cope with the added work of extending the promotion of industrial standardization to cover the entire nation.

(3) Testing Division (including training for testing work)

Estimating this increase to amount to perhaps 700 every year, around 3,500 additional demands would have to be met 5 years hence. The workload per person should be held within perhaps 35 per year, Accordingly, 60 senior/ intermediate and 38 junior officials would be necessary for Phase 1, to be increased in

Phase 2 by 30 and 18, respectively, to cope with the above-mentioned rise inthe amount of testing demand. The corresponding increases for Phase 3 would be, by similar estimate, respectively 30 and 16.

The foregoing tentative staffing schedule is summarized below:

		Phase 1 (1st-5th year)	Phase 2 (6th-8th year)	Phase 3 (9th-11th year)
Senior/intermediate grade officials		66	97	130
Junior officials		41	60	77
Foreign experts on temporary assignment	Long-term	9		
	Short-term	10		

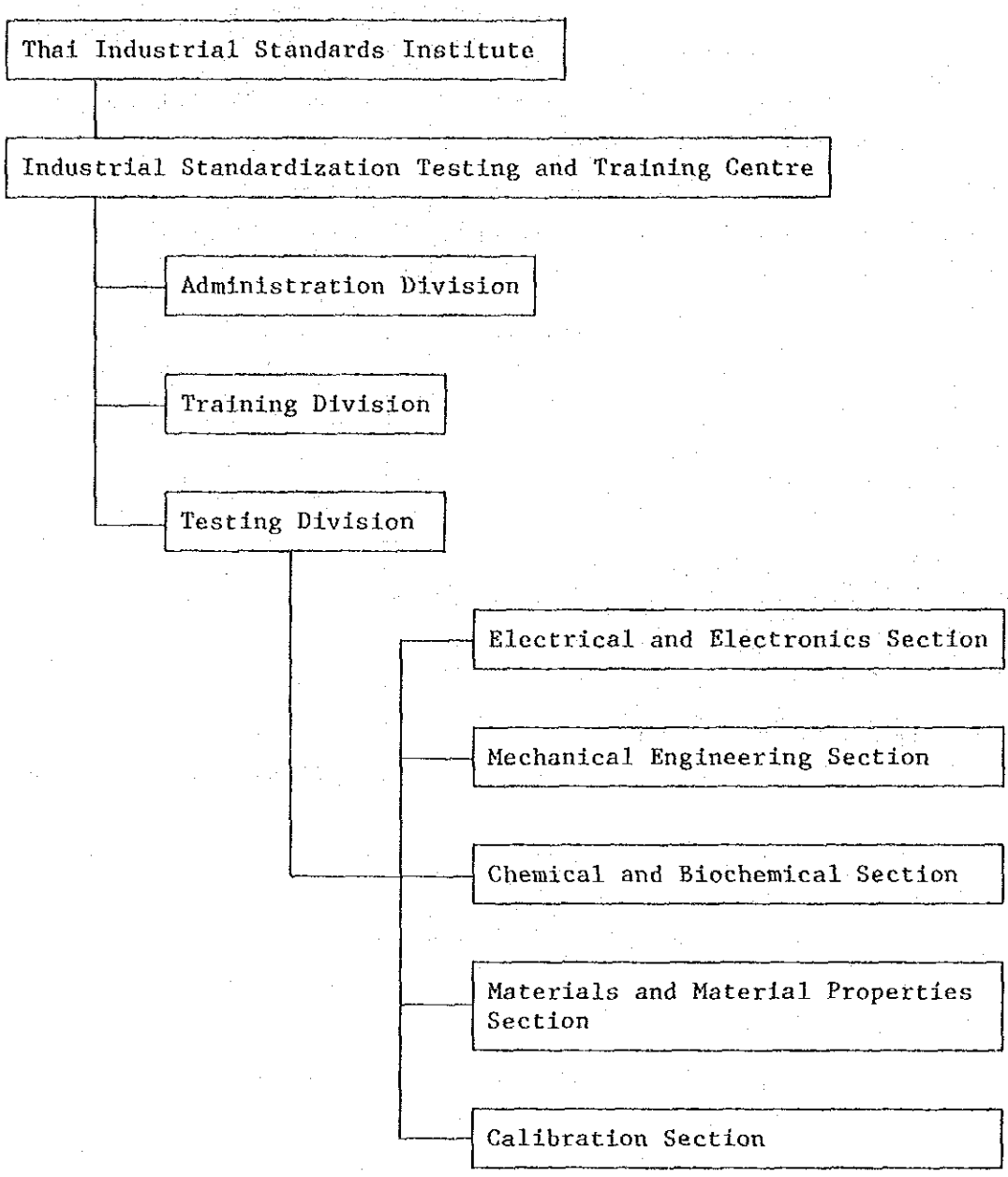


Fig. 5.1-1 Organization of Industrial Standardization Testing and Training Centre

5.1.2.3 Personnel training for the staff of the Centre

(a) Instructors in in-house standardization and quality control

Institution and training of Centre personnel to serve as instructors in in-house standardization and quality control in courses for outside trainees are to be implemented through:

(1) Training provided within the Centre by foreign experts

(2) Assignment of Centre personnel to foreign institutions for training.

The foreign experts to be called upon to provide the training on different subjects during different periods of time are:-

1 for 4 years in in-house standardization
1 for 4 years in quality control -- for senior personnel in charge of promoting quality control
1 for 4 years in quality control -- for staff in charge of quality control
1 for 3 months in design of experiments
1 for 3 months in on-line quality control

(b) Personnel for testing

Personnel to engage in testing and inspection operations in the Centre, also, are to be trained through:

(1) Training provided within the Centre by foreign experts

(2) Assignment of Centre personnel to foreign institutions for training.

The training should be conducted in accordance with the following cources and the term of each cource is about 3 month.

- Training for testing of electrical equipments
- Training for testing of electronic equipments
- Training for testing of machinary products
- Training for analyzing of chemical products.

The programme for personnel training is shown in Tables 5.1-2(a) and (b).

Table 5.1-2 (a) Programme for Personnel Training - Industrial Standardization Testing and Training Centre

		Phase 1 (1st - 5th year)			Phase 2 (6th - 8th year)			Phase 3 (9th - 11th year)		
		Foreign experts on temporary assignment	Trained within Centre	Trained in Foreign institution	Foreign experts on temporary assignment	Trained within Centre	Trained in Foreign institution	Foreign experts on temporary assignment	Trained within Centre	Trained in Foreign institution
Industrial standard-ization	Standardiza-tion	1		2						
	Quality control	4		4						
	Sub-total	5		6						
Testing										
	Electrical/ electronic equipment	6	20	4		14			22	
	Machinery	3	30	2		17			14	
	Chemicals	3	8	3		7			6	
	Materials; properties of matter	2	14	2		10			4	
	Calibration		1							
	Sub-total	14		11						
Total		19	73	17		48			46	

Table 5.1.2(b) Programmes of Assignment to Centre of Foreign Specialists and for Assignments Abroad of Centre Personnel for Training Abroad

Domain \ Year		1st year	2nd year	3rd year	4th year	5th year
In-House Standardization			⇢ 2			
Qaulity Control	Leaders		⇢ 2			
	Staff		⇢ 2			
	Design of Experiments				⟷	
	On-line QC					⟷
Electric	Household Electrical Equipment	←	→		⇢	⟷
	Electrical Component	⇢		⟷		
Electronic	Audio equipment Electronic Component	⇢ ←	→	⟷	⇢	
	Video Equipment OA Equipment					⟷
Machinary	Automotive Parts Precision machine parts	⇢		⟷		
	Industrial machine parts Machine tool	←	→	⇢	⟷	
Material & Physical	Metal material Non-metal material	⇢ ←	→	⇢	⟷	
Chemical	Chemical Analysis	⇢ ←	→	⟷		
	Food & Pharmaceutical	⇢			⟷	⇢

⇢ Assignment abroad of Centre Personnel

⟷ Assignment to the Centre of Foreign Specialists

5.1.3 Industrial Metrology Testing Service Centre

5.1.3.1 Functions and activities (refer to Table 5.1-3)

The function and activities envisaged for the Centre are as indicated below:

(a) Industrial metrology

(1) Establishing the metrological system: To establish a system best adapted to national needs and circumstances for making available primary standard designated by the National Committee on Metrology, as well as other standards required within the Centre for providing calibration services.

(2) Operating the metrological system: To establish, maintain and seek ensuring compatibility with international standard for primary standards designated by the National Committee on Metrology, and to make the standards available within the Centre, to other government institutions and to private enterprises.

To establish, maintain and make available other internal standards for such quantities as viscosity, density, hardness, to serve in extending the coverage of the Centre's calibration services.

(3) Enhancing the accuracy and extending the coverage of calibration services; developing calibration techniques: To modernize the standards and calibration equipment, to enhance the accuracies obtainable in calibrating metrological standards within the Centre, in government institutions and in private enterprises. To develop new calibration methods and techniques.

(4) Calibration service: To provide calibration service within the Centre, for Government institutions and for private enterprises. To undertake roving calibration service, to extend the coverage of calibration services to ever wider ranges of private enterprises.

(5) Technical information service: To report results of research and development undertaken within the Centre; to furnish technical information; to ensure other technical information services within the Centre, to other Government institutions and to private enterprises.

(6) Technical guidance and dissemination services: To provide consultation service, to organize training courses and seminars, with the aim of disseminating metrology-mindedness; to exchange information, perform international comparisons with neighbouring ASEAN countries and with advanced nations.

(b) Testing

(1) Testing for research and development: To perform testing based on international and foreign standards, with a view to promoting exports; also testing for research and development, with a view to enhancing the national level of technical capability.

(2) Testing on request: To be performed in answer to requests from other Government institutions, from research institutes and from private enterprises.

(3) Instruction and training: To be administered to Centre personnel, to enhance their technological capability, and to personnel from other Government institutions and from private enterprises, to enhance their capability for dealing with new products and processes.

(4) Technical information service: To be provided to private enterprises and other Government institutions.

Table 5.1-3 Functions and Scope of Activities Progressing with Phase of Development - Industrial Metrology Testing Service Centre - Industrial Metrology

Functions	Scope of Activities in Successive Phases of Development		
	Phase 1 (1st-5th year)	Phase 2 (6th-8th year)	Phase 3 (9th-11th year)
(1) Establish national system for ensuring availability of metrological standards	Draw up plan best adapted to Thailand for ensuring requisite availability of metrological standards (match industrial metrology with legally designated metrology); ensure traceability of all quantities	Improve/extend	Set system on firm footing
(2) Establish/ maintain/make available metrological standards	Establish the metrological standards (primary) selected by the National Committee on Metrology; maintain and make available the different metrological standards	Maintain/make available metrological standards in new domains; extend scope of coverage; enhance established accuracies. - Organize international (ASEAN region) comparisons of metrological standards	Same as left Same as left (to join family of advanced nations in this respect)
(3) Improve calibration accuracy; extend scope of calibrations; develop calibration techniques	Extend facilities for calibration of instruments; develop calibration method, improve calibration accuracy; perform basic studies in measuring techniques and instruments	Extend scope of calibrations; compile manuals on calibration of different instruments; enhance accuracy of calibration techniques	Further extend activities
(4) Metrological calibration service	Provide other government institutions and private enterprises with metrological and calibration services	Roving calibration services (government institutions and private enterprises accorded priority)	Further extend services to include all applicants
(5) Technical information service	Publish and furnish on request technical information	Same as left	Same as left
(6) Technical consultancy/ dissemination service	Furnish consulting/ training services to other government institutions and private enterprises	Same as left; also disseminate metrology-mindedness at national and regional (ASEAN) levels	Same as left

Table 5.1-3 Functions and Scope of Activities Progressing with Phase of Development - Industrial Metrology Testing Service Centre - Testing

Functions	Scope of Activities Progressing with Phases of Development		
	Phase 1 (1st-5th year)	Phase 2 (6th-8th year)	Phase 3 (9th-11th year)
(1) Testing for research and development	Perform testing to serve in developing new standards and products	Same as left	Same as left
(2) Testing on request	Perform testing on commission from government institutions, from other testing establishments and from private enterprises	Same as left	Same as left
(3) Enhancement and dissemination of testing techniques	Assimilate and progress in basic and applied testing techniques; disseminate acquired techniques to other testing establishments and private enterprises	Adapt techniques to new products and new processes; achieve conformity with international standards. Disseminate among enterprises a large range of testing techniques adapted to new products	Same as left
(4) Information service	Furnish technical information	Same as left	Same as left

5.1.3.2 Organization and personnel

(a) Organization

A tentative organization chart is presented in Fig. 5.1-2.

(b) Staffing schedule

A tentative staffing schedule covering the successive phases of development is presented in what follows.

(1) Central Services Group

The current personnel number 6 in the corresponding Division of TISTR could need increasing by 3 during Phase 1, and by further 1 each during the ensuring Phases 2 and 3.

(2) Industrial Metrology Testing Group

The current technical personnel in TISTR engaged in establishing and maintaining national metrological standards numbers 4 in the domain of electrical quantities, 3 in that of physical quantities -- length, mass, force, pressure -- and 3 in that of thermometry, photometry and inoizing radiations, together with 33 others charged with actual testing work.

As future reinforcement plan:

- Phase 1:

To cover the extension of coverage in thermometry and electricity, as well as relevant maintenance work, and further to establish a system of metrological calibration and to extend caliration service, additional personnel amounting to perhaps 24 might be necessary.

- Phase 2:

  To cover the expected necessary extension of metrological standard coverage to the physical quantities of density and viscosity, and to the industrial quantities of hardness, surface roughness and circularity, additional personnel amounting to perhaps 18 might be necessary.

- Phase 3:

  Assuming extension of coverage in mass and flow rate, as well further development of calibration service, further additional personnel amounting to perhaps 9 might be necessary.

In respect of testing personnel, taking account of the 6.6 percent target annual increase set forth in the 6th 5 year plan for industrial development, and of the increasingly essential part to be played by testing in research and development accompanying the progress of industry and the concomitant sophistication of industrial products, and further considering the need to eliminate the current overloading of testing service, an annual enhancement of 8 percent would have to be foreseen for the testing workload: This could mean having to increase the testing personnel by 20 during Phase 1, by 14 during Phase 2 and by 18 during Phase 3.

The foregoing tentative staffing schedule is summarized below:

	PHASE 1	PHASE 2	PHASE 3
Senior/intermediate grades:-	55	73	88
- Metrology	(21)	(30)	(34)
- Testing	(30)	(38)	(48)
- Administration	(4)	(5)	(6)
Junior grade:-	41	56	69
- Metrology	(13)	(22)	(27)
- Testing	(23)	(29)	(37)
- Administration	(5)	(5)	(5)
Total:-	96	129	157
- Metrology	(34)	(52)	(61)
- Testing	(53)	(67)	(85)
- Administration	(9)	(10)	(11)

The foregoing staffing schedule should be coordinated with the schedule for extending the corresponding facilities and equipment. Also, in view of the lead time required between recruiting and effective reinforcement of testing capability, the estimates of workload in the forthcoming years should be reflected in regularly-revised long- and short-term staffing programms, which should serve as basis for drawing up the annual plans for implementation of the staffing schedule.

5.1.3.3 Personnel instruction and training

Instruction and training of personnel is advised to be provided through:-

- Instruction/training provided within the Centre by foreign experts

- Instruction/training provided within the Centre by foreign experts
- Assignment of Centre personnel to foreign institutions for training

The instruction/training is to be provided in separate programmes as specified below, to last 3 months each, whether given by foreign specialists or through assignment to institutions abroad.

- For those to engage in establishing metrological standards
- For those to engage in calibration service
- Separate programmes for testing operations in different domains.

For further detains, refer to Table 5.1-4(a).

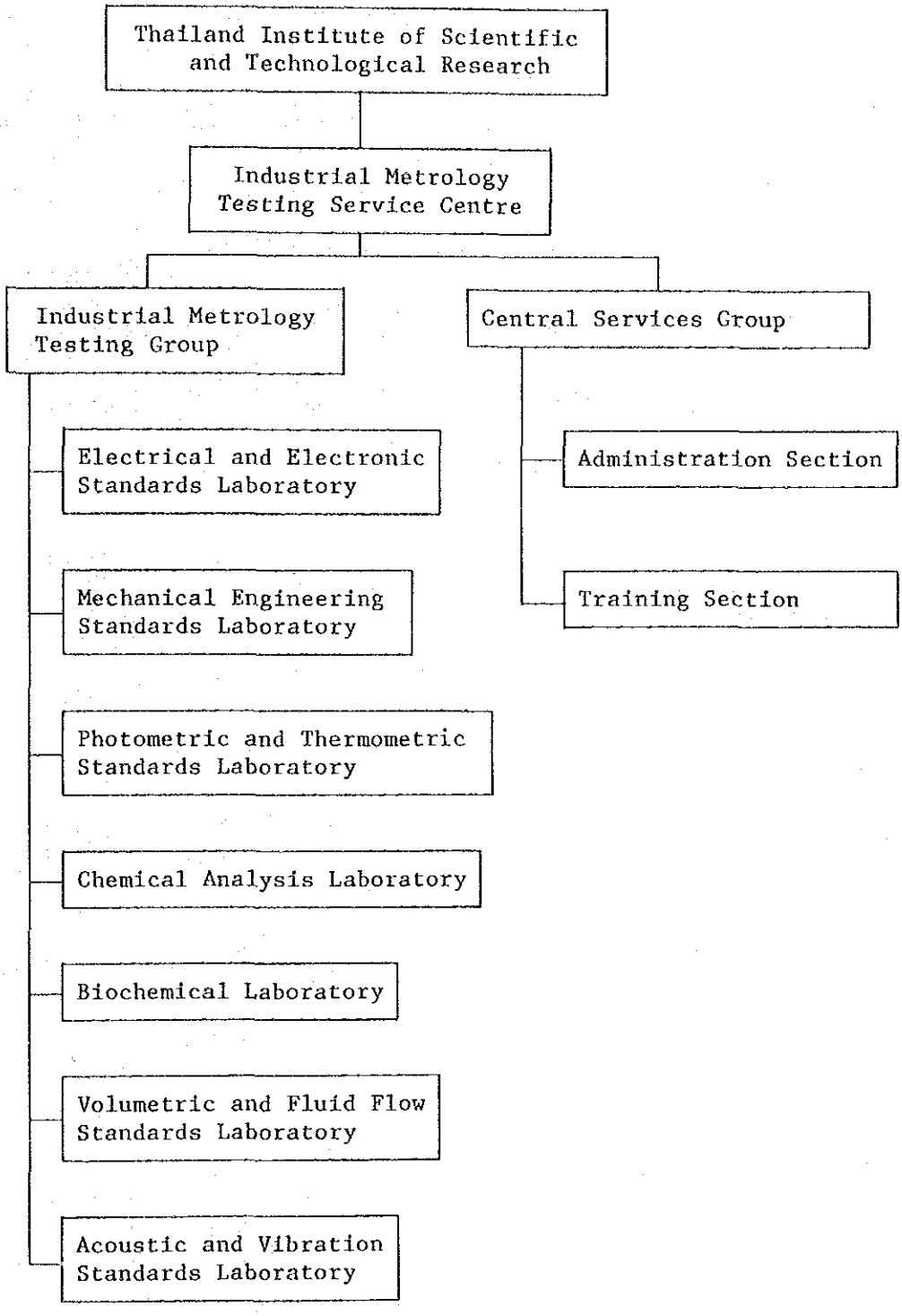


Fig. 5.1-2 Organization of Industrial Metrology Testing Service Centre

Table 5.1-4(a) Programme for Personnel Training - Industrial Metrology Testing Service Centre

	Phase 1 (1st-5th year)			Phase 2 (6th-8th year)			Phase 3 (9th-11th year)		
	Foreign experts on temporary assignment	Trained within Centre	Trained in Forein institution	Foreign experts on temporary assingment	Trained within Centre	Trained in Forein institution	Forein experts on temporary assingment	Trained within Centre	Trained in Foreign institution
Electrical and Electronic Laboratory:-									
- Metrology	2	8	2		4			2	
- Testing	4	4	4		2			4	
Mechanical Engineering Laboratory:-									
- Metrology	3	7	2		4			3	
- Testing	2	2	2		3			5	
Photometric and Thermo-metric Laboratory:-									
- Metrology	2	5	2		3			2	
Chemical Analysis Laboratory:-									
- Testing	2	5	1		6			6	
Biochemical Laboratory:-									
- Testing	1	2	2		3			3	
Volumetric and Fluid Flow Laboratory:-									
- Metrology	1		2		3			5	
Acoustic and Vibration Laboratory:-									
- Metrology	1		2		4			4	

Table 5.1.4(b) Programmes of Assignments to Centre of Foreign Specialists and for Assignments Abroad of Centre Personnel for Training Abroad

DOMAIN / YEAR			1st Year	2nd Year	3rd Year	4th Year	5th Year
Metrology		Electricity —AC, DC	⇠------⇢ ⟵⟶	⟵⟶	⇠------⇢	⟵⟶	
		Temperature			⇠------⇢	⟵⟶	
		Photometry, radiation			⇠------⇢		⟵⟶
		Mass, length	⇠------⇢ ⟵⟶	⟵⟶			⟵⟶
		Volume - flow	⇠------⇢	⇠------⇢	⟵⟶	⟵⟶	
		Pressure - force	⟵⟶	⟵⟶		⇠------⇢	
		Sound - vibration			⇠------⇢ 2	⟵⟶	
Testing	Electrical equipment	Components	⟵⟶	⟵⟶		⇠------⇢	
		Household appliances	⇠------⇢			⟵⟶	
	Electronic equipment	Equipment for popular market	⇠------⇢ ⟵⟶	⟵⟶			
		Equipment for industry			⇠------⇢		⟵⟶
	Machinery	Metallic materials	⇠------⇢ ⟵⟶	⟵⟶		⟵⟶	
		Industrial machinery				⇠------⇢	
	Chemistry	Chemical analysis	⇠------⇢ ⟵⟶	⟵⟶		⟵⟶	
		Bio-chemistry				⟵⟶	⇠------⇢ 2

⇠------⇢ Assignment abroad of Centre Personnel

⟵⟶ Assignment to the Centre of Foreign Specialists

5.1.4 Construction plan

5.1.4.1 Principal buildings and equipment

In order to permit the Industrial Standardization Testing and Training Centre and the Industrial Metrology Testing Service Centre to function and serve as envisaged in the preceding Sections, it is advised to provide equipment and buildings as set forth below.

(a) Industrial Standardization Testing and Training Centre

- Main Building

The floorage envisaged for this building is derived from the spaces to be occupied by the facilities and equipment considered necessary for conducting tests for certification and for instruction/training in quality control and industrial standardization.

Adding to the above the attendant and accessory floorage referred to earlier, the total floorage of the Industrial Standardization Testing and Training Centre will amount to approximately 5,200m^2.

After completion of the building, installation of equipment, and commencement of regular operation, the running expenses to cover personnel, utilities, repair and miscellaneous expenditures are estimated in rough approximation to amount to:

Unit: ฿ million

	1st Year	2nd Year	3rd Year	4th Year	5th Year
Personnel	7.9	8.3	8.6	8.9	9.3
Utilities	1.2	1.2	1.3	1.4	1.4
Repairs and miscellaneous	2.9	3.1	3.2	3.4	3.6
Total	12.0	12.6	13.1	13.7	14.3

Allocation of the amounts corresponding to the above should be foreseen the provided in the annual budget to cover operation of the Centre.

(b) Industrial Metrology Testing Service Centre

- Main Building

The floorage envisaged for this building is derived from the spaces to be occupied by the facilities and equipment considered necessary for maintaining national metrological standards and calibration service and for conducting research and development tests.
Adding to the above the attendant and accessory floorage referred to earlier, the total floorage of the Industrial Standardization Testing and Training Centre will amount to approximately 5,200 m^2.

After completion of the building, installation of equipment, and commencement of regular operation, the running expenses to cover personnel, utilities, repair and miscellaneous expenditures are estimated in rough approximation to amount to:

Unit: ฿ million

	1st Year	2nd Year	3rd Year	4th Year	5th Year
Personnel	8.6	8.9	9.3	9.6	10.0
Utilities	1.1	1.2	1.3	1.5	1.6
Repairs and miscellaneous	3.4	3.5	3.7	3.9	4.1
Total	13.1	13.6	14.3	15.0	15.7

Allocation of the amounts corresponding to the above should be foreseen the provided in the annual budget to cover operation of the Centre.

5.1.5 Rough Estimate of Project Cost

The cost of realizing the envisaged Centres, to be incurred from acquisition of requisite land to start of service operation, is as estimated below. It is assumed that access roads and other environmental infrastrucure already exist. For imported articles, the prices have been estimated assuming a conversion rate of ¥6 = ฿1.

5.1.5.1 Industrial Standardization Testing and Training Centre

(a) Ground and buildings

Land	฿ 3.1 million
Land grading	฿ 2.5 million
Building construction	฿ 147.3 million
(b) Equipment	฿ 391.6 million
Subtotal	฿ 544.5 million

5.1.5.2 Industrial Metrology Testing Service Centre

(a) Ground and buildings

Land	฿ 3.1 million
Land grading	฿ 2.5 million
Building construction	฿ 147.3 million
(b) Equipment	฿ 477.1 million
Subtotal	฿ 630.0 million
Total	฿1,174.5 million

The foregoing master plan for the Project proposal - 1 represents an envisaged conceptual plan based on the situation observed at the time of site survey. In actually carrying out the Project, time should be taken to draw up a practical and realistic plan of implementation, in the context of national policy and measures, and with consideration given to the orders of priority in implementation and to available financial and manpower resources.

Moreover, in the course of Project implementation, any changes in financial or other circumstances governing the progress of work should be flexibly countered with realistic and practical measures apposite to the situation.

5.2 Project Proposal 2 - Establishment of Joint Private Testing Laboratories

5.2.1 Objectives

The establishment of joint private testing laboratories would permit satisfying requests emanating from private enterprises for testing and analysis, and upon making the laboratory equipment widely available for joint use by individual enterprises, the resulting fuller use made of the equipment will permit lowering the charges demanded for testing, and contribute to enhancement of product quality and of productivity.

5.2.2 Outline

(a) Location of joint laboratories

The first joint laboratory should be located in or near Bangkok, where the main concentration of industries is found -- desirably within an industrial estate. In future, with progressing dispersion of industry to outlying regions, similar joint laboratories should be established in regional centres of industry, to meet the needs of the particular industries concentrated in the respective regions.

In Thailand, the needs of future industrial development should be met by multiplication of such joint private testing laboratories -- that might be established separately to serve different fields of technology and in different zones of industrialization promoted by the Government.

(b) Operation of joint laboratories

At the outset, immediately following establishment, a joint laboratory should be staffed with personnel assigned from existing public institutions and/or member enterprises. It should be, in principle, financed with funds contributed by member enterprises offering donations or capital investments, with membership subscriptions, as well as with charges levied for requested tests and personnel training.

5.2.3 Functions and activities

(a) Undertake on request various testing or analysis of products to serve in developing new products and in evaluating product quality

(b) Undertake on request the training of personnel to engage in testing, with long- and short-term courses involving both classroom lectures and laboratory practice

(c) Undertake on request instruction and guidance service in the enterprise premises

(d) Make available to enterprises the use of certain facilities and equipment for their undertaking testing and analyses for research/development work.

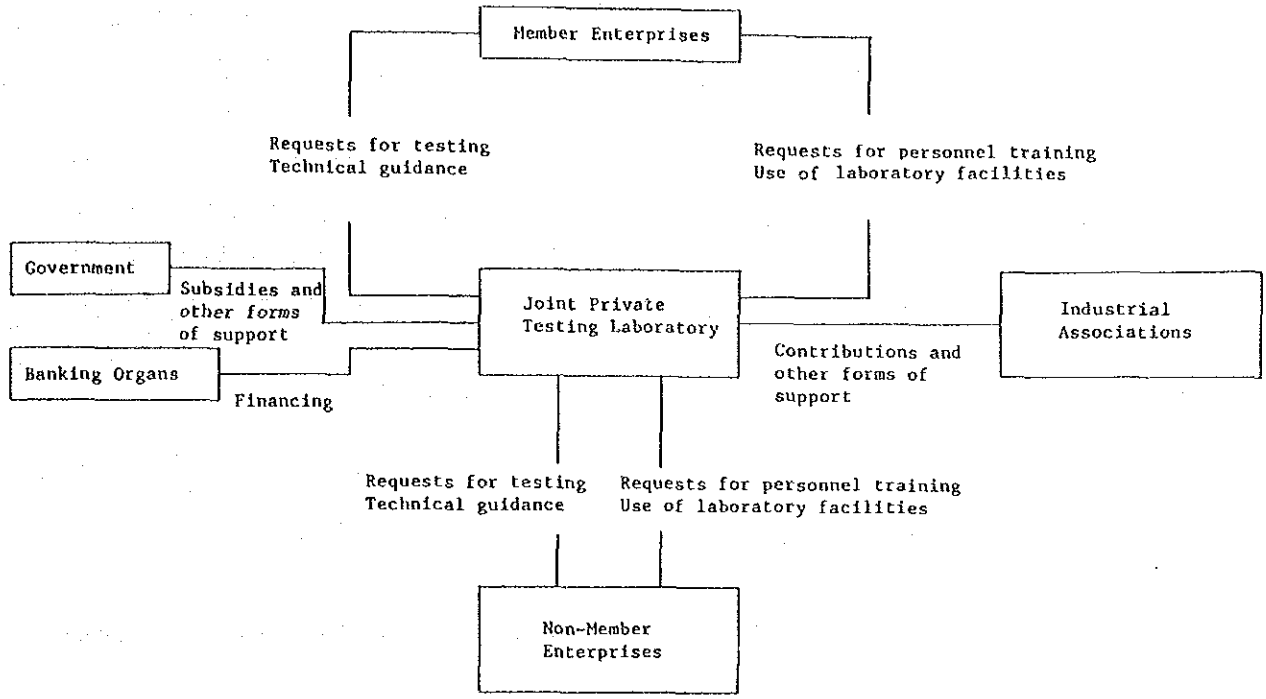


Fig. 5.2-1 Position of Joint Private Testing Laboratory among Client Enterprises and Supporting Bodies

The position to be occupied by a joint private testing laboratory --in the circle of enterprises it serves and of its supporting bodies-- is illustrated in Fig. 5.2-1.

5.2.4 Government Assistance

Government assistance advisably to be provided for aiding the establishment and stable operation of the joint private testing laboratories is described in what follows, in terms of financial, tax and other measures. In whichever of the above assistance is provided, it will constitute an appreciable burden on treasury, and careful scrutiny is called for in selecting the projects, the means and the extent of assistance to be extended, based on such criteria as concordance with national policy and expected contribution to enhancing the national industrial level, as well as the financial viability of the envisaged laboratory.

5.2.4.1 Financial Assistance

Conceivable forms of financial assistance to be provided by Government include:-

- Subsidizing part or whole of the costs incurred in constructing and equipping the joint private laboratories
- Acquiring and leasing to the operating entity the requisite laboratory buildings and equipment
- Making available through public financing institutions part or whole of the requisite funds under privileged terms including interest rate, term of repayment, grace period.
- Subsidizing part or whole of the interest to be paid for loans from private financial institutions.
- Purchasing an appreciable portion of shares or bonds issued by the operating entity for ensuring financial coverage.

Further, if the entity operating the laboratory does not yet enjoy adequate credit with the financial institutions for obtaining loans, Government may be called upon to furnish complementary security.

It should also be noted that the financial assistance may require coverage not only of the initial fund for establishment and equipment but also of operating expenses.

5.2.4.2 Tax Privileges

Conceivable tax privileges include:-

- Exempting part or whole of the tax imposed on donations offered to a joint laboratory by member enterprises
- Exempting part or whole of duties imposed on imported laboratory equipment
- Exempting part or whole of the registration tax imposed upon establishment of a joint private laboratory.

Additional measures would include:-

- Alleviating income tax on earned profit, to facilitate subsequent acquisition of laboratory equipment providing higher performance or renewal of equipment
- Refunding taxes upon incurrence of loss
- Privileges on equipment depreciation, including accelerated depreciation.

5.2.4.3 Other Forms of Government Assistance

(a) Assistance for Acquiring Land

Assistance in the acquisition of requisite land for establishing a laboratory could be provided in such forms as transfer at reduced price, or renting at reduced rate, of Government-owned land.

Another form of assistance would be to have tracts of land reserved for joint private laboratories, when establishing industrial estates.

(b) Assistance for Acquiring Laboratory Equipment

Assistance could be provided for acquiring laboratory equipment through information furnished in consultations on the equipment to be acquired, in such aspects as equipment performance and accuracy, prices, and sources of supply.

(c) Assistance for Laboratory Staffing

Assistance could be provided for laboratory staffing through assignments by request of testing and other technical personnel from public institutions, and through instruction and training provided in public institutions to laboratory personnel in specific subjects and techniques.

(d) Facilitation of Financing

Assistance could be provided on financial matters through references to financial institutions for arranging loans, and through consultations on tax privileges.

(e) Entrusted Tests

Some tests currently conducted at public institutions could be entrusted to joint private laboratories for activating their work, such entrusted tests could include those to verify conformity with TIS for certification purposes.

5.2.5 Points to be Heeded in the Operation of Joint Private Laboratories

(1) Member enterprises should be encouraged to utilize the laboratory facilities by performing the tests and measurements in their own hands. In this connection, consideration should be given to protecting trade secrets accruing from work conducted in the laboratory especially in case of developing new products.

(2) A workshop should be provided, to permit member enterprises to undertake trial manufacture of new products, with appropriate guidance and instruction furnished on the use of the workshop equipment.

(3) Study groups should be set up gathering together enterprises undertaking similar activities, for them to bring up problems of common interest for discussion on possible solutions. For instance, improvements in testing procedures and methods might be studied, for the resulting methods to be reflected in establishment and revisions of TIS.

(4) Tests could be conducted on materials and components commonly used by member enterprises, to furnish unbiased test data; the laboratory could serve as intermediary in arranging for cooperative procurement of materials and components.

(5) The facilities to equip the joint private laboratories should advisably be capable of conducting certification tests for conformity with TIS.

CHAPTER 6

BENEFITS EXPECTED FROM INDUSTRIAL DEVELOPMENT AND FOR EXPORT PROMOTION FROM DEVELOPMENT OF INDUSTRIAL STANDARDIZATION, TESTING AND METROLOGY

6. BENEFITS EXPECTED FOR INDUSTRIAL DEVELOPMENT AND FOR EXPORT PROMOTION FROM DEVELOPMENT OF INDUSTRIAL STANDARDIZATION, TESTING AND METROLOGY

Development of industry and the promotion of exports are premised upon:-

- Rationalization of production
- Effective utilization of available resources
- Reduction of production cost
- Smooth commercial transactions, ensured through an orderly market
- Intensification of industrial activity resulting from the foregoing measures.

The development of industrial standardization, testing and metrology will establish the rules to constitute the basis, and also serve as tool, for implementing the measures enumerated above.

Considered from the overall standpoint of industrial development:-

- Development of industrial standards will:-
    - Contribute to standardization of production processes
    - Serve as basis for rationalizing production
    - Provide the guiding rails for smooth commercial transactions between enterprises.

- Development of testing and metrology will:-
    - Provide the means of verifying conformity with industrial standards presented by the products in the course of their manufacture and distribution to consumer
    - Consequently serve in maintaining order in the market.

The promotion of exports is premised upon enhanced competitiveness of the exported commodities in the international market. This competitiveness is not determined solely in terms of price, but also by such factors as the extent to which the commodity satisfies the needs of the envisaged market,

and the reliability with which it will serve its intended purpose. The development of industrial standardization, testing and metrology clearly affects all these factors.

In the factor of price, as already mentioned above, development of the above system will contribute to rationalization of production processes and consequently to reduction of production cost. Standardization and testing systems will further facilitate stably manufacturing products conforming with the foreign customer's requirements in terms of performance and quality.

Harmonization realized between domestic and international industrial standards will contribute to enhancing interchangeability between equivalent components of foreign make, to serve in removing a barrier against exportation of domestically-manufactured products and components, as well as against importation of inexpensive foreign materials and components.

Also, consolidation of the system for assuring product reliability --e.g. effective functioning of the certification system-- at industry and at national levels should effectively serve in raising international reliance on exported products, to induce simplification or exemption of inspection procedures in the country of destination, and consequently contribute to smoothing the way for exports.

The development of industrial standardization, testing and metrology --with consequent spread of industrial standards and of quality control practice among individual industrial enterprises-- should provide beneficial impacts on the conduct of operations within enterprises: Upon analysis, the benefits prove to be as follows.

Particularly effective economical benefits are known to be obtained in the assembly industries, and in the case of Thailand, where this type of

industry --motor car and agricultural machinery manufacture etc.-- is being accorded priority, industrial standards should advisably be extended with first to cover these industries. In respect of the different activities within an enterprise, standardization has brought appreciable economic benefits in particular to the design, purchasing and inspection departments.

The development of industrial standardization, testing and metrology serves not only in facilitating rationalization of production processes, enhancement of product quality and reliability, and smooth distribution of manufactured products, but further also contributes vastly to social development --maintenance of order and protection of health and safety.

Abbreviations Used in the Present Report for
Thai Government, Public and Other Institutions

ATI	:	The Association of Thai Industries
BOI	:	Office of the Board of Investment
BOT	:	Bank of Thailand
CSD	:	Commodities Standards Division, MOC
DCR	:	Department of Commercial Registration, MOC
DHW	:	The Department of High-Way
DIP	:	Department of Industrial Promotion, MOI
DMR	:	Department of Mineral Resources, MOC
DSS	:	Department of Science Service, MOSTE
ETL	:	Electrotechnical Laboratory
IEPD	:	Industrial Economic & Planning Division
IFCT	:	Industrial Finance Corporation of Thailand
IFRPD	:	Institute of Food Research and Product Development
MIDI	:	Metalworking & Machinery Industries Development Institute
MOC	:	Ministry of Commerce
MOI	:	Ministry of Industry
MOSTE	:	Ministry of Science, Technology and Energy
MPC	:	Office of the Maritime Promotion Commission
NCM	:	National Committee on Metrology
NESDB	:	National Economic and Social Development Board
NML	:	National Measurement Laboratory
NSO	:	National Statistical Office
STREC	:	Scientific and Technological Research Equipment Centre
TISI	:	Thai Industrial Standards Institute, MOI
TISTR	:	Thailand Institute of Scientific and Technological Research, MOSTE
TMDPC	:	Thailand Management Development and Productivity Centre
TSC	:	Testing and Standards Centre
TTC	:	Trade and Training Centre