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PROMOTION OF SUPPORTING INDUSTRIES IN THAILAND*

REPORT OF THE JOINT UNIDO/ECFA MISSION TO THAILAND

26 SEPTEMBER - 15 OCTOBER 1988

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Abbreviations used

ADB	Asian Development Bank
AIT	Asian Institute of Technology
AJDF	ASEAN - Japan Development Fund
ARTEP	Asian Regional Team for Employment Promotion
ASEAN	Association of South East Asian Nations
BED	Business Economics Department, Ministry of Commerce
BOI	Board of Investment
BOT	Bank of Thailand
BOTT	Board of Trade of Thailand
DEP	Department of Export Promotion, Ministry of Commerce
DIP	Department of Industrial Promotion, Ministry of Industry
DTEC	Department of Technical and Economic Co-operation
ECFA	Engineering Consulting Firms Association, Japan
EGAT	Electricity Generating Authority of Thailand
EPZ	export processing zone
ESB	Eastern Seaboard Development Programme
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
FTI	Federation of Thai Industries
GTZ	German Agency for Technical Co-operation
IEAT	Industrial Estate Authority of Thailand
IEPD	Industrial Economics and Planning Division, Ministry of Industry
IFC	International Finance Corporation
IFCT	Industrial Finance Corporation of Thailand
IMC	Industrial Management Co., Ltd.
IMET	Institute for Management Education Training
JETRO	Japan External Trade Organization
JICA	Japan International Co-operation Agency
JPPCC	Joint Public-Private Sectors Consultative Committee
KEIDANREN	Japan Federation of Economic Organizations
MIDI	Metalworking and Machinery Industries Development Institute
MOC	Ministry of Commerce
MOI	Ministry of Industry
MOSTE	Ministry of Science, Technology and Energy
NESDB	National Economic and Social Development Board
NIDA	National Institute of Development Administration
NPC	National Petrochemical Corp., Ltd.
OECD	Organization for Economic Co-operation and Development
OECF	Overseas Economic Co-operation Fund, Japan
PTT	Petroleum Authority of Thailand
SET	Securities Exchange of Thailand
SIFO	Small Industry Finance Office, Department of Industrial Promotion, Ministry of Industry
SMI	small and medium industry
STDB	Science and Technology Development Board
TCC	Thai Chamber of Commerce
TDRI	Thailand Development Research Institute
TID	Textile Industry Division, Department of Industrial Promotion, Ministry of Industry
TISI	Thai Industrial Standards Institute
TISTR	Thailand Institute of Scientific and Technological Research
TMDPC	Thailand Management Development and Productivity Centre
TPA	Technological Promotion Association (Thai-Japan)
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization

Introduction

In the ASEAN countries acceleration and diversification of industrial development has been the most effective means to create additional employment opportunities for a rapidly growing labour force, to alleviate the balance of payments situation and to achieve higher utilization of domestically available resources. Based on strong national industries, the ASEAN countries have increasingly adopted an outward-looking industrial development approach both in fostering industrial exchange and co-operation at the regional level and in strengthening their exports of manufactures towards the world market.

In the strategy framework of both export diversification and import substitution the existence of a dense network of supporting industries - such as local parts/components manufacturers and sub-contracting industries - assume critical importance in generating self-sustained industrial development. It is in this context and based on a Trust Fund given to UNIDO by Japan that UNIDO and the Engineering Consulting Firms Association of Japan (ECFA) have agreed to initiate a joint study on the requirements and options for the promotion of supporting industries in the ASEAN countries. The individual country studies are to provide specific recommendations on the basis of which the Japanese Government will consider the provision of further funds for related technical assistance measures in co-operation with UNIDO.

The project has adopted a broad concept of supporting industries incorporating local parts/component manufacturers and subcontracting industries as well as local equipment suppliers and the provision of key industrial services (such as quality control, training, design, packaging, etc.) which can either be rendered by other enterprises or by specialized institutions. In the development context of the ASEAN countries most of these support industries tend to be medium-sized establishments, predominantly to be found in the private sector.

A Joint UNIDO/ECFA Study Mission was fielded to Thailand between 26 September and 15 October 1988. Its terms of reference called for a review of the present status of supporting industries and the identification of suitable technical co-operation projects geared at improving their performance. Specially, the mission was

- to provide an overall assessment of the role, the development potential and the bottlenecks of local supporting industries within the broader macro-economic and sectoral trends of the national economy and the framework given by national industrial policies and priorities;

- to identify possible new or adapted policies and measures to promote supporting industries, in particular through international co-operation;

- on the basis of factory visits, to single out crucial micro-level constraints (technological, managerial, financial, marketing-related etc.); and

- to generate suitable project concepts for the rehabilitation and modernization of existing enterprises and the establishment of new production facilities.

The Mission team had the following composition:

Surjit Sachdeva (team leader)	Special Technical Adviser, Special Trust Fund Projects Section, UNIDO
Nils Ramm-Ericson	Senior Industrial Development Officer, Regional and Country Studies Branch, UNIDO
Tsunenobu Miki	Industrial Economist, ECFA

The Mission was advised throughout its stay through regular meetings and consultations with Dr. Narongchai Akrasanee, Executive Vice-President, Thailand Development Research Institute (TDRI). Dr. Narongchai and Ms. Anusara Chanvanitchai of the Industrial Management Co., Ltd. also provided valuable assistance in the design of the Mission's comprehensive programme, in co-operation with the Foreign Relations Division, Office of the Permanent Secretary, Ministry of Industry and the Secretariat of the Federation of Thai Industries.

The Report of the Mission has been prepared at UNIDO headquarters by the Regional and Country Studies Branch on the basis of inputs from the Mission members. It reflects the findings and recommendations of the Mission as well as results of research previously undertaken by UNIDO. Specific attention may be made in this context of the working paper "Thailand: A framework for technical assistance programming in industry" (UNIDO/IS/R.19), issued on 4 February 1986.

It is hoped that the project profiles presented in this report will provide the basis for drafting of concrete project proposals for (subsequent Trust Fund arrangements) between Japan (the private sector in particular) and UNIDO.

In an Annex III (pages 75-77) the detailed comments prepared on the project profiles (on basis of the draft version of this report) by the Ministry of Industry are presented. These comments will constitute important inputs for the follow up work in pursuing the recommendations and proposals of the report.

The members of the Mission wish to express their thanks to the many Government officials as well as private sector representatives who devoted their time to often long discussions of various issues. Without their co-operative spirit the tasks foreseen could not have been accomplished in such short time, considering the complexity of the exercise.

I. The industrial sector in the Thai economy: Performance and challenges ahead

(a) STRUCTURAL CHARACTERISTICS

(i) High import dependence

The industrial sector of Thailand has grown remarkably since the early 1960s although the resulting structure reveals serious shortcomings. This could be attributed to the rather indiscriminate promotional policies of the Government, the impact of the growth of the other sectors, mainly agriculture, and the development of the world economy.

Up to the mid-70's the emphasis of Thailand's development efforts had been placed on capital formation and heavy investments on infrastructures. Industrial investments, promoted by attractive incentives, were concentrated on industries serving domestic requirements. By the early 1970's Thailand's import bills had become very large as result of heavy imports of capital goods, intermediate products and energy. The import bills were covered essentially by foreign exchange earnings from agricultural exports supplemented by the inflows of foreign capital funds. As the growth rates of the export incomes did not keep pace with the import growth rates, the country's trade deficits became larger, thus adversely affecting both internal and external equilibrium This notwithstanding, during the 1970s four significant export manufacturing branches had, however, emerged, namely, textiles, clothing, electronics assembly (mainly integrated circuits) and gems cutting.

Still by the mid-1980's the structure of the Thai industry reflected this concentration on either industries processing agro-products or industries producing end-products for (domestic and/or export) consumption. The import content of these industries, in particular those in the latter category, was very high, as capital goods and intermediate goods industries were still little developed and inter-industry linkages weak. In other words, the manufacturing industry sector had become a significant net user of foreign exchange earnings and, in general, the situation of the sector tended to be characterized by:

- import-dependent production processes;
- inadequate utilization of current comparative advantages, viz. through labour intensive processes and domestic raw material processing;
- a bias against exports; and
- a general inefficiency of production; and lack of technological innovation.

(ii) Industrial restructuring programmes

In recognition of these shortcomings, and in order to enhance the competitiveness of the country's industry in general, the Government launched major programmes of industrial restructuring (as set out in the Fifth National Economic and Social Development Plans 1982-86), among others addressing issues relating to (i) promotion of manufacturing exports, (ii) technology

development and promotion for engineering industries and (iii) policy and programme for promotion of small-scale and regional industrial development.

Significant structural changes in Thai manufacturing have taken effect during the last years in response to emerging challenges and opportunities arrising from the international economic development and supported by policies and measures put forward in implementing the industrial restructuring programmes. In particular, strong expansion of the manufactured exports sectors have been experienced. Manufactured exports amounted in 1987 to 65 per cent of total exports. [Manufacturing output in 1987 was 24.1 per cent of GDP while agricultural output was only 15.9 per cent.]

(b) PRESENT PERFORMANCE AND IMMEDIATE TARGETS

(i) Performance

Thailand's manufacturing sector expanded rapidly during the last two years - 1987 and 1988 - by 9.1 per cent and 12.5 per cent respectively. [The NESDB has indicated expectations of a continuing manufacturing sector growth in 1989, of about 12 per cent. An overall economic growth in 1989 of 8.5 per cent is predicted - to be compared with the average annual growth of 5 per cent targetted under the Sixth National Development Plan 1987-91.]

Nearly all industries have expanded satisfactorily, with particularly the export-oriented ones working under full or nearly full capacity utilization. Some industries have already experienced shortages of raw materials and skilled personnel and there is an urgent need to improve industrial and other economic infrastructure to cope with the rapid expansion.

(ii) Strategies

The strategies being employed as main guidelines for Thailand's economic adjustment and having thus constituted the framework for the current impressive manufacturing sector growth, have been categorized as follows:

- Growth with stability strategy. At the outset of the Fifth Plan, Thailand was faced with severe financial constraints due to the high level of past borrowings and low level of export earnings as a consequence of the prolonged world economic downturn. Therefore, the Government concentrated on restoring stability conditions as the primary objective. A prudent macroeconomic management approach was undertaken by limiting the level of foreign borrowings and tightening the screening of new projects.

- Growth with co-operation strategy. The primary aim here was to enhance the country's international competitiveness, efficiency and quality of products through close co-operation between the public and private sectors. The private sector was encouraged to take a more active and, in many cases, a leading role in development activities particularly in production, marketing, technology and job creation. The public sector co-operated with the private sector by providing supporting facilities, with special emphasis on increasing public-sector efficiency and reducing public-sector obstacles to development through the process of deregulation and better

co-ordination of law and development. Foreign investors were welcome to participate in the development of Thailand, in both direct and portfolio investments.

- Growth with diversification strategy. This was a direct response to the economic fluctuations and increasing protectionism in the world economy. The primary focus was to diversify both products and markets in order to minimize risks. As a result, Thailand has enjoyed a relatively diversified economic structure covering agriculture, industry and services, as well as increasing dispersion of export markets. This has enabled the country to cope with world economic fluctuations and maintain a positive growth rate in spite of severely unfavourable external environments, for example, during 1985-86 when most developing economies, including Singapore, were suffering from negative growth rates.

- Growth with decentralization strategy. This three-pronged strategy aimed at following:

  First, the decentralization of the decision-making power from the central authority to local levels through strengthening the autonomy and accountability of the decentralized public entities. Since local authorities usually are better aware of their priorities and constraints, they could respond more effectively to the needs particularly in areas of direct local concerns, such as environment and resource endowment implications of development undertakings.

  Second, the decentralization of economic activities from the Bangkok Metropolis to the provincial areas in order to spread development. The Government approved a scheme to provide incentives for industries locating outside the Bangkok Metropolis.

  Third, the final and the most important aspect of this strategy was to carry out domestic adjustment between leading and lagging sectors or groups in society.

(iii) Economic policies

The new Chatichai Choonhavan Government, in pledging the continuance of stability as its major economic platform, has indicated economic policies with following aims:

- To improve the living standards of the people and to make the economic system flexible - although stable - and in line with the current world economic situation in order to strengthen the country's economy and make it more competitive in the world market through greater efficiency.

- To encourage the private sector to play a role in developing the country's economy. The Government will be a promoter and co-ordinator between government agencies and the private sector.

- To balance the development of economic sectors - agriculture, manufacturing, services and others.

- To decentralize economic growth to the rural areas and continuously redistribute income and create more job opportunities in the industrial, agricultural and service sectors.

Specifically, in respect of the manufacturing sector:

- To decentralize industries to the provinces by providing infrastructural facilities and incentives as well as fiscal and monetary measures to support decentralization.

- To give priority attention to labour-intensive industries and industries which use domestic raw materials.

- To improve laws, regulations and organizations governing industries to support industrial development.

- To promote small and medium industries as a base for the country's industrial development.

The Sixth National Economic and Social Development Plan 1987-1991 emphasizes the development of the production system with special attention being paid to providing employment and expanding the industrial base of the country. It is envisaged that the growth rate of the industrial sector will significantly outpace the planned overall economic growth. Much of the effort will be towards developing engineering industries as the Government recognizes that rapid growth in these, especially metalworking industries, is the foundation for long-term industrial development.

(iv) Challenges ahead

Thailand has always welcomed foreign private direct investment in manufacturing. In general, foreign direct investment is treated in the same way as local investment if it is promoted. [The country allows full foreign ownership if the project is export-oriented (80 per cent of production is exported at least by third year of operation). A minority ownership is required if the project is meant largely for the domestic market.] Very fast growth of foreign direct investment in manufacturing has been recorded since 1986, and it is expected that such foreign direct investments will continue to increase in the next few years. Many of these new projects will create requirements for intermediate goods from local sources, thus a new set of investment opportunities.

Indeed, over the next two-three years international conditions will be expected to lead to further rapid expansion in Thailand. Investment by both Thais and foreigners will grow, in particular investment in labour intensive export-oriented ventures, inspite of serious infrastructural bottlenecks, e.g. insufficient port facilities in Bangkok, and inadequate electricity supplies, and a severe shortage of engineers, foremen and semi-skilled labourers. Only unskilled labour is abundantly available.

In the longer run, however, this industrial structure, much based on labour-intensive industries with export-orientation, will have to be adjusted because when there is a high demand for labour, ensuing labour shortages and rising labour costs reduce the comparative advantages of exports. With the

objective of pursuing such adjustment of the industrial structure increased attention needs to be given to the tasks of (i) promotion and development of industries which transfer technology to Thailand, (ii) developing the country's manpower resources to absorb such technology and (iii) at the same time, maintaining and upgrading the quality of the country's exports.

Special attention will be given to the promotion of investment in selected areas with the aim at improving the production efficiency of existing industries and increasing the country's self-sufficiency in terms of raw materials utilization and development of high technology. This may be done, e.g., by extending promotional privileges to research and development projects; to produce and use more local inputs; and to provide special support for technology transfer.

At the centre of the industrial promotion programme in Thailand are the incentives of BOI. However, the Investment Promotion Act limits the companies given special tax privileges etc. and further tends to give priority to large investments due to investment efficiency. Therefore, the incentives cannot be easily used by existing small and medium industries, which account for the major portion of the Thai industrial scene and the incentives do not work effectively to promote a broad-based industrial layer, such as parts industries, etc. For this reason alone, there are still large amounts of parts and intermediate goods being imported into fields producing final products, such as home electrical appliances and automobiles, which have shown steady development.

For example, when, in connexion with promotion of the mould and die and other supporting industries which are small in size, the government is trying to attract companies from abroad through the Investment Promotion Act so as to improve the sector's capabilities, this is causing problems [such as criticism of unfair competition] from the existing domestic industries, which do not enjoy any preferential treatment or privileges.

Thus, another set of promotion policies and measures are required for the effective further development of the country's small and medium industries, like those in the engineering and plastic sectors providing supportive inputs or parts and components.

II. The development of Thai supporting industries: Basic issues

(i) The development framework

Industrial development in the recent past in Thailand has been impressive, as documented in Chapter I. In looking forward to the 1990s, however, new elements in the international economy and intransingence of internal constraints will call for the formulation and development of further refined strategies and approaches.

There are two underlying themes in the emerging strategic issues of Thailand's industrialization. First, the overriding priority of strategies to broaden industrial growth is the key to harmonizing and co-ordinating the multiplicity of policy measures, the goal being to make industry more directly relevant to improving the living standards of the people and to create powerful incentives for demand-based industrial expansion. Second, the objective to achieve greater international competitiveness for locally manufactured products, regardless of their destination in external or domestic markets, is the touchstone on which production decision-making is being decided. The essence of this fundamental goal is to provide a solid indigenous launchpad for deepened industrial development and continuous dynamic growth. In pursuing these strategic objectives main attention is directed to the integration of national capacities and capabilities into the industrial development efforts.

As noted in Chapter I, Thailand's industrialization process was during the 1960s and 1970s largely based on the country's natural resources, with the development of a strong and diversified food processing sector coupled with production of light consumer goods and building materials. Capital goods and intermediate goods production did not, however, develop in step with the production of final consumer goods. The considerable reliance of Thai manufacturing on imported inputs was fostered by the prevailing system of incentives biased in favour of the finishing stages of producing consumer goods relative to intermediate goods, discouraging, therefore, backward integration. During the Third National Development Plan 1972-76 the Government made certain policy changes to promote the development of export industries. However, the export policies were directed primarily to deal with short-term constraints without due consideration to the impact of those policies on exports in the longer run. The promotional priveleges tended still to be biased towards the protection of import-substitution industries and high priority was accorded to consumer goods industries at the expense of the production of semi-finished products and capital goods. The effect of this was a concentration on industries processing agro-products and on industries producing end-products for domestic consumption. The import content of these industries, in particular in the latter category, was generally high, as capital goods and intermediate goods industries had not been sufficiently developed and inter-industry linkages thus remained weak.

The industrial restructuring programme launched during the Fifth Plan 1982-86 addressed these issues. It was recognized that the provision of basic facilities and promotional privileges were still inadequate to effectively support the development of export industry. Above all, attention was given to the need for active promotion of the development of small and medium scale

industry and thus greater diversification of manufacturing activities. In particular, it was noted that production linkages (through activities of supporting industries or subcontracting) between small and medium scale industry and large scale industry had been very limited.

Thus, one effect of the earlier policies had been that little attention was paid to the creation of 'supporting industries' with different product or process specialization along with the development of larger industries. In order to further deepen and strengthen the industrial structure, both in terms of linkages with other economic sectors and in terms of a stronger interdependence of the various branches of manufacturing, a comprehensive promotional approach would be required aimed not only at final producers but also at their, so called, supporting industries, that is, their suppliers of production inputs (including machinery) and of industrial services required.

Indeed, as mentioned earlier, special attention is being paid in the Sixth Plan 1987-91 to the development of the production system in this context and much of the effort will be directed towards developing engineering industries as the Government recognizes that rapid growth in these is the foundation for long-term industrial development.

(ii) The concept

As the term 'supporting industries' is not yet well established and hence subject to differing interpretations,[1/] a brief conceptual outline of the term's use in this report may thus be warranted (bearing in mind, however, that a watertight definition is not intended nor does it appear to be feasible at all). In principle, each industry providing inputs to other producers can be considered as a supporting industry. In this sense, the production of textiles 'supports' clothing manufacturers, a steel factory 'supports' the fabrication of metal products, plywood manufacturing 'supports' furniture-makers etc. At the same time, being a supporting industry is not an intrinsic property of any industrial branch or factory but essentially depends upon the length and nature of the production chain and the corresponding position of a specific industry therein. Typical categories of supporting industries - essentially in the small or medium industry category - would cover:

- separate manufacturing operations, e.g. in the metalworking field (often in the context of subcontracting);

- materials processing, e.g. in the textile field;

- production of dies and moulds, spare or replacement parts production;

1/ A well-formulated definition has been given in a recent publication by the Board of Investment "Support Industry in Thailand", as follows: "The definition of support industries [for the purposes of this publication] extends to all industries which sustain the activities of major manufacturing companies by providing essential materials, components and services. This includes any company supporting the production process of other industries, from the provision of basic machinery and parts, to providing processed raw materials, component parts, or testing services."

- production (both domestic and export-oriented) of parts and components;

- production of accessories, e.g. to the garments industry;

- production of packaging items, e.g. containers, caps etc.; and

- service industries, e.g. to undertake repair and maintenance work, testing and calibration services, design services.

The present report adopts a rather broad concept of supporting industries:

- At the core of the support industry concept have traditionally been those industries producing parts and components. The tend to belong to the private sector and have been the domaine of small- to medium-sized enterprises. Often they are linked to prime manufacturers by subcontracting arrangements as is predominantly the case in the automotive sector. Also (independent) manufacturers of accessories for, say, the garment industry constitute an important category of supporting industries.

- A less obvious albeit essential segment of supporting industries are the producers of machinery and equipment, be it moulds and dies for plastic or rubber processing industries; woodworking machinery; industrial pumps etc. By definition they are part of the engineering sector although they serve, of course, other industrial branches as well. This category may also include specific industries involved in materials processing, such as metal plating or textile dyeing.

- Finally, industrial services have been included as a third support category. Such services can either be provided by other enterprises (e.g. packaging or design) or by specialized institutions (e.g. training or quality control) which can be operated by private associations or public sector entities.

(iii) Basic future issues

In overall terms, the strengthening of the supporting industries in Thailand can be seen as contributing to making industrial development more self-sustained by generating stronger industrial interlinkages and hence reducing the high degree of import dependence. The building-up of a viable domestic parts/components and equipment industry is particularly important in order to raise the local content ratio of industrial production.

As noted earlier there is a general danger, as has been the case in many countries including Thailand, to put too much emphasis on the promotion of assembly operations while at the same time neglecting capability generation in medium-sized firms supplying the required production inputs. A biased processing pattern in favour of final (assembled) products is the consequence. In this context, a brief comparative look at the experience of the two economies, the Republic of Korea and Taiwan Province of China, is instructive. While the former long neglected the development of an efficient local supply base of parts/components and hence continued for some time to suffer from high import dependency, in the latter industrial priorities were

different from the start with stress having been placed on establishing a powerful domestic parts/components industry first. It was only out of parts manufacturing that the assembly sector subsequently grew.

Obviously, in a competitive world economic environment based on comparative advantages and specialization there should be reasonable limits to a strategy of import substitution and the raising of domestic content. After all, 'support' should not be regarded as a physical concept. Whether a supplying industry effectively 'supports' or rather 'weakens' a user industry, is a question of the former's production costs and product quality as compared to a potential sourcing from the world market.[1/]

Another very important issue for Thailand's industry in this context is that of the present [business] tax system and the considerations of a replacement of the present business tax by a flat rate manufacturers' value added tax. Detailed technical work has already been carried out for the introduction of such a system. The situation at this moment is that business tax rates have been partially restructured in recent years in order to reduce the cascading effect by lowering the rate of most intermediate goods. [But there is still a wide band of rates - between 1.5 per cent and 40 per cent with most goods taxed at 9 per cent.] The cascading effect introduces an element of discrimination against the domestic producer in favour of the importer which increases with the level of fabrication. More importantly it discriminates against the development of subcontracting activities, [which often play an important role in export industries]. This discrimination was reduced (but not eleminated) by the reduction of the business tax to 1.5 per cent on intermediate products.

1/ Cf. UNIDO, "Industrial Policy in the Developing Countries. An Analysis of Local Content Regulations", UNIDO/IS.606, 3 February 1986.

III. Target industries: Linkage creation towards an integrated industrial structure

(a) ENGINEERING INDUSTRIES

(i) Basic issues

As indicated earlier, in the design of the Government policies, the development of a strengthened production system and broadened industrial base is given specific attention and much of the effort will be directed towards developing engineering industries, especially metalworking industries.

Important considerations in this context have no doubt been that:

- "First, many engineering products can be produced reasonably efficiently at a small scale of output;

- Second, the engineering production units tend to be labour-intensive, and offer opportunities for absorbtion of labour. But they also tend to be skill-intensive which, if properly developed, would create a pool of skilled labour;

- Third, there are some products - mostly parts, components - for which export markets exist. Subcontracting of parts can be a significant element;

- Fourth, there are strong linkages both backward and forward among products. Products usually require the joint utilization of several processes (e.g. forging or precision casting followed by machining and heat treatment; in other words a given product serves as link for various processes). Processing facilities are highly versatile and can turn out a great variety of products. Engineering products are used extensively as inputs in the production of other engineering products;

- Fifth, the engineering industries tend to be the "carriers" of technological change. Because of the heterogenous nature of the products, constant adaptation of the products usually occurs, and there are numerous opportunities to borrow ideas and to make changes that have effects beyond the confines of the engineering industries themselves."[1/]

The engineering industries sector was given particular attention in the earlier mentioned industrial restructuring programme work in 1984-85. It was noted that, while Thailand may have considerable scope for the development of engineering industries based on an increasing internal demand, at present

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1/ Ref. "Engineering industries in Thailand - Report on Seminar on Industrial Restructuring by the RESCOM Secretariat and UNIDOs, 5-6 November 1984". (presentation by Dr. Chatri Sripaipan, Faculty of Engineering, Chulalongkorn University) UNIDO/IS/R.14.

this demand was largely filled by imports essentially because the technical and economic capabilities in the country were deficient. Competition with imports was impaired by a lack of knowledge on how to utilize existing resources of machine and labour efficiency and by the lack of a programme to improve the technological capabilities. Barriers or obstacles to modernization and development of the engineering industries resulted in high cost, degraded product quality and a general inability to react flexibly as required in a competitive market. There were many causes underlying this situation, such as:

- lack of basic knowledge of engineering techniques;
- relatively low level of production technology capability (e.g. lack of capability to produce products of even quality);
- unavailability of industrial supplies and materials and/or limited knowledge in selecting and use of materials and equipment;
- insufficient supply of skilled labour in appropriate fields;
- inadequate design and innovative skills to initiate new products or adapt foreign designed products to suit the requirement of the domestic market;
- inability to obtain relevant information in production technology, markets, raw material supplies, and equipment usage;
- bias in the fiscal system of protection and multiple taxation (cascade effect) which works against domestic production of engineering goods; and
- small market, irregular orders and severe competition.

It was furthermore, noted that engineering industries in Thailand basically were of two kinds; firstly, small Thai-owned enterprises which generally concentrate on the production of machinery and parts mainly for agricultural processing and in repair works, possessing little or insignificant technological know-how; and, secondly, larger engineering industries, either completely Thai-owned or joint ventures, which have developed in response to Government policies to encourage import substitution of various kinds. Small and medium firms could be considered to have the most potential for future development if they were able to overcome the disadvantages vis-à-vis larger firms in terms of access to know-how and technology to significantly improve the quality of their products at reasonable cost. The larger firms were in much better position, themselves already having considerable expertise and wider access to sources of technology. Thus, although it might be considered that the awareness of new or appropriate technology for industrial products and production techniques should primarily be the responsibility of the industry itself, understanding and practical support by governmental bodies were needed for, in particular, small and medium scale industries.

(ii) Characteristics and current status of Thai engineering industries[1/]

Primary and secondary metal forming

Thailand currently has to import most of the steel required for domestic use, and there are eight furnance-equipped steel mills with a total installed capacity of 700,000 tons per year. There are also some 40 rerolling steel mills with a combined capacity of 600,000 tons per year.

The Thai Tech Steel Co. Ltd. is investing in the manufacture of rolling mills in co-operation with two state-owned institutions. Local steelmakers who operate with electric arc furnances and rolling mills usually import mills from abroad, but the new factory should reduce that amount by 90 per cent. The company has joined the Thailand Institute of Scientific and Technological Research and the Metallurgy Department of Chulalongkorn University in a project to develop high quality steel, and in conjunction with a Japanese company, is also considering the production of roll mills for exprot.

Foundry and casting

Although casting in Thailand dates back many centuries, it is only since the mid-1970's that the number of foundries have grown rapidly in order to supply the growing demand from sugar mills, tin mines, automobile assemblers and agricultural machinery makers. Steel casting in particular experienced rapid expansion. Today's industry consists of foundries ranging from small scale to larger operations, which are principally involved with sand and die casting.

A major portion of the foundry work is small scale operations. The technology used is generally obsolete. These small shops use sand mould for casting, have little or no pattern-making capacity, use basic "chinese copola" for melting, and manual methods for shakeout and finishing. Most operators possess little or no knowledge in the melting and pouring techniques, no knowledge on the composition of casting and have no analysis equipment for metal or sand quality checking. The quality of casting is generally low. They turn out products such as agricultural hand tools, repair parts for agricultural machinery, architectural metal works, plumber brass goods and pipe fitting.

Foundries in a second group are larger establishments with fairly modern facilities. Most are equipped with modern melting facilities such as induction furnaces. They are able to make their own patterns, have equipment for spectometric analysis, use mechanized methods for handling and finishing, and have quality control programme. Their major business is in the production of heavy parts for tractor, truck, and processing machinery. The larger foundries can produce most standard alloy steel castings. However, in some cases, there are difficulties in achieving the desired composition tolerance and desired microstructure.

1/ This sub-chapter draws heavily on information provided by the Office of the Board of Investment in its publication "Support Industry in Thailand", March 1988.

There are problems of shortage of qualified pattern makers who can work from drawings. Many foundries lack experienced metallurgical engineers. Only one or two of the foundries has research and development units, although there are some product development works carried on an on-and-off basis by regular production engineers with periodic consultation with university staff.

Among the best equipped modern foundries is the Siam Nawaloha Foundry Co. of the Siam Cement Group, which manufactures a line of vehicle parts such as drum brakes, clutch housings, spring brackets, seat trunnions and trunnion brackets for heavy trucks, as well as front wheel hubs, disc brakes, exhaust manifolds, and flywheels for passenger cars and pickups. The company produces original equipment for a wide range of automobile manufacturers and assemblers in Thailand and exports parts also to the USA.

There are several large steel casting companies, like Thai Pattana Cast Steel Co. which have more modern facilities and good access to foreign technology. The consistency and quality of casting are both major elements in the development of the industry, which is often influenced by the size of the domestic market.

One of Thailand's better-known engineering companies, Siam Machinery and Equipment Company (SME), has developed its own large casting technique, and has been exporting to American and Japanese machine tool manufacturers for over ten years. Large castings are also supplied to the ceramic, household equipment, mining equipment, and chemcial pump manufacturers. Products include surface grinding machine parts, tractor axle brackets, special castings for sugar plant pumps, and impellers for the mining industry. SME also has one of the most modern foundries in the region. The company has received technical and engineering support from overseas companies for its pattern making, and the quality of the foundry process is controlled at every stage. 95 per cent of production is of original parts for Japanese and European companies locally and overseas.

There are also a number of die casting companies which make autoparts, electrical and telecommunications machinery and hand tools. Bangkok Die Casting and Injection Co. Ltd. is one of several companies producing die-cast spare parts for motorcycles and electrical appliances. The Izumi Piston Manufacturing Co. [Thailand] Ltd. produces aluminium pistons for diesel engines.

Domestic producers can satisfy most of the required original equipment parts for agricultural machinery and diesel engines, and there are several specialist maileable casting companies which produce pipe fittings. On the other hand, not all casting components needed in the automotive industry can be produced locally. Also certain precision casting capabilities are missing.

Forging

As in Japan and other industrialized countries, the Thai forging industry's development [like that of the foundries] has been heavily dependent on the automobile industry.

At the present time the domestic market in Thailand is still relatively small, but is growing rapidly and beginning to take advantage of the higher volumes made possible through exporting. There are now several companies

which are well equipped to produce quality parts to modern standards. One example is the Thai Industrial Forgings Co. Ltd. which has a standard forged products line which includes torque rods and hooks for heavy duty trucks, cam gears, idle gears, and rocker arms for agricultural diesel engines, and kick starters and underbrackets for motorcycles.

Metal cutting and machining

Gear-cutting companies have seen a relatively gradual expansion, but tend to remain small. The sector has many small companies with equipment which is generally outdated, and most of the production is for the agricultural machinery industry. Other main users are sugar factories, tapioca factories and machining shops. Production of gears for the automobile industry is only at a pioneering stage, and there is much scope for expansion. The sector is still dominated by family owned businesses, and there has been little foreign investment.

In contrast, one of the most modern factories is the PCS Industrial Co. Ltd. in Nakhon Ratchasima. The company was set up in 1980 and has played a key role in the development of the country's engineering capability. Investment in the most modern digitally-controlled machinery has equipped the plant with the means to compete internationally in the mass production of high precision parts. The company maintains stringent quality control, an active research and product development section, and is also capable of designing precision parts for customers. The main products are hydraulic pumps, lubricant pumps, gears, shafts, and other precision components. PCS Industrial is currently manufacturing aircraft parts with a tolerance of less than one micron for a client in the USA.

Moulds, tools and dies

Mouldmaking is a skilled, labour-intensive industry, characterized in Thailand by a large number of small businesses which often restrict their output to in-house use. There are altogether about 300 factories in Thailand which fall into three main groups. At the top level are some 20 factories which make high-quality tools and dies for themselves. An example is Sri Thai Co., a major producer of melamine products. The second level, of about 14 factories, consists of those which produce good quality tools and dies both for outside clients and for themselves. A few of these companies specialize in making moulds for the electronics industry.[1/] The remainder (the third category) are smaller producers whose output does not generally conform to international standards.

The tool and die industry requires good quality and good prices. It is an industry in which inputs of both capital and skilled labour are highly intensive, and where the customer tends to seek out the manufacturer, putting a premium on the reliability of the product.

Thailand has recently started to export tools and dies. Larger dies are exported to China, Indonesia, Taiwan Province of China and Australia.

1/ See further subchapter (b) (v) below.

There has been a move to diversify from metal to higher precision plastic dies. In 1983, plastic dies accounted for 22 per cent of output, and metal for 35 per cent. By 1987, plastic had risen to 35 per cent and metal fallen to 24 per cent.

A recent JICA study[1/] stresses the importance of that the modernization of management and the improvement in technical levels in the mould and die industry be carried out through associations formed between manufacturers and users. As a supporting industry for mass production industries it is vital that the mould and die manufacturers have links with their customers. But despite this, it is the practice of Thai mould and die manufacturers not to carry out business promotion activities, and instead to wait until users contact them. As a result they have little or no knowledge of the user market.

One reason for this is that the mould and die industry is a seller's market as it is swamped with many orders, and so there has been no need to undertake activities aimed at increasing business. However, the current rapid increase in investment from overseas which is continuing to take place in Thailand, has prompted some manufacturers to change their attitudes and make improvements in technology and increase the extent of contacts with the market in response to requests from users among overseas companies operating in the country. Amidst such trends calls are starting to be heard from within the industry for the establishment of a mould and die industry association which would facilitate an exchange of opinions on the topics of technology, types of machinery, the market, etc. MIDI[2/] is currently examining setting up an industry organization which would serve as a channel for information.

Support from the Government side [provided through MIDI] can be envisaged to comprise assistance with information, the setting of targets aimed at technical levels for the industry, and the implementation of various sorts of training.

Many manufacturers are very interested in obtaining modern equipment, such as electrical discharge machines (EDMs). However, due to limited utilization time such machines would not always be cost effective. Therefore, efforts should be made to promote the joint purchase and joint use of expensive machinery.

The modern mould and die industry is both a technology-intensive and labour-intensive industry. There are many manufacturers of moulds and dies which rely on experience alone and having a very limited base of technicians and skilled workers. If the level of the Thai mould and die industry is to be raised, it is necessary to foster and carry out on continuous basis training and education of technicians who have some basic engineering knowledge.

A few companies carry out production and design based on engineering knowledge; the level of this is generally not very high. There are few companies which use design divisions. The majority of companies do not employ

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1/ "Industrial Sector Development in the Kingdom of Thailand - Mould and Die and Toy Industries", JICA, August 1988.

2/ See further part (iii) below.

draftsmen. An overwhelming number of company operators have a low level of appreciation of the importance of having designers within their own companies. Even though it may not apply in the case of product plans, there are many companies which cannot adequately draw plans for moulds and dies, and most of the companies rely on plans supplied by their customers.

The above-mentioned JICA-report also points at the problem of out-dated machinery and insufficient understanding of machinery and equipment. A mixture of old and new machinery is to be found in any one factory, and because processing precision is determined by the level of the old machinery, full use is not made of the capacity of new machinery.

Though there are various types of moulds and dies, all of which have different requirements in regard to quality, the basic trend is towards high quality. In order to manufacture moulds and dies which are high in quality it is essential to understand machinery, and in particular, the precision of machinery. Measures suggested are:

- Increasing technical education and training;
- The promotion of modern equipment through the supply of long-term low interest loans;
- The joint purchase and joint use of expensive processing machinery, and inspection and trial machinery and equipment at an industry level, and also the establishment of joint factories.

Metal components and parts production

Components and parts used in vehicles or in other machinery can be divided into two categories. The first are standardized parts which are mass produced, and the rest are those which require one or more special production processes. The automobile parts markets absorbs much of Thailand's component manufacturing output and local companies now supply a wide variety of parts such as cylinder liners, pistons and piston rings, diesel engine bodies, balance weights, rocker arms, flywheels, valves, radiators, gear covers, handcranks, shock absorbers, bearing housings, ring gears and coupling fans, and exhaust manifolds.

There are about 100 companies (whereof about 60 in the Bangkok area) producing standardized parts such as springs and wire in different metals, strengths and sizes. Producers of original equipment for the local vehicle assembly market include NHK Spring Co., and the Bangkok Spring Industrial Co., which supply, among others, coil springs and leaf springs to some of the auto assemblers.

Heat treatment

While some of the larger companies have heat treatment facilities in their own factories, there are also specialized companies such as PKN Co., which has the most modern fluidized bed heat treatment facility in the region. The company carries out carburizing, carbonitriding, and nitriding treatments, and will add nitrocarburizing in the near future. Much of the output is for automobile parts manufacturers.

Pressworks

There are over 50 companies in the sector, but few specialize in only pressworking. Demand has increased with the spread of industrialization, but most companies remain small. Production is mainly of motor vehicle and motorcycle components, followed by metal furniture and contruction equipment, structural metal products such as tanks and pressure containers, farming equipment and machinery components.

Most products are made in a simple process such as punching, blanking, shearing, and blending. Most of the small to medium size presses are locally built. The presses produce parts with satisfactory quality for products which do not require close tolerance. Many companies design and make their own dies. The problem in presswork operation practice lies partially on the proper use of the machine and mainly on the design, production and use of tools and die. Indeed, the process is heavily dependent on the quality of the dies, and as products become more complicated and sophisticated, die design and production will become more elaborate and difficult.

Stamping

This is another specialized process, used mainly in products for the automotive industry, a feature of which is a high degree of subcontracting to a number of outside companies. The air-conditioning industry is also a major user of stamped parts.

Surface finishing and precision plating

There are three major companies engaged in traditional galvanizing in Thailand, all of which started as Thai-Japanese joint ventures. These companies produce hot-dip corrugated plain galvanized sheets up to 2 mm thickness. Input materials are largely imported, and the process tends to be sheet by sheet, and therefore slow.

However, the Bangkok Steel Industry Co. has recently invested in a continuous hot dip galvanizing line with a capacity of 60,000 tonnes per year, using 90 per cent local parts and technology imported from Australia.

Plating is most commonly carried out in nickel, followed by copper and zinc. Some firms also undertake tin, hard chrome, and rare metal plating. Most of the output is taken up by electrical appliance manufacturers and the motor vehicle component market, for which companies like the Union Autoparts Manufacturing Co. produce bicycle and motorcycle parts using fully automatic uni-chrome and double nickle-chrome plating equipment.

There has also been interest expressed in an electrogalvanizing project for ASEAN, with Thailand cited as the possible host country.

Precision plating is also available although for the present time companies such as Thai Metal Plating Ltd. concentrate on ornamental plating for the jewellery and watch trade. However, as the electronics sector grows in Thailand, companies like this will move into specialized plating for electronic components as well.

Fabrication

The major process used is welding. Large fabrication firms are fairly well equipped with various types of equipment including inert-gas welding and automatic welding. For some products such as large storage tanks, pressure cylinders, and boilers, the fabrication works has been done according to standards. Testing facilities are also available in larger firms which include ultrasonic and x-ray devices. These types of non-destructive service are also available locally.

For the small fabrication shops, only simple electric and gas welding equipment is used. The control of the fabrication and welding processes is generally poor. The equipment used to prepare the work piece for fabrication process is fairly basic, consisting of items such as simple guillotine and flame cutters. The fabricated products from these small shops normally have poor appearance. Most of the fabrication firms are subjected to the shortage of certified skilled welders.

The light fabrication industry, such as the metal furniture industry, uses relatively simple processes. If proper equipment and tools, such as jigs and fixtures are used, the industries would not require high skilled labour. A major problem is the limited product design capability.

Steel structures for large and small scale construction projects are manufactured locally by some of the larger firms in the sector. Thai companies have also been involved in the design, manufacture and construction of water treatment plants, dams, chemical plants, and other industrial works.

The Thai Nippon Steel Engineering Co. is investing in a multi-million baht venture to produce high quality steel structures for export. The Bangkok Steel Engineering Co. is another major steel fabricator. The company produces a range of heavy industrial equipment, conveyors, crane girders, bulk storage silos and liquid storage tanks, dryers, and other agricultural equipment. It has also fabricated and erected a local rolling mill and continous casting machine.

General machinery

There are a number of companies of varying sizes involved in the production of industrial machinery. Many of them tend to specialize in making equipment for specific industries such as sugar or tapioca mills. The Bangna Steel Works is one such company, specializing in local tapioca factory machinery production with well established export markets in South East Asia, and growing markets in Africa.

The Triumph Engineering Co. Ltd. was originally set up to manufacture a complete range of parts for the country's 44 sugar factories. The company now has customers in other industries as well. The plant has a wide range of capabilities in machining, boring, drilling and milling, and is equipped with the largest heavy duty roller lathe in the country which can take loads of up to 50 tonnes and 12 metres in length. The company has produced a propellor shaft for the Royal Thai Navy, as well as equipment for textile, cement and tapioca factories, paper mills, and the electrical industry.

A company which has had success in manufacturing machines for export is WESCO, a joint venture between Thai and West German partners, which developed its own designs for a full range of hand operated and semi-automatic machinery to produce aluminium tubes. The company runs a rigorous inhouse training course for apprentice engineers, and makes fully-automatic integrated production lines which are equipped with digital electronic process controls. Both individual machines and complete assembly lines are made.

(iii) Propective approaches and projects to strengthen Thailand's engineering industries

Recognizing the key role the engineering industry sector has as the foundation for the country's industrial development, priority attention during the Sixth Plan 1987-91 is given to the development of intermediate engineering industries - foundry and casting; forging; metal cutting and machining; mould, tool and die making; metal components and parts production; and fabrication - which will have an impact on other manufacturing sectors.

The effective upgrading and development of Thailand's machinery and metal working industries is particularly important for Thailand in current international context. Due to the prevailing economic conditions, many industrialized countries, including Japan, are searching for new bases outside of their own countries in which to site their industrial enterprises so as to reduce the cost of manufacturing. Some of this interest has been focused on Thailand because of its appropriate level of economic development and skilled and easily trained manpower and also the increasing availability of basic supporting industries. The industries which are being located in Thailand employ a relatively high technology; many of these operations manufacture industrial engineering equipment and parts.

In order to ensure effective development of the Thai engineering and machinery industries sector the Government established in 1986 the Metalworking and Machinery Industries Development Institute (MIDI) within the Department of Industrial Promotion (DIP) of the Ministry of Industry. MIDI is to serve as the centre for the development of the industrial engineering, machinery and metal working industries. Large-scale Japanese grant aid and technical assistance was provided for this purpose. MIDI's main tasks are to develop and raise the level of technology and efficiency of the small and medium-scale machinery and metal working industries as well as to develop personnel, towards building up a pool of skilled labour ready to meet the needs of foreign investors. MIDI's immediate aim is to raise the technological level of following metal working processes, namely, casting, welding and sheet metal working, machining, heat treatment, automation, electroplating and presswork. The Institute's aim is also to develop industrial and metal working products in following areas, namely, agricultural machinery, moulds and dies,[1/] gears, pumps and valves, tools, machinery, automotive and industrial machinery parts.

1/ Assistance to MIDI for the development of the tool and die industry has been provided since 1987 under UNIDO/UNDP assistance (DP/THA/86/010). A second phase of this assistance is under consideration.

To meet these objectives, MIDI is:

- Providing technical training to small and medium-sized machinery and metal working factories in Bangkok and the provinces to increase efficiency of production.

- Sending technical experts to provide advice on a firm-by-firm basis; providing general technical advice and advice on quality control and production planning control.

- Providing testing and examination of various metal products, testing of metallurgical properties, analysis and examination of metal structures and non-destructive testing.

- Conducting economic and technical research to determine the technological level of each branch of the machinery and metal working industries to find out the problems facing them and how assistance can be provided; and to determine the extent and method of providing such assistance and technological transfers.

- Carrying out research and experiments and constructing prototype machinery as a service to factories; identifing and assisting firms which would be willing to manufacture such machinery for the local market thereby reducing the dependency on imports.

- Providing information and news of developments in metal working technology and regarding engineering designs, production control, quality control, production planning, etc.

- Serving as a co-ordination centre for other agencies for other agencies concerned with industrial machinery and metal working in such areas as industrial development planning, manpower development, market research and development; integrated manufacturing and technological development.

MIDI is equipped with various such high precision and special processing equipment, material testing and inspection equipment and precision measuring instruments which the small- and medium industries would not easily be able to install at their own plants.

Management guidance is being handled by the Thailand Management Development and Productivity Centre (TMDPC) of the Industrial Productivity Division of the Department of Industrial Promotion. TMDPC offers seminars and training as well as consultancy services.

As overall comment it may be stated that Thailand has advanced to a stage when it is able to absorb the high-tech production processes of engineering industry without fear of being put at a disadvantage by overdependence on foreign technology. Thai entrepreneurs have developed skills in the formation of Thai/foreign joint ventures. Thailand also has a relatively large (and fast-growing) domestic market for engineering and electronics products. Its labour having long experience basically in assembly and repair work is easily trainable to the levels of technological skills required for a dynamic engineering industry operating within the framework of middle level/advanced technology.

The UNIDO/ECFA Mission discussed various concepts and ideas for technical co-operation and other special support areas such as:

- Machine tools: Investment promotion - possible joint ventures, in particular for components of machinery (such as plastics injection machines, packaging machinery, textile machinery)

- Moulds and dies: Upgrading of existing plants and identification/ promotion of new ventures as independent support industry (not subsidiary to large company using the moulds). It would cover moulds for metal as well as plastics and rubber parts. A Mould Makers Association is presently being formed. This Association might be counterpart. A number of concrete proposals for action are given in the JICA report (August 1988) on Thailand's Mould and Die and Toy Industries.

- Training in design of moulds and products. Introduce CAD/CAM training in mould making. Sponsorship by new 'Mould Makers' Association also training in jigs and die making.

- Forging, foundry work: Upgrading of the 'second group' of existing not-so-modern small industries, for instance through introduction of low cost technology of die casting in small foundry units. The possible upgrading/modernization should be closely studied case by case and suitable foreign co-operation or linkages enterprise-to-enterprise, be initiated. Market acceptance would be main issue.

  - One approach could be to seek to establish joint ventures with Japanese support industries wishing relocate production capabilities.

  - Another approach would be to upgrade the 'second group' to supply local machinery manufacturers. (Such local subcontracting is, however, negatively affected by the absence of a smooth VAT-system.)

  - A "Foundry Association" should be set up.

- Metal finishing: There is scope for quality-conscious joint ventures in metal finishing surface treatment.

- Comprehensive engineering industry sector assessment of training needs. Development of/support for company-sponsored schemes.

- Training in productivity improvement.

- Training in equipment design and engineering.

- Development of design and fabrication capabilities (e.g. modification of machinery by use of low cost automation). Some of these activities could perhaps be carried out in new joint ventures.

- Engineering Service Centre for SSIs with information regarding capacities, subcontracting exchange, raw material bulk buying, testing service, etc.

- A study on prospects and potentials for automotive parts production, to be carried out in co-operation with interested big auto companies. The study is to provide an assessment of required technological capabilities for Thai companies, taking into account also possibilities for regional (ASEAN) specialization.

- Study of development of supporting industries in relation to industrial estates in the provinces.

- Identification of possible Japanese (supporting) industries who could come in and use Thailand as base for exports of parts and components. The Small-scale Industry Association and the Board of Trade may set up information base for Thai potential subcontractors.

- Basic management training for SSI subcontractors.

(b) ELECTRONICS INDUSTRIES

(i) Current status

According to a recent survey[1/] of electronics products manufacturers (excluding software) in Thailand, there presently exists about 100 firms in the industry. Further to the major consumer electronics (radios, cassettes, television sets, etc.) producers for domestic and export markets and some export-oriented producers of integrated circuits which were producing by the mid-1970s, a number of Thai and joint venture companies began at that time to produce a wider range of electronic components primarily for export markets. The early 1980s then saw a rapid expansion and diversification of firms in both the electronic components and the integrated circuit industry.

The most recent phase of development (the "post-Yen appreciation phase" from 1987) is still rather difficult to assess since developments have been taking place so rapidly. Several existing companies such as Seagate and Minebea have expanded greatly in the last 18 months, both in existing product lines and new ones: the former into the assembly and testing of computer hard disk drives to accommodate their rapid growth, and the latter into ferrite magnets, the subassembly of magnetic recording devices and a wider range of electronic motors. Several other existing producers of integrated circuits, printed circuit boards, and other components have also expanded their production operations substantially.

The most notable new entrant into the industry has been Sharp which became the first major producer of a consumer electronic product, namely microwave ovens, to locate a factory in Thailand to serve primarily export markets. The company was followed by several subcontractors from Japan which have located close to the assembly plant to supply a number of microwave oven component parts.

1/ "The Development of Thailand's Technological Capability in Industry - Capability Development for Electronics and Information Technology-Based Industries", TDRI, Bangkok, October 1988.

Several other export-oriented firms have also been established, exprorting products such as printed cirucuits boards, floppy disk drives, and power line conditioners.

(ii) Linkages and input structure

The sources of inputs and linkages between domestic producers are important issues when looking the prospective development of the Thai electronics sector. Subcontracting, in particular, has been shown to be an important means of transferring managerial and technical skills between firms.

In general, the structure of the present electronics industry can be represented by the illustration of Figure 1. The consumer electronics and industrial electronics sectors presently import large percentages of their required inputs, with the exception of packaging, casing, and minor components, and sell the vast majority of the output on the (protected) domestic market. The electronic components and computer hardware sectors, on the other hand, also import all the technology and an even higher percentage of the inputs, but export all the output to world markets. The telecommunications industry falls inbetween the two extremes as it produces some products for the domestic market and some for export, although it also uses predominantly imported parts and components.

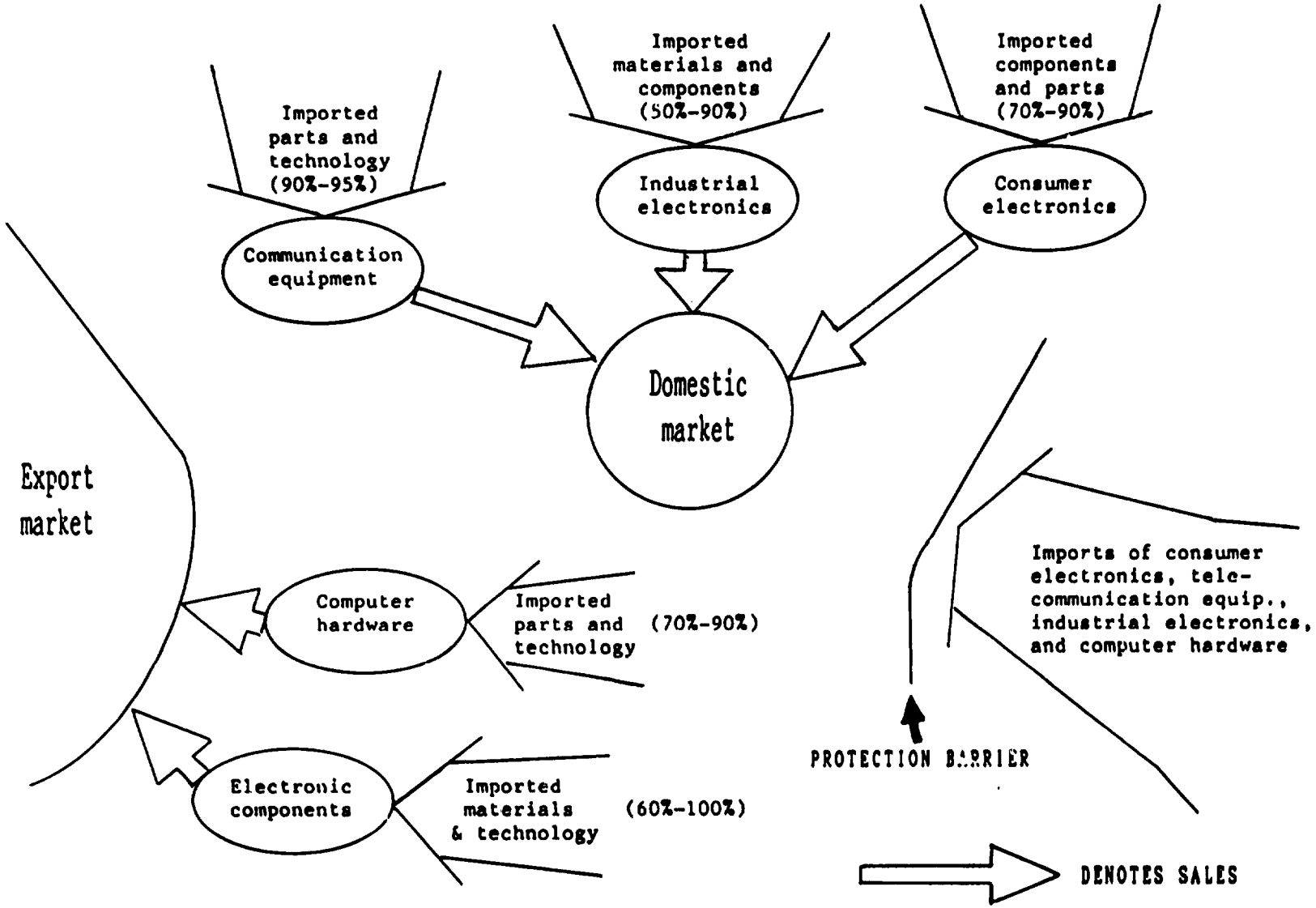
While the picture has improved in recent years, with more linkages developing between component producers and the other sectors, the situation is far from ideal and the Thai industry still relies heavily on imported inputs and technology.

According to a recent publication by the Board of Investment[1/] a large number of companies are producing a considerable range of components and parts, either supplying domestic manufacturers of consumer products or exporting directly. These components and parts include:

- compressors for refrigerators [1 company]
- cables for computer applications
- crystal valves for radio broadcasting equipment
- microwave circulators and insulators
- integrated circuits [8 companies]
- printed circuit boards [2 companies]
- hard disk drives [1 company]
- quartz crystal [1 company]
- transformers under 500 KVA
- miniature ball bearings [2 companies]
- electrolytic condensers
- alternators and generators
- miscellaneous electronic components such as microphones, relays, loudspeakers, flyback transformers and chassis.

1/ "Support Industry in Thailand", Office of the Board of Investment, Bangkok, March 1988.

Figure 1. Linkages and inputs in the electronics industry



Source: "The Development of Thailand's Technological Capabilities in Industry - Capability Development for Electronics and Information Technology-Based Industries", TDRI, Bangkok, October 1988.

(iii) Technological support services

There are needs for technological support services from the government to the electronics industry in Thailand, perhaps, not so much to the big industries or joint ventures but to the small ones, mainly active in component and parts manufacturing.

Policy and policy measures are being devised to facilitate the flow of technology to the industry and to supply the required manpower. Universities and TISTR will supply technologies by unpackaging foreign technologies or by doing their own research. While big industries can afford their own research laboratory, small ones will have to get their technologies through training courses, consultancy or contracted research with the university. The Department of Industrial Promotion will supply basic technologies to the industry.

There is also interest in the possible setting up of a Software Institute to be co-ordinated by FTI.

(iv) Manpower development

In the electronics industry, generally regarded as being relatively skill-intensive, the importance of having a motivated, well-trained labour force is key factor; the lack of sufficient technical manpower is always a major constraint on development. It has been suggested that for many developing countries the accumulation of a critical mass of skilled manpower would constitute "the means of overcoming the key barrier to entry in the electronics industry".

Particularly for low level workers, the main part of the training process is carried out on the job. Comprehensive training programmes are being set up in many companies, both Thai and foreign firms.

At present time the links between electronics firms and technical and/or management training institutions appear to be rather weak. One exception is the co-operation recently established between a number of foreign-owned electronic companies and the King Monghut Institute of Technology at Lad Krabang to establish special evening courses to provide advanced training for technicians.

(v) Prospective supportive industries and new industries producing electronic components

Availability of effective supportive industries (established in line with prevailing comparative advantages) will constitute an important element for the future development and expansion (and reduction of import dependence) of the country's electronic components manufacture. Potential new electronic component industries would in particular include those which are considered to have beneficial linkages - technologically and industrially - with the country's existing firms. The prospective development of the integrated circuit industry provides the basic framework for such projections, given the dominance of the subsector and the fact that technological development in

integrated circuit production has far-reaching effects also on production of other electronics components.

As far as supportive industries to such electronics component manufacturing is concerned, there are a few small to medium size firms producing die punches and precision jigs and fixtures supplying the existing integrated circuit industries. This sort of engineering firms constitute an important core for accumulation of high precision and automation technology. The production tools supplied to the integrated circuit industries have to be very precise; in most cases precision in the level of microns is required. Furthermore, production equipment used is essentially automated and is therefore providing the firms with good access to such technology. Starting from this point, and with properly planned promotion these firms could grow into engineering firms with sophisticated technology supporting the integrated circuit industries and other electronics components industries.

There are many other integrated circuit related production tools and equipment that could be localized. For example, auto stamping machines, auto die-attach machines, auto chips loaders etc.

As far as new industries are concerned, there are at least two important trends in integrated circuit industries to be noted. The first is that the industries are rapidly moving towards a clearer division of labour. Fewer firms may be able to operate a complete production line starting from raw material purification through devices design up to packaging and testing. Firms have to concentrate more to a particular process in the whole production line so as to establish their own competitive edges. In this evolving process, there exist areas where the barrier of entry is relatively low for the newcomers.

The second trend is the rapidly growing demand for custom-made and semi-custom-made integrated circuits. It is estimated that by the end of the year 2000, approximately 40 per cent of the total integrated circuits will be semi-custom-made. These two conspicuous trends lead to new possibilities for the newcomer. A prospective industry which does not require intensive investment and at the same time can benefit from the country's well-trained engineers is the very large scale integrated circuit (VLSI) design industry.

The UNID/ECFA Mission noted promising prospects for pressed parts production e.g. through joint venture promotion and/or assessment of possibilities for upgrading of selected "second group" of local small engineering industries. The same approach would be suitable for broadened plastic parts production.

Still another prospective product is condensed capacitors.

It might also be suggested that a comprehensive assessment ('top down') of prospective electronics parts/components productions be made. The BOI and the large company members [that is the prospective buyers of such parts] of the Electrical, Electronics and Allied Industries Club of the Federation of Thai Industries might be interested in sponsoring such research.

(c) CHEMICAL INDUSTRIES

(i) Basic chemicals

The Thai chemical industry imports most of the industrial chemicals it requires. However, since the availability of natural gas from the Gulf of Thailand has now come on line, the percentage of chemical imports is expected to drop in the near future.

The biggest users of chemicals are the producers of sulphuric acid and sulphates, chloroalkali and clorinated products, soaps and detergents, pesticides, fertilizers, plastics and paints.

With the completion of a new sulphuric acid factory south of Bangkok, the country is now estimated to be self-sufficient in that chemical which is among the major ingredients in the production of detergents and aluminium sulphate.

Also most of other chemicals required for manufacture of soaps and detergents are produced locally.

Pesticides production is still a very small industry when compared to those in Indonesia, Malaysia and the Philippines which are all producing their own major chemical ingredients for that purpose. Fertilizer production has developed into a big industry in Thailand during recent years, for which main chemical ingredients are still imported.

Two other major users of imported chemicals are the plastic and the paint industries.

The plastic industry relies on hydrocarbons extracted from natural gas and crude oil for its main materials, both of which are now readily available from Thai firms as well as from abroad.

(ii) The plastics industry

The petrochemical complex now being established in the Eastern Seaboard will enable the manufacture of plastic resins in Thailand. The first petrochemical complex known as NPC-1 will consist of an olefins unit and four related downstream units and is being currently built in Rayong Province. A second and much larger petrochemical complex to be designed and built starting this year, referred to as NPC-2 will be mainly an aromatics complex though some olefins will also be produced. The NPC-2 project will be producing styrene monomer, polystyrene, styrene butadiene rubber, acrylonitrile butadiene styrene, linear alkylbenzene, terephthalic acid, ethylene glycol, vinyl chloride monomer, polyvinyl chloride, polypropylene, polyethylene or a total of at least 11 projects. When completed, both complexes will provide important raw materials for Thailand's plastics industry.

The raw materials for Thailand's NPC-1 complex will come from ethane and propane from the currently existing Petroleum Authority of Thailand (PTT) owned natural gas separation plant which processes Gulf of Thailand gas. The raw materials for the proposed NPC-2 complex will partly come from the

Gulf of Thailand gas condensate and natural gas liquids and also from refineries in the form of naphtha. The main aromatics of the second complex will be benzene and p-xylene.

The NPC-1 complex is being built around the partly government-owned National Petrochemical Corporation which will produce the olefins. At the downstream end of the NPC-1 complex the investment is solely in the hands of private investors: Thai Petrochemical Industry Ltd. (TPI), Thai Plastics and Chemicals Co. (TPC), Thai Polyethylene Co. (TPE), and HMC Polymers Co. (HMC). Among these four companies the first two mentioned currently produce plastics resins based on imported raw materials. The remaining two companies belonging to the Siam Cement Group and the Sri Krung Wattana Group are currently erecting their plants. TPI and TPE will be producing polyethylene, TPC which is currently producing PVC resins will expand its production facilities, and HMC will be producing polypropylene.

The National Petrochemical Corporation will manufacture some 115,000 metric tons of ethylene and some 105,000 metric tons of propylene per year to be supplied to the four downstream plants mentioned above.

The plastics (plastic resins) presently used by Thai industry are mostly imported. The major ones are:

- Polyethylene. Currently the Thai Petrochemical Industry Co. is the only producer (using imported ethylene). Late this year the Thai Polyethylene Co. Ltd, of the Siam Cement Group, will start production. This additional capacity is expected to meet domestic demand and also bring about excess capacity for export.

- Polyvinyl chloride (PVC). The Thai Plastic and Chemical Company is currently the only PVC producer in the country (based on imported vinyl chloride monomer). In the NPC-1 complex a further plant will be set up.

- Polystyrene. At present there are four major manufacturers. Due to the growth of the toy industry and the packaging industry demand for polystyrene is expected to increase rapidly.

- Polypropylene. It is presently imported, but will be manufactured in the downstream development product of NPC-1. The factory is due to be completed in late 1989.

- Engineering plastics. The Eternal Resin Factory is presently the sole producer of acrylonitrite butadiene styrene. The PETPACK company is currently producing bottles of polyethylene terephthalate (using imported resins).

In general, the future of the Thai plastic industry is likely to depend on the following demand factors:

(a) as material substitutes;
(b) use in the packaging industry;
(c) use in the electronics industry;
(d) as automotive parts and others.

These factors being considered, the prospects for the development of the plastics industries seem to be highly promising at the present time, as is evidenced by the keen interest shown by investors in the so called NPC-2 project. Thailand is fast becoming a manufacturing base for Japan and other East Asian countries which are suffering from high labour costs and rapidly appreciating exchange rates, in addition to the removal of trade preferences in the case of some countries. These investments will lead in turn to the growth of demand for plastic intermediate goods in the industrial sector on a sufficiently large scale to achieve economies of scale.

The potential constraints lie in the area of trained manpower, since the incoming firms will bring technologies which are new to Thailand. In the plastic conversion stage, there is a need to improve quality control which will eventually require in the long run the development of supporting industries such as mould-making and plastic machinery industries. In the short run, however, these needs can be met by import of technological know-how and supervisory staff.

(iii) Prospective approach and projects to strengthen supporting industry in the Thai chemical industry sector

The UNIDO/ECFA Mission identified areas and specific proposals concerning the further development of the Thai chemical sector through strengthened support industry activities, such as:

- Establishment of a Plastic Development Centre with the Plastic Industry Club of FTI.

- Promotion of production of chemicals (downstream end-use products) in small/medium industries (possibly joint ventures).

- Demand study of plastic products for the automotive sector and for other industrial uses (e.g. electronics, electrical appliances).

- Sponsored training by industry club, like the one set up with the Plastics Industry Club.

- Comprehensive sector assessment of training needs in the petroleum/petrochemicals sector.

IV. Focal points of future technical assistance: Prospective approaches and projects to strengthen supporting industries

This chapter deals with certain prospective areas for future technical assistance and co-operation activities with the purpose of strengthening supporting industries. It refers briefly to various projects identified by the UNIDO/ECFA team as warranting further examinations. Most of the project proposals are elaborated further in the Annex.

It is hoped that the project profiles in the Annex will provide the basis for drafting of concrete project proposals for subsequent Trust Fund arrangement(s) between Japan (the private sector in particular) and UNIDO.

Implementing these projects under other arrangements is, however, also possible, the ultimate objective of this exercise being the promotion of supporting industries in this country.

As indicated in the previous chapter, priority is to be given to the engineering, electric/electronics and chemical subsectors, according to the government. The Mission is in full agreement with this.

(a) EXAMINATION OF GOVERNMENT POLICIES ON SPECIFIC ASPECTS AT THE SUBSECTOR LEVELS

Rapid expansion of the industrial sector has made it very necessary to review government policies at the level of subsector and necessary actions to be taken by the government as well as the private sector. For example, the tariff system traditionally oriented toward protection may need to be modified to export orientation.

Some studies at the subsector level have been undertaken in the recent past, including those made by ADB onthe petro-chemical and engineering industries, those made by Chula Unisearch, Chulalongkorn University on the metal and machinery, and electronics subsectors, and those by JICA on the mould and die, and toy industries. In view of both the government and industries, further studies on more specific aspects, such as local sourcing, should be carried out.

Subsectors to be given particular focus on are automotive and electronic/electronics indsutries with emphasis to local production of components.

With above-mentioned background, the Mission proposes projects numbered 3, 6, 8 and 5 (in the Annex). The first aims at promotion of supporting industries in connexion with industrial development in provinces outside Bangkok and its vicinity. The second is to identify automotive parts and components not yet produced locally but may be viable to do so by implementing measures to upgrade the existing industries and to encourage it. The third is a similar study for the electric and electronics parts. The fourth is to study possible linkages between foreign enterprises in export processing zones and the domestic industries.nd its neighbouring provinces.

Some other projects, such as No.7 can be implemented as part of possible follow-up actions of these studies.

(b) MANPOWER DEVELOPMENT

Rapid industrial development has caused shortage of skilled workers and engineers. Investors who are going to establish their new industries are hard faced with this problem. The existing ones are in an almost equally difficult position through the increasing job-hopping practices.

Existing training/educational institutes of importance include universities, technical colleges, vocational training schools, etc. The sudden surge of industrial investment has created demand for skilled workers and engineers which far exceeded the supply capacity of these institutes. A study has been made by TDRI on the demand of manpower by job category in the future which showed wide gap of the demand and possible supply from existing training/educational institutes.

Many individual enterprises, existing as well as new ones, are now trying to meet their need for such personnel by organizing their own training schemes. Some such examples are those conducted by the Plastic Industry Club and that by Toshiba. A number of companies including Toshiba and Toyota have established their own training schools.

The problem of accute shortage of this manpower is expected to continue; the solving of it will be the most important challenge for Thailand to maintain the present momentum for development. Thus, there is need for co-ordinated approach. It is also imperative to encourage and improve training schemes of enterprises, to supplement formal and vocational education.

With this background, the Mission felt projects which will be very much needed and proposes project Nos.16 and 17. The former aims at giving immediate response to the situation. The latter has a longer-term perspective towards a strengthening of the country's science and technology capabilities by way of a Technical Entrepreneur Park concept.

(c) INDUSTRIAL INFRASTRUCTURE AND SERVICES

Thailand is considered by foreign, specifically Japanese, industrialists as one of the most attractive investment locations. Lack of well organized infrastructure is, however, crucially hindering foreign investments. Among others, adequate industrial land is in short supply. In response to this situation, a number of industrial estates have been built by the initiatives of private parties including foreigners in the past. It has come to the stage where locations for such ventures have to be found outside geographical areas familiar to industrialists. It is expected that the project No.4 proposed herewith will be beneficial in encouraging more industrial estates be built outside Bangkok.

Thailand has fairly well developed network of supporting institutions to help industries in technical, managerial and other aspects. There are, however, some areas still in which specialized supporting institutions, if established, can help industries substantially. Specifically, the Mission identified such need in the plastic processing and packaging industries and proposes the project Nos.9, 10, 11 and 12.

(d) DIRECT ASSISTANCE TO SMIs

(i) Upgrading of the technological capabilities of SMIs to meet the standard of large industries as subcontractors or suppliers.

The recent boom of foreign investment inflows is expected to continue for some time, although possibly not at present very high level. In this, the export-oriented industries have been the driving force, typically the assembly of electric and electronics products. Foreign investments in supporting industries to these assembly industries are also increasing. The automotive industry is expected to follow this trend.

In general, the automotive and electronics industries will offer excellent opportunities for a wide range of local supporting industries to emerge or the existing ones to be strengthened.

While efforts have been made to realize such opportunities, it has not yet taken place on a substantial scale. The Project No.7 aims at identification of products and potentially capable SMIs to manufacture them, and programming of technical assistance required.

Conservation of energy is, beside being an important issue at the national level, one of the areas Thai industries can effectively strengthen their cost competitiveness.

A project covering co-operation in the establishment of energy conservation programmes at plant level in certain industries (supporting industries for packaging etc.) is presented as project No.15.

(ii) Assisting exports of engineering products by SMIs

The engineering industry in Thailand, with exceptions of few larger companies, is still dominated by SMIs. Certain range of industrial machinery, such as food processing, plastic, agricultural machinery and light vehicles, has, however, reached the stage of exporting their products, although it may be at the lower end of the markets for the time being. If such move is encouraged, the industries supported by them will also benefit, since international operations bring with them international competitiveness in quality as well as price, and perhaps a widening of the range of products available. With this objective, the mission proposes project No.2, which contains as core component advisory services to the engineering products manufacturers, being prospective exporters.

(iii) Support to the textile/garments sector

Competition in the international markets for textile products and garments is getting harder and harder. Constant improvement in technology and other aspects is very necessary for Thailand to maintain and strengthen its competitive position.

Two project proposals are presented in relation to supporting industry development in the textile/garment sector, project Nos.13 and 14. The former seeks to identify opportunities for new investment in such supporting industries while the latter project forcuses on the needs for strengthened specialized textile finishing capabilities.

(e) PROMOTION OF FOREIGN INVESTMENTS

A number of factors including high cost of labour and recent Yen revaluations have made some industries in Japan weak in international competition. This is the main factor of the recent surge of investments to Thailand from Japan. That is, they are relocating production bases in order to keep their markets which have far been served by producing in Japan. Many more, including SMIs (by Japanese standards), are considering to follow. These Japanese SMIs with limited human and other resources to go into international operations need to be assisted at the pre-investment stages. The project No.1 has been proposed to assist these potential investors to relocate more effectively, by way of conducting opportunity studies, so that such operations will be beneficial to both Japanese and Thai partners (and to the whole economy and bilateral relations).

V. Framework for implementation programme and institutional requirements

A. PROGRAMME BASIS

The mission has attempted to identify needs and requirements for a further development of the Thai supporting industry structure in order to meet the challange of an envisaged future development in key areas of the country's manufacturing. These needs and requirements have been seen in relation to a strengthening of existing industrial facilities directly or by means of institutional support - in technology adaptation, R&D, training and skills development, etc. - as well as in the form of proposed new investments and joint venture opportunities, often envisaged with specific technology inputs from the foreign partner(s).

In some cases, in particular concerning proposed assistance to institutions working with the country's small- and medium-scale industry, projects are relatively well developed. Some are even being under active consideration for possible funding under various TA-programmes. The mission felt that even these later projects should be taken note of and special attention given to their importance for the furtherance of the country's support industries. In other cases, only preliminary ideas could be presented requiring substantial preparatory work before implementation may be considered.

B. CRITERIA FOR SELECTION

The programme to be designed on the basis of the present report and to be carried out by UNIDO jointly with Japan within a Trust Fund arrangement will have to operate within fairly narrow financial constraints. Accordingly, specific care will need to be exercised in selecting the projects to be implemented. It is suggested that the selection process be based primarily on the three following criteria:

- Programme focus: Individual projects should be selected as elements of a coherent action programme which clearly defines the relationship and interlinkages between the projects. Without a focussed implementation there is a danger of misspending the limited resources on dispersed activities. The overall objective 'strengthening of supporting industries', though important, appears too broad to provide the required focus.

- Impact maximization: If a programme as limited as the one under consideration here is to have an impact industrial progress of the Thais at all, it will need to concentrate on projects with maximum spread effects. Accordingly, priority is to be given to such projects (be they of an investment or technical assistance nature) which can be expected to affect a large number of downstream activities and user industries.

- Short gestation period: As the programme to large extent is aimed at the removal of constraints currently facing the country's engineering and other key supporting industry sectors, preference will be given to projects with a short gestation period, particularly those permitting immediate implementation.

- Direct assistance to industry: The programme will favour projects that involve direct assistance to the country's industries. Possibilities to combine direct assistance measures with institution-building projects should be explored and co-operation with other donor agencies (bilateral and multilateral) be sought for this purpose.

The above general selection criteria - while providing a basic framework from which to derive priorities - certainly leave a number of different options to be pursued. Without wanting to prejudice the decisions to be taken, the present report holds that preference may be considered to be given to projects addressing key problems or opportunities of the small- and medium-scale engineering industries and other key supporting industry sectors to broaden the spectrum of supporting production and services of required quality in the country - be it in the metropolitan area or in provincial locations.

Another most important aspect is the effective pursuance of new investment opportunities. Here, the UNIDO/Japan programme may provide certain resources for promotional and investigatory activities, leaving costs directly linked with the investment to be covered under other arrangements.

New investments may in some cases be resulting from relocation of manufacturing plants from Japan, e.g. in the textiles field. Such relocation might be facilitated by the association of Thai engineering and construction companies in the setting up of the relocated plants.

As for proposed activities aimed to strengthen institutions in their provision of services and guidance to the support industries, it would be important to ensure that the requisite basic institutional infrastructural set up is already in place, as is the case with, for instance, MIDI and TISTR, so that immediate results may be achieved. Particular importance will be attached to industry or branch associations initiatives.

C. INSTITUTIONAL ARRANGEMENTS

In view of the distinct orientation of any suggested programme towards medium-sized private industries as the relevant target group, the Mission has specifically sought to explore which type of institutional arrangement would be conducive to its efficient implementation. On this issue, there was a broad consensus that the nature of the envisaged projects would warrant the creation of specific counterpart institutional arrangements which, above all, should be closely linked to private industry both in its outlook and in its personnel composition. Such arrangements may be set up through co-operation between the secretariat of the Federation of Thai Industries (FTI) and the Foreign Relations Division, Office of the Permanent Secretary, Ministry of Industry.

Annex I

PROJECT NO.1

Project title: Assistance to promote foreign investments in selected technology-intensive supporting industries

Co-operating agency: Board of Investment (BOI)

Objective: The basic objective is to enlarge and strengthen the country s industrial base by the promotion of foreign investments in the areas where local industries cannot meet the quality standards.

Immediate objectives are:

1. to explore the possibilities of investment from industrialized countries, mainly from Japan; and
2. to ascertain the technical and financial viability of the investment projects proposed.

Project description: The project will promote foreign investments in the areas where the existing technology gap is too large for Thai industries to fill. This promotion will involve:

- identifying (within the framework of the UNIDO/ECFA programme) subsectors suitable for foreign investments[1/] and enterprises interested in pursuing the investment;
- conducting opportunity (pre-investment) studies for selected subsectors; and
- recommending guidelines for financial, managerial, administrative and other arrangements for prompt materialization;
- recommending investment and other incentives which the Thailand Government could provide to the industries.

International assistance inputs:

- Consultants for project development and promotion (industrial economist, industrial engineer, financial analyst) (4 m/m).
- Staff travel.

1/ The pricrity subsector may be chosen from die and mould making, forging, casting, metal finishing/surface treatment, engineering design, etc. and, in terms of specific products, components for automotive, electric and electronics industries, rubber products, etc.

PROJECT NO.2

Project title: Assistance for the exports of engineering products produced by Thai small and medium industries

Co-operating agency: Industrial Machinery Club of FTI

Objective: The basic objective is to enlarge and strengthen the country's engineering industry.

Immediate objectives are:

1. To explore the possibilities of export of engineering product and industrial machinery or parts produced in Thailand, and

2. To examine the technical and commercial feasibility of such exports.

Project description: The project will pave the way for the Thai engineering industries to enter into the international markets by:

- contacting Thai companies making engineering products, such as industrial machinery and parts or components which could potentially be exported;

- review the prospects in the overseas markets being considered; and

- recommending actions necessary for the Thai manufacturers to capture the potential market opportunities (including the necessary technological improvement and appropriate business transaction arrangement).

Background: The engineering industry in Thailand, with exceptions of few larger companies, is dominated by SMIs. Certain ranges of industrial machinery, such as food processing, plastic, agricultural machinery and light vehicles, have, however, reached the stage to expand into international markets, although it may be at the lower end of them initially. If such move is encouraged, the industries supported by them will also benefit, since international operation means the international competitveness in quality as well as price.

Indeed, some small and medium engineering industries are already engaged in the export business. One example of a local engineering industry which is making arrangements of exporting and assembling small three-wheeled vehicles called 'Tuk-tuk' is the Pholasith Tuk-Tuk Industry Co. Ltd, in Bangkok.

Members of the Industrial Machinery Club of FTI are also intensifying their marketing activities abroad.

International assistance inputs:

- Consultants for international business development approx. 1-2 m/m per product/per country of potential market.

- Support of overseas travel of Thai entrepreneur(s) to potential market(s).

PROJECT NO.3

Project title: Promotion of supporting industries in connexion with industrial development in provincial areas (outside Bangkok and its neighbouring provinces).

Co-operating agencies: The Department of Industrial Promotion in co-operation with the Industrial Estates Authority of Thailand and the Federation of Thai Industries.

Objective: The basic objective of the project is the development of an effective supporting industry infrastructure in provincial areas of Thailand (outside of Bangkok and its neighbouring provinces) complementary to and supportive of the development of industrial estates and export processing zones in these areas.

Project description: Under the project following activities will be carried out:

(i) Selection of three specific provincial areas where industrial estates development is planned. These areas may include areas in the North (e.g. Lampang Province which may act as centre for production of ceramic products, equipment and machinery manufacturing plants and fruits canning or Chiang Rai Province for farm product processing, jewellery and garments making), in the Northeast (e.g. in Korat for agro-industries and agricultural machinery manufacturing) and in the South (e.g. in Songkhla Lake Basin area or Surat Thani Province for light industries - marine-based, rubber-wood furniture, agro-based, garments, etc.).

(ii) In respect of each selected area a long- to medium-term perspective assessment of the future industrial development of that area will be made. This may involve the potential building up of an industrial structure directed towards world market competitiveness in respect of [some of] the products which the area will specialize in. This assessment will include

(a) Preparation of an economic assessment of potentials of and priorities for the area's industrial development, including linkages, resource-base and international and domestic market;

(b) Preparation of opportunity report on potential industries (new establishments or expansion) in priority fields as identified under item (a).

(iii) For each area an analysis will be made of infrastructure and support requirements of small and medium industries. This analysis will involve:

(a) An industrial enterprises' demand survey on support requirements in major functions like production process and technology information, sales and supply markets, finance, management, etc.;

(b) A report will be prepared on basis of the demand survey results. This report will present a perceived organizational set up, including the role of entrepreneurial associations, and public sector support measures, conducive to the envisaged development of the area's industry and its international competitiveness. The report will cover the planned industrial estates/ export processing zones development, other specific industrial requirements (due to available raw material base etc.) and requirements for industrial servicing establishments (such as maintenance and repair shops, printing facilities, etc.).

(iv) An action programme for the area's future industrial development will be formulated for each area and presented at national workshops in the respective areas. A report on potential industries in priority fields will also be presented at the workshops.

Background: At present almost 90 per cent of Thailand's industrial output is generated in the central Region (in Bangkok metropolitan area in particular) because of its well established infrastructure, large market size, availability of educated manpower, good urban services, and accessibility both to other regions and abroad. Although the disadvantages of such agglomeration are bound to appear sooner or later in the form of rise of land prices, wages, transportation costs and pollution abatement costs, individual industrialists at present hesitate to go out of the metropolitan area because the investment environment is in most respects very inferior in the non-metropolitan regions (with underdeveloped industrial location areas, low-skilled manpower; inconvenient transportation, poor urban services and limited local market size).

Main constraints to industrial development in regions outside Bangkok are:

- lack of national capability in promoting industries in the regions;

- lack of information and access to marketing and technology needed by enterprises; and

- lack of adequate financial resources and appropriate governmental incentives for promotion of investments.

Concerted efforts towards overcoming these constraints are being pursued by the Government in co-operation with the concerned private sector associations, in particular in the context of the work of the Joint Public Private Consultative Committee (JPPCC).

The Ministry of Industry has recently announced the intended development by the Industrial Estates Authority of Thailand (IEAT) in co-operation with the private sector of a number of industrial estates at various locations in the Northeastern, Northern and Southern part of the country.

The Federation of Thai Industries has expressed support for the Ministry's industrial estate plan and suggested that equal treatment in terms of Board of Investment promotion be provided to private groups whether they develop industrial estate alone or in joint venture with IEAT.

International assistance inputs:

International experts
- industrial economist (8 m/m)
- industrial engineer (8 m/m)
- short-term specialists (e.g. agro-industries; marine-products; garments) (12 m/m)

Staff travel

Local consultants/experts

PROJECT NO.4

Project title: Assistance to the establishment of private industrial estates.

Co-operating agency: IEAT and BOI.

Objective: The basic objective is to enlarge and strengthen the industrial sector of Thailand by alleviating the problem of the shortage of industrial land in areas outside of the central provinces around Bangkok.

Immediate objectives are:

1. to assess the demand for such developed industrial land for new investments; and

2. to examine the financial and technical viability of establishing new industrial estate(s), in the said areas.

Project description: The project will promote establishing industrial estate(s) in areas outside of the central provinces around Bangkok by the initiative of the private sector and involvement of Japanese industries by:

- considering potential industries and formulation of industry mix of the proposed industrial estate(s);

- assisting in identifying foreign investors interested in locating their projects in the estate(s);

- formulating basic plans for necessary facilities and physical layout;

- concluding preliminary financial analysis of its viability; and

- recommending suitable investment promotional programme.

Background: Thailand is considered by foreign, specially Japanese, industrialists as one of the most attractive investment locations. this is due mainly to the political stability, and liberal business climate. Lack of well organized infrastructure is, however, crucially hindering foreign investments. A number of industrial estates have been built by the initiatives of private parties including foreigners in the past. It has come to the stage where locations for such ventures have to be found outside geographical areas familiar to industrialists.

International assistance inputs:
- 4-8 m/m of expert assistance.
- Staff travel.

PROJECT NO.5

Project title: Study on scope, structure and determinents of linkages between enterprises in export processing zones and the domestic Thai economy.

Co-operating agencies: The Department of Industrial Promotion, the Industrial Estates Authority of Thailand (IEAT) and the Federation of Thai Industries (FTI).

Objective: The purpose of the project is to provide an information base and support to government policy-making as well as enterprises' corporate planning which would enable a nationally more integrated export production, as regards local content as well as technological capabilities.

Project description: The project will consists of (i) the preparation of a analytical study with recommendations as to policy-making and promotion of linkage development between EPZ-enterprises and the local economy and (ii) review of recommendations and findings of the study at a national workshop.

The study will provide

- an analysis of the experiences and results of the activities hitherto in Thai EPZs and bonded warehouse operations as regards linkages with the economy of the surrounding area (as well as the country as a whole) in the context of national economic development objectives; and

- action-oriented recommendations to further a closer integration between the EPZ production and the national economy outside the EPZ, in particular potential backward linkages.

The study will also provide information on selected export-oriented industries outside the EPZs as to the extent they are using domestic raw materials. The question should be considered whether a location of export-oriented firms outside EPZs should be promoted in order to increase their backward linkages.

Specifically, within the framework of the investigatory phase of the study, particular attention will be given to following aspects:

- Potential and mechanisms for manufacturing of products, or assembly work, on subcontract basis outside the EPZ;

- Comparative analysis of the benefits gained from producing the same products in EPZ enterprises and in non-EPZ enterprises;

- Identification of various factors which affect the selection of local or imported raw materials/parts.

Based on above empirical findings and analysis the study will put forward proposals for policy measures geared to enhancing the domestic integration of EPZ activities and hence the domestic value added of export-oriented production. Potential policy measures to be assessed as to their effectiveness could include: increased selectivity in approving investment projects, inter alia, based on their linkage potential; establishment of a relationship between the granting of investment incentives and the domestic value added ratio of production; support schemes for local suppliers of required inputs (technological upgrading, quality control, standardization, etc.).

In the development and formulation of the proposals for policy measures and supportive actions aimed at enhancing the export potential of the concerned industries special account is to be taken of relevant experiences from other countries pursuing successful export-oriented industry promotion.

International assistance inputs:

- Services of local short-term consultants/research institute (3x2 m/m)

- International consultant/UNIDO economic research staff (2 m/m)

PROJECT NO.6

Project title: Policy-oriented study on potential expansion of auto parts production

Co-operating agency: The Ministry of Industry (the Industrial Economics and Planning Division) and the Federation of Thai Industries

Objective: The objective of the project is to provide technical support for the policy-making relating to the development of the Thai automotive parts and components industry.

Project description: A techno-economic study will be prepared on the long-term prospects for the Thai automotive components industry as supplier to the domestic auto-assemblers and, in particular, to export markets. The study will cover

(i) a review of firstly the activities of the present autopart producers and their support industries; secondly the demand for parts and components by the domestic auto assemblers; thirdly the existing gaps as to capacities and capabilities in producing certain parts and components; including needs for upgrading technological and managerial capabilities; and fourthly the present and potential exports of parts and components;

(ii) development prospects for the Thai autoparts and components industry (different scenarios)

(iii) policies and measures towards achieving such prospective development, including schemes for training and skills development, upgrading of quality control and testing activities, organizational changes, etc.

Identifying parts not produced at present buy which may be viable to produce locally and policies, measures will be proposed to promote it. The project will consider in this regard aspects of man power (including expatriates), infrastructure, investment producedures and incentives, tariff system, etc. Consideration will also be given to the possibilities for the ASEAN regional specialization arrangements.

Background: The Government has encouraged the increase of local contents over a number of years. Owing also to considerable efforts exercised on the part of the private sector concerned, now the local content stands at around 55 per cent and is considered to have reached the stage where conventional encouragement and control

may not be as effective as before. Due to the limited size of the domestic market, exporting some portion of the production is imperative. the existing system of encouragements and protection may need some modifications and the ASEAN regional specialization arrangements can be instrumental in this regard.

At present in Thailand 37 makes of passenger cars are being assembled locally at 17 assembly plants. Of these 17 plants, 11 assemble exclusively passenger cars. Most of the assemblers are Thai-foreign joint ventures. They have a combined production capacity of 162,5000 cars per year.

There are around 350 firms producing automobile parts and components, some of which are promoted by the Board of Investment.

In 1988 680 million baht worth of automobile parts and components were exported, mostly to US, Western Europe, Singapore, Malaysia, Saudi Arabia, Japan and Indonesia.

The export target for 1989 for automobile parts and components is 1,200 million baht. This expected steep increase is above all a consequence of the fact that automotive parts and components production in many producer countries is being more and more expensive, paving way for higher demand for those parts and components made in Thailand whose quality is up to international standards.

The Automobile Industry Development Committee under the chairmanship of the Permanent Secretary of the Ministry of Industry has been established as forum for investigations and discussions prepartory to the Government's policy-making.

International assistance inputs: International consultant(s), 8 m/m
Staff travel.

PROJECT NO.7

Project title: Assistance for the development of the capabilities to manufacture components for selected industries such as automotive, electric and electronics industries

Co-operating agency: Development of Industrial Promotion, Ministry of Industry

Objective: The basic objective is to strengthen the existing component manufacturing industries and to increase the degree of the industrial integration/self-sufficiency of the manufacturing sector.

Project description: The project will promote further development of Thai components manufacturing industries by

- identifying components which could be made locally;
- identifying manufacturers which are potentially able to manufacture the components in question;
- programming technical assistance required, such as managerial and technical guidance or advice on possible financial assistance arrangements (the project itself will not have any financial component); and
- implement such assistance, at least, on a trial basis.

Background: In general, the automotive, electric and electronics components fields offer excellent opportunities to contribute to the strengthening of a wide range of supporting industries within a designated priority area of Thailand's industrial development.

(a) As a first step it will be essential to identify and focus on those market segments where the prospective demand appears to permit progress in the efficient localization of components.

(b) The Government expects small- and medium-scale industries to be increasingly involved as subcontractors for large-scale assemblers and component manufacturers. While efforts have been made to establish such linkages there are a number of factors hindering it from taking place on a substantial scale, including the generally insufficient technical and managerial capabilities of smaller companies to undertake the work with the level of quality and the consistency of delivery required.

Thus, there is considerable scope for technical assistance through which UNIDO could address these problems. Specifically, experts could be fielded to identify

- production activities which could be subcontracted to small and medium companies;
- subcontractors (potentially) able to perform the work;
- type of technical assistance required, such as managerial and technical guidance or advice on possible financial assistance arrangements (the project itself will not have nay financial assistance component).

International assistance inputs:

- Experts for managerial and technical guidance and advice on possible financial assistance arrangements (12-24 m/m).
- Staff travel.
- Training overseas.

PROJECT NO.8

Project title: Assistance for a study on the prospects and potentials for production of components and other requisites for the electric appliances and electronics industry.

Co-operating agency: The Ministry of Industry (IEPD) and the Federation of Thai Industries.

Objective: The basic objective is to propose, for consideration of the Ministry of Industry and the industry, actions condusive to promoting production of components and other requisites for the electric appliances and electronics industry.

Project description: The project will promote production of electric/electronics parts in Thailand by

- examining existing production capacities of Thai companies and assessing their need for upgrading technological and managerial capabilities;

- identifying parts not produced at present but which may be viable to produce locally and policies measures to promote it. The project will consider in this regard aspects of manpower (including expatriates), infrastructure, investment procedures and incentives, tariff system, etc. Consideration will also be given to the possibilities for the ASEAN regional specialization arrangements.

Background: The government has encouraged the increase of local content over a number of years. Owing also to considerable efforts exercised on the part of the private sector concerned, the local content is considered to have reached the stage where conventional encouragement and control may not be as effective as before. Due to the limited size of the domestic market, exporting some portion of the production is imperative. The existing system of encouragement and protection may need some modifications and the ASEAN regional specialization arrangements can be instrumental in this regard.

International assistance inputs:

- Consultants for project development etc. (tent. 6-8 m/m).

- Staff travel.

PROJECT NO.9

Project title: Assistance in setting up of a Plastic Development Centre in Bangkok

Co-operating agency: Plastic Industry Club of the Federation of Thai Industries

Objective: The basic objective is to promote, develop and support the plastic products manufacturing industry which is downstream to main petrochemical complex presently at advanced stage of completion in the Eastern Seaboard Development Project. This will serve to utilize the newly produced indigenous raw materials for use by the local industries displacing imports and enable export of such products to the users in the region.

The immediate objectives will be introduction of standardization, quality control and testing services for the plastic processing industry to enable it to produce semi-finished/finished articles corresponding to international standards. the project will also aim at providing technical advisory services to the plastic industry in connection with operation of existing plant and equipment, product design, choice and specifications of raw materials and activities and choice of new technology. The plastic processing industry will also be provided assistance in mould design, fabrication and training of its personnel.

Project description: The project is to be implemented in two phases; the first phase comprising preparatory work leading a detailed description and plan for implementation of the project and the second phase covering the establishment ofthe centre and its functioning in accordance with the plan of implementation developed in phase I.

The project is being promoted by the Plastic Industry Club of the Federation of Thai Industries whose members also include the plastic resin manufacturers who in turn are mostly joint ventures of Thai and Japanese companies; the Japanese companies being the eminent plastic producers with worldwide operations.

The Centre will be established by the private industry through the FTI and will have its own governing body to direct its work programme and relationships with the plastic processing industry. The manufacturers of the resin, plastic processing machinery manufacturers and the plastic processing industry will be member of the proposed Centre.

The FTI Plastic Industry Club has examined the conventional plastic development centre concept and have decided to establish the Thai Centre with financial support from its members. It is expected that the

Japanese plastic producing companies who have joint venture companies in Thailand will also be interested to support such a Centre which will not only help development of end uses of the plastic resins but also develop opportunities for diversification of plastic industry into such areas as engineering plastics and also entering into export markets.

The FTI Plastic Industry Club, however, suggests that the preparatory assistance should be funded from an outside source such as Japan and services of the Japanese experts should be obtained through UNIDO to help prepare project concept and programme of its implementation through an independent agency. Advantage should also be teaken of the experience with UNIDO of setting up similar projects in other developing countries.

Background: With the development of petrochemical industry in Thailand, the plastic conversion processing industry has acquired an important role. There are over 2,000 plastic processors in Thailand catering to a very diversified market employing processes such as blow moulding, injection moulding, compression moulding, extrusion and other techniques. Thailand presently produces six types of resins but further diversification is on the plans. The exports of Thai plastic products which was a meagre 8.6 million baht in 1971 rose to 1,000 million baht in 1985. Major export items included PVC, acrylic sheets, rain coats, tableware, artificial flowers and toys. The most promising area for the domestic market is the packaging industry and the highest growth is expected in the products based in PP, LDPE and HDPE.

The plastic industry is organizing itself to co-ordiante the proposal for setting up the Plastic Development Centre on the same pattern as earlier similar UNIDO projects now operating successfully in countries, e.g. India, China.

International assistance inputs: Short-term consultants (international and local) for survey of the industry and designing the scope, structure and activities of the proposed centre.

- 2 international consultants (3 m/m each)	US $80,000
- local experts - services provided by the plastics industry	---

PROJECT NO.10

Project title: Assistance for the establishment of a Packaging Design Centre for the Thai Packaging Association

Co-operating agencies: Thai Packaging Association and Industrial Service Institute, Department of Industrial Promotion, Ministry of Industry

Objective: The overall objective is to upgrade packaging design technology for the Thai packaging industry with particular attention to the requirements of export-oriented production. Specifically the objective of the project is to strengthen the technical packaging service provided by the staff of the Thai Packaging Association (TAP)in advanced packaging design technology, information and documentation, and to establish and develop computerized packaging design technique for use by the Association's members.

Project description: The Packaging Design Centre will be established as a common packaging technical facility under the Thai Packaging Association. Support, including the provision of office facilities and co-operating staff, is to be provided by the Industrial Services Institute, Department of Industrial Promotion in Bangkok.

The project will serve as a non-profit making organization and will provide the TPA members with advice on packaging design technique by computerization. The Centre will also conduct study mission to developed countries in order to upgrade the packaging design knowledge of the TPA members. Consultancy service by packaging design specialists will be one of the main activities of the Centre.

Background: Packaging is important for commerce and transportation of all kinds of products because it prevents and protects products from the environment until delivering to ultimate users; it reduces losses and damage caused during transportation, handling inventory and distribution; and it provides fast and convenient handling during transportation and inspection and also reduction of insurance and transportation cost. Moreover, packaging acts as a promotional tool for description and advertisement of products. However, in Thailand, packaging has generally not yet been up to the international standard level. Unproper packaging still causes considerable losses and damage to goods which might be unacceptable for export.

Past experience has shown that Thai entrepreneurs are quick to accept or adapt new product designs once they reconize their value. Packaing is no exception. Unfortunately, most Thai entrepreneurs, especially those

with small and medium scale operations are isolated from the rest of the world. They are thus unaware of existing technologies and design alternatives which could improve their packaging and help increase sales.

The Thai Packaging Association, in proposing this projects is aiming at helping Thai entrepreneurs to broaden their knowledge base of existing packaing technologies and creative packaging design. It will assist these entrepreneurs to make better, more informed decisions about packaging to protect their products and make them appear more attractive. The project will help the entrepreneurs to design or develop suitable packaging.

The focus of the project is on promotion of existing packaging designs and on ways to improve packaging quality in Thailand. It is anticipated that the project will in particular be of benefit for industries selling on the export market, although some benefits vis-à-vis the domestic market may also result. Among the industry sectors on which the project will concentrate are agro- and food-processing, garments and textile products, handicrafts and small consumer goods.

International assistance inputs: Packaging design experts (for training TPA's personnel) 12 m/m

- Study mission 5 scholarships
- One complete set of micro-computer
- Packaging design software

PROJECT NO.11

Project title:	Survey of cushioning materials produced for packaging purposes
Co-operating agency:	The Thai Packaging Centre of the Thailand Institute of Science and Technological Research (TISTR)
Objective:	The objective of this project is to investigate and analyse locally available cushioning materials which are used in packaging to protect goods from damages during distribution and to develop a guide for the local cushioning materials manufacturers for cushion selection.
Project description:	The project (involving co-operation between the cushion producers and the Thai Packaging Centre of TISTR) will aim at determining the best kind of cushions, using locally available materials, that can be applied for shock protection. These cushions will be laboratory tested for shock protection efficiency. All data will be collected, calculated and analysed. The data will be shown in the form of various cushion curves and published as a technical guide or handbook which will be a tool in selecting cushions for specific needs.
Background:	Thailand is an increasingly interesting location export-oriented investment. Many Thailand-made industrial products are exported all over the world. A not-uncommon problem is that when the products arrive to the ultimate consumer it is found that they have been damaged during the distribution. This is often due either to the exporter's unawareness of the product fragility or lack of knowledge in using suitable cushion, if possible based on local materials. It is, therefore important that a technical guide or handbook be prepared which compiles cushion specifications to help users to select proper cushioning materials (if possible based on local Thai materials) suitable to their needs.
International assistance inputs:	A consultant to assist in setting up and operating the equipment (2 to 3 m/m). A set of drop testing machine for cushioning materials, maximum 300 G.

PROJECT NO.12

Project title: Assistance for the development of modified atmosphere packaging for food products.

Co-operating agencies: The Thai Plastic Industry Association and the Thai Packaging Centre, TISTR

Objective: The basic objective of the project is the upgracing of exports of food products through modern packaging techniques.

The immediate objective is to study the possibilities of extending shelf-life of some potential export products, e.g. fresh produce, marine products, by modified atmosphere packaging, emphasizing utilization of local packaging materials.

Project description: The project comprises a study covering (i) a survey in local packaging materials suitable for modified atmosphere packaging, (ii) a laboratory study on this technique related to food quality during storage, and (iii) a cost analysis.

The study result will be evaluated for possible further development on commercial scale. Wide dissimination of the research findings will be carried out at the end of the project, through seminars and publicity in technical papers.

Background: Fresh produce and marine products are target groups of exports specified in the current Economic and Social Development Plan of Thailand. The government has put strong emphasis on export promotion of these products. Due to their high-perishable characteristics, packaging is playing a very important role in quality keeping during transportation and storage.

Globally, at present time, food processing techniques are rapidly advancing and application of high technology is being carried out. Modified atmosphere packaging (MAP) is the preferred modern technique, because it is utilizable for many kinds of food, such as agricultural, livestock and marine products. It can prevent from food oxidation, discoloration, micro-biological growth and thus extend shelf-life of the food.

There have been many commercial applications of MAP, covering equipment, packaging materials and techniques related to packed food quality in various developed countries, e.g. Japan, European countries, USA for many years. This has, however, not been transferred to Thailand yet. The proposed study of the possibilities of application of the MAP system in Thailand using

available local packaging materials for the mentioned target products is very important not only for food quality preservation but also for the country's exports promotion.

International assistance inputs: Short-term consultants to assist in selection of suitable packaging materials, evaluation of food quality, setting up and operating the modified atmosphere gas generating equipment as well as providing advisory for this system.

A set of modified atmosphere gas generating equipment.

PROJECT NO.13

Project title: Identification of opportunities for new investment in supporting industries for the textile and garment sectors.

Co-operating agency: Department of Industrial Promotion

Objectives: The basic objective is to contribute to improved productivity, efficiency and competitiveness of the country's small and medium scale textile and garment industries through efficient provision of inputs of high quality from local support industries.

Immediate objectives are

- to ascertain technical and financial viability of selected projects categorized as supporting industry in the areas of finishing (dyeing and printing) and for the garment industry (such as production of buttons, and fasteners);

- to improve design capabilities; and

- to promote selected projects for materialization.

Project description: The project will have the following components:

1. Identification of opportunities for new investments establishing industries which manufacture requisites of the garment industries, including service industries for textile finishing in areas calling for specialized high standard establishments.[1/]

   An opportunity study would contain the following elements:
   - Project background and history
   - Market and plant capacity
   - Materials and inputs
   - Location and site
   - Project engineering
   - Plant organization and overhead costs
   - Manpower
   - Implementation scheduling
   - Financial evaluation

2. Promotion of investment and/or transfer of technology from industrialized countries. Preparation of specific terms-of-reference for feasibility studies.

3. Training of Thai designers in Japan.

1/ See also project proposal No.14.

Background:

The garment industry in Thailand is very much dependent on inputs for its requisites, not only of yarn and fabrics, and certain specialized textile finishing services but also of accessories such as buttons, fasteners, etc.,. The lack of such inputs from local sources has brought forth substantial disadvantages to the indutry vis-à-vis its main competitors, like Taiwan Province of China and Hong Kong, where such requisites could be obtained locally.

The main export market of Thai garment industry has traditionally been the USA and Europe, where buyers prefer Thai industries to manufacture according to the designs provided by the buyers themselves. The Thai industries now trying to penetrate in the Japanese market, have found that Japanese buyers want the Thai suppliers to propose products designed in Thailand. There s accordingly a pressing need to strengthen design and product development capabilities on the Thai side.

International assistance inputs:

Consultants for project development and promotion (one industrial economist/financial analyst and one engineer) (3 to 4 m/m)

Staff travel

Training scholarship for 3 to 5 designers in Japan for 3 months.

PROJECT NO.14

Project title: Promotion of textile finishing companies working on commission basis

Co-operating agency: Textile Industry Division, Industrial Promotion Department in co-operation with the National Federation of Thai Textile Industries

Objective: To promote the establishment of specialized textile finishing (dyeing and printing) plants to work on commission basis. This would include promoting the establishment of industrial complexes for dyeing/printing plants, through co-operation among concerned enterprises.

Project description: To carry out a survey of existing finishing facilities in Thailand and of potentials for the establishment of further specialized textile finishing establishments with particular attention to opportunities for relocation of Japanese finishing enterprises.

The survey [which conceptually would be of a nature of backward linking from the garment makers, who would have the market knowledge] will i.a. cover existing and potential:

- types and amounts of yarn and fabrics being subject to finishing
- types of machinery required for such finishing.

The survey would identify bases and modalities of the establishment of a pilot finishing plant which could be promoted as a demonstration factility.

Background: There has been considerable advances over the recent years in textile dyeing and finishing technology. The major advances have been to reduce the number of processes required, reduce the amount of chemicals required, reduce the usage of energy, speed the operational throughput time and improve quality. In particular in following areas modern machinery is needed:

- Pretreatment lines
- continuous dyeing and washing
- computerized colour matching
- computerized dye recipes/weighing systems
- computerized sample dyeing techniques
- rotary printing machinery

Although much of Thai textile finishing is being carried out by the weaving mills themselves, there is also room for specialized finishing plants - dyeing houses and printing plants.

Thailand's textiles production up-stream (spinning, weaving) is good, while the industry's finishing capabilities are not satisfactory. The country's fabrics exports consist mainly of plain grey cloth for subsequent finishing treatment overseas.

At the same time some 70 per cent of the fabrics used by the Thai garment exporters are imported (mainly from Japan and the Republic of Korea).

Why are not high quality finishing - dyeing and printing - plants being set up? One factor is the location policy (away from the sensitive and crowded central plain area around Bangkok). Water pollution is an important factor in textile finishing processes.

Furthermore, the finishing industry is working with high precision technology which requires considerable investments in plant and machinery. The Thai small and medium industry is at a disadvantage (compared with many of its competitors) in that there is a 28 per cent import tax/tariff on the machinery. In the case of projects with an investment of over 50 million baht the Board of Investment, however, now gives privileges in the form of exemption of import tax on machinery.[1/] It should also be borne in mind that for dyestuff there is still a 30-40 per cent import tariff.

In general it may be stated that the textile and garment industry in Thailand is now moving away from the mass production end towards small quantitites and high quality items. For instance, it has been suggested that, say, some 10 small weaving establishments may be interested in sponsoring one or more small printing units for small batch high quality printing work.

As an interesting example which may be studied in the Thai context may be mentioned that the textile industry in the Republic of Korea addressed some years ago the problems of the finishing/dyeing being a weak link in their textile industry's drive for higher-value-added products. To upgrade the dyeing segment, dyers have been induced to move into industrial complexes established with Government funding. By 1987, two industrial complexes for dyeing, housing 120 firms, were in operation.

International assistance inputs:

- Initial phase: International consultant (under subcontract) approx. $30,000

- Establishment of a pilot plant as a demonstration facility in fullfilling objectives of human resource development and pollution abatement measures.

1/ Some 10 companies intending to establish plants for good quality finishing have recently applied for BOI privileges.

PROJECT NO.15

Project title: Co-operation in energy conservation programmes at plant level in selected industrial branches

Co-operating agency: The National Energy Administration (NEA) in co-operation with the Energy Conservation Centre of Thailand and the Federation of Thai Industries.

Objective: The basic objective of the project is to effectuate energy conservation at plant level in selected industrial branches (related to supporting industries/ packaging industries, namely ceramics, glass ware and pulp and paper production.

Project description: Under the project following tasks are foreseen:

(i) to establish energy conservation assistance programmes based on reports providing:

(a) rough estimation of savings potential at each industry;

(b) possibility of substituting present energy sources with cheaper ones;

(c) most important types of feasible energy saving measures at each plant;

(d) general interest in energy conservation among company managers and company personnel;

(e) need for training of company managers and company personnel in energy conservation technique;

(f) terms of reference for the second stage of the project and the main energy conservation project.

(g) cost for performance of the second stage of the project. The second stage of project through actual measurements and detailed energy audits leads to an energy balance in form of sankey diagram and a preparation of feasibility studies.

(ii) to implement as demonstration projects one or two pant level energy audits and energy conservation feasibility studies.

(iii) to provide training of NEA and Energy Conservation Centre staff as energy auditors and trainers.[1/]

The specific activities under the project will comprise following main elements:

- Initial assessment and selection of specific plants (by NEA)
- Detailed energy audit/feasibility study in respect of selected plants
- Training programme for NEA and Energy Conservation Centre staff

The work will be carried out in collaboration with the Federation of Thai Industries and the concerned branch associations/clubs.

International assistance inputs: Experts for feasibility study/energy audit, (per plant: 2x1 m/m)

Training, fellowships.

1/ Training courses covering practical and theoretical matters in areas of industry and energy conservation for training of personnel in energy conservation techniques is an integral part and includes:

- Description of need for energy conservation projects and presentation of basic energy technology;
- Description of how to analyze the energy systems and energy utilization at factory;
- An analysis of how to plan and carry through an energy audit and how this is related to the entire energy conservation project;
- Description of different types of measuring instruments to be used for an energy audit and measuring methods to be involved, and presentation of need for calibration, checking and repair of the instruments;
- Description of basic calculation formulas to be used to calculate different energy flows based on measurement results;
- Discussions on practical measures to obtain a more efficient utilization of energy by means of saving and recovery measures, processing changes and by a changeover to cheaper energy sources.

PROJECT NO.16

Project title: Assistance for the manpower development at industry level.

Co-operating agency: MIDI, Technological Promotion Association (TPA), universities and FTI industry clubs, depending on the subsector in question and the nature of the training.

Objective: The basic objective is to provide some immediate alleviation of the problem of accute shortage of engineers, middle management and skilled workers and thus help Thailand maintain its present growth momentum. While the project will aim at such quick, if not complete solution of the problem, it could be reoriented towards more regular and comprehensive programmes in due course.

Project description: The project will encourage and strengthen crush training schemes conducted by industries by:

- identifying the training needs of the company/ subsector in question (in many cases they may have been identified already);
- preparing appropriate curricula and teaching materials (the latter including case studies);
- identifying suitable lecturers/instructors and recruiting them if required;
- organizing the courses in collaboration with related institutions.

There may be several categories of training schemes, namely

1. by an individual company for its own needs;
2. by a group of companies for their common needs; and
3. by a company or companies not necessarily for their requirements but more for the sake of the industry sector at large (including training for their subcontractors), often in association with (1) or (2). [Training of these categories could be a part of the project proposed elsewhere on subcontractor development.]

A course will take trainees from school leavers or those already in the company(s) in question, either of these or in some mixture according to the individual cases.

Training schemes under consideration will utilize existing training facilities, those of individual companies as well as those of public institutions such as MIDI, TPA, etc., which have expressed their willingness to co-operate with this project.

International assistance inputs:

- Experts for course preparation and, if required, for lectures.
- Study tour abroad, especially to other ASEAN countries where the level of technology is similar.

PROJECT NO.17

Project title: Assistance to establish a pilot facility for a Technical Entrepreneur Park

Co-operating agency: King Mongkut's Institute of Technology, North Bangkok

Objective: The basic objective is to strengthen the country's capabilities for science and technology development and for the creation of entrepreneurs and workers with modern technological and managerial attitude.

Project description: The project will establish a pilot facility for a Technical Entrepreneur Park (TEP), which will be in effect a small scale workshop/ factory for production of capital goods, mechanical as well as electrical. It will be operated in close link with the private sector and in such a manner that it resembles a real production enterprise.

The main function/activity will be production of prototype machinery and equipment. It will be manned by 7 staff including the manager but there will be a number of trainees, some recent graduates from the university who will be trained to become technical entrepreneurs and some non-graduate personnel to be trained as skilled workers and "Meisters" in the future. Besides the prototype production and training, it is expected to have the additional function as an industrial extension centre in due course.

This facility will be established as a model and might form an embryo of a TEP which will include other subsectors/ areas in the future.

Further preliminary investigations will be necessary in order to fully examine the feasibility as well as programming of this project.

Background: It is considered that the economic downturn experienced in the first half of the 1980s was due to the heavy dependence on agricultural exports and the unsatisfactory performance of the industrial sector rooted in insufficient production capacity of intermediate and capital goods. The educational system is not regarded successful in producing entrepreneural and innovative spirits in the young people. After observing experiences of other countries, notably those in Taiwan Province of China, it has been proposed that an exposure of young people to a simulation of a real enterprise can be a possible solution.

International assistance inputs:

- Experts on precision machinery production and on technical entrepreneur training
- Training for TEP staff
- Equipment such as lathes and milling machines (tent. estimated to cost US $760,000)

Annex II

List of persons met and industries and institutions visited by the UNIDO/ECFA Mission to Thailand

26 September - 15 October 1988

BANGKOK

MINISTRY OF INDUSTRY

Industrial Economics and Planning Division (IEPD), Office of the Permanent Secretary

Ms. Orapin Werawut, Director
Mr. Charmroon Malaigrong, Industry Specialist

Foreign Relations Division, Office of the Permanent Secretary

Mr. Songkram Thamagasorn, Director
Ms. Duangjai Pitugchaiyawong
Ms. Porntip Siripanuwat
Mr. Soodsakorn Putho

Office of Basic Industry Development, Office of the Permanent Secretary

Mr. Trakarn Chairat, Director

Department of Industrial Promotion (DIP)

Mr. Padetpai Meekun-Iam, Director, Planning Division,

Textile Industry Division

Ms. Prani Opasanon, Director
Mr. Pramode Vidtayasuk, Head, Textile Policy and Planning Sub-division
Mr. Satit Sirirangkamanont
Ms. Lalita Kitkrailard (standardization and quality control)
Ms. Nantaya Yanumet (textile chemist)

Metal-working and Machinery Industries Development Institute (MIDI)

Dr. Damri Sukhotanang, Director
Mr. K. Schultz, UNIDO Adviser
Dr. Tadaharan Kuroiwa, Japanese Advisory Group Leader

NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT BOARD (NESDB)

Mr. Chakramon Phasukavanich, Director, Government-Private Co-operation Division

Mr. Panithan Yamvinij, Chief, Industrial Planning Sector, Government-Private Co-operation Division

DEPARTMENT OF TECHNICAL AND ECONOMIC CO-OPERATION (DTEC)

Ms. Wajana Pintusarn, Chief, UN Sub-Division
Ms. Kittikorn Konsilapa, Programme Officer

BOARD OF INVESTMENT (BOI)

Mr. Staporn Kavitanon, Deputy Secretary-General

INDUSTRIAL ESTATE AUTHORITY OF THAILAND (IEAT)

Mr. Vibul Taweesup, Deputy Governor

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Dr. Smith Kampempool, Governor
Ms. Salaisophin Komarakul na Nakorn, Chief, Foreign Relations Division

THAI PACKAGING CENTRE

Ms. Amornrat Swatditat, Director
Ms. Anchalee (R&D)
Ms. Mayuree (testing)

SCIENCE AND TECHNOLOGY DEVELOPMENT BOARD (STDB)

Dr. Montri Chulavatnatol, Assistant Director (and Professor, Department of Biochemistry, Faculty of Science, Mahidol University)

PETROLEUM INSTITUTE OF THAILAND

Mrs. Thongtip Ratanarat, Executive Director
Ms. Thassanee Ruthira Kanok
Mr. Sakarindr Bhumiratana, King Mongkut's Institute of Technology, Thonburi

MINISTRY OF UNIVERSITY AFFAIRS

Mr. Vichit Sri-Saant, Permanent Secretary
Dr. Pienpak Tasakorn, Department of Chemical Technology, Chulakongkorn University

PETROLEUM AND PETROCHEMICAL COLLEGE, CHULALONGKORN UNIVERSITY

Dr. Woraphat Arthayukti
Dr. (Mrs) Suda Kiatkamjornwong
Dr. (Mrs) Pattarapan Prasassarakich

CHULA UNISEARCH, CHULALONGKORN UNIVERSITY

Dr. Cnatri Sripaipan, Director (and Associate Professor, Faculty of Engineering)
Ms. Suchata Jinachitra, Deputy Director

KING MONGKUT'S INSTITUTE OF TECHNOLOGY, NORTH BANGKOK

Dr. Somchob Chaiyavej, Vice Rector

INDUSTRIAL FINANCE CORPORATION OF THAILAND (IFCT).

Mr. Aswin Kongsiri, Senior Executive Vice-President
Mr. Chinsuk Viravan, Deputy Manager, Small Industry Credit Guarantee Fund

THAILAND DEVELOPMENT RESEARCH INSTITUTE (TDRI)

Dr. Narongchai Akrasanee, Executive Vice-President

INDUSTRIAL MANAGEMENT CO. LTD

Dr. Maitree Wasuntiwongse
Ms. Anusara Chanvanitchai
Mr. Yoji Watanabe, Development Economist, UNICO International Corporation
(industrial consultant)

ENERGY CONSERVATION CENTRE OF THAILAND

Mr. Pinij Gritiyaransan, Executive Director
Mr. Weerachai Chayantnakorn, Engineering Manager

FEDERATION OF THAI INDUSTRIES (FTI)

Mr. Ah-Ram Kotikula, Executive Secretary
Mr. Pairote Gesmankit, Deputy Executive Secretary

RUBBER-BASED INDUSTRY CLUB

Mr. Erwin Muller, Chairman,(and Vice-President, Siam Motors)

PLASTIC INDUSTRY CLUB

Ms. Anna Prateeb Kosintranont, Hon. Secretary (and Hon. Secretary of Industrial Machinery Club; Finance Manager, Sintraco Ltd. Partn.)

IRON AND STEEL INDUSTRY CLUB

Mr. Ganok Bhongbhibhat, Chairman, (and Adviser to the President of Bangkok Steel Industry Co. Ltd)

Mr. Kovit Chailert, Member, (and Admin. Div. Mgr., The Siam Iron and Steel Co. Ltd)

THAI ELECTRICAL, ELECTRONIC AND ALLIED INDUSTRIES CLUB

Mr. Korn Suriyasat, Chairman (and President of Thai Toshiba Electric Industries Co. Ltd.)

AUTO PARTS INDUSTRY CLUB

Mr. Chamlong Peganan, Member (and Managing Director, The Siam Nawaloka Foundry Co. Ltd.)

INDUSTRIAL MACHINERY CLUB

Mr. Preecha Temprom, Chairman (and President of Bangna Steel Works Ltd.)

Ms. Anna Prateeb Kosintranont, Hon. Secretary (and Hon. Secretary of the Plastic Industry Club; Finance Manager of Sintraco Ltd. Part.)

Mr. Pongtorn Manupipatpong, Adviser to the Industrial Machinery Club (and Lecturer, Faculty of Engineering, King Mongkut's Institute of Technology, North Bangkok)

Mr. Kietphong Noichaiboon, Vice-Chairman (and Managing Director of Ekarat Engineering Co. Ltd.)

CHEMICAL INDUSTRY CLUB

Mr. Teerajitt Stnirotamawong, Chairman (and Strategic Planning Director of Corro-Coat)

NATIONAL FEDERATION OF THAI TEXTILE INDUSTRIES

Mr. Songkram Cheevaprawatdomrong, President [and Managing Director of Krung Thai Spinning Co. Ltd.]

Mr. Tawad Oranonsiri (Manager, Thai Silk Reeling Industries Co., Ltd.)

Mr. Sopon Wichitrakorn (President, Oriental Fibre Co. Ltd.)

Mr. Supong Chayutsahakij (Director, Teijin Polyester (Thailand) Ltd.)

BOARD OF TRADE OF THAILAND

Mr. Yukta Na Thalang, President
Mr. Prayoon Talerngsri, Executive Director

THAI PACKAGING ASSOCIATION

Mr. Anek Vidhayasirinun, President (and Managing Director, T-Hi-Tech Co. Ltd.)

Mr. Manit Kamolsuwan, Vice-President, (President of Printing Industry Club of FTI and Manager of Continental Packaging (Thailand) Co. Ltd.)

Mr. Suchint Lausangngam, Adviser to Thai Packaging Association (and Managing Partner of Kwang Hua Industries Ltd., Part.)

Mr. Surasith Bunyaphisand, Thai Packaging Association

Mr. Poon Kongcharoenkiat (Packmates Co. Ltd.)

Mr. Vallop Manathunya (Bangsue Chia Rice Mill Co. Ltd.)

Mr. Prateep Leopairut (President, Thai Petrochemical Industry, Co. Ltd.)

Mr. D. Sigvanich (Thai Packaging Co. Ltd.)

NATIONAL PETROCHEMICAL CORPORATION LTD

Mr. Sippanondha Ketudat, President

TOYOTA MOTOR THAILAND CO. LTD [TOYOTA ASSEMBLING FACTORY 1]

Mr. Suparat Sirisuwanangkura, Sect. Manager, Production Engineering

THAI TOSHIBA ELECTRIC INDUSTRIES CO. LTD.

Mr. Korn Suriyasat, President
Ms. Nirmol Suriyasat, Director
Dr. Charuay Boonyubol, Director, Engergy Research and Training Centre, Chulalongkorn University

THE SIAM CEMENT CO. LTD.

Dr. Bancha Udomsakdi, Manager, R&D Centre (Bangkok)

Mr. Yukio Obana, Director, National Thai Co. Ltd

Mr. D.N. Azad, Senior Vice-President, G Premjee Ltd (holding co.)

Dr. Akira Kuroda, Consultant (SMI expert)

TECHNOLOGICAL PROMOTION ASSOCIATION (THAI-JAPAN)

Mr. Cheovet Yimsirikul, General Manager

JAPAN EXTERNAL TRADE ORGANIZATION (JETRO)

Mr. Jan Tsunekawa, Director, General Affairs and Industrial Co-operation Department

JAPANESE CHAMBER OF COMMERCE, BANGKOK

Mr. Yoshihiro Kawasaki, Secretary-General

UNDP

Mr. F. Ossella, Deputy Regional Representative
Mr. V. Lavides, Senior Industrial Development Field Adviser
Mr. A. Schnieper, JPO, UNIDO

WORLD BANK

Dr. Suchart Thada-Thamrongvech, Economist

CHIANG MAI

NORTHERN INDUSTRIAL ECONOMICS AND PLANNING CENTRE

Ms. Suchada Varaphorn, Chief, Northern Industrial Economics and Planning Centre

NORTHERN INDUSTRIAL PROMOTION CENTRE

Mr. Somboon Aranyabhaya, Chief of Technology 1 Sub-Division

CHIANG MAI CHAMBER OF COMMERCE

Mr. Nit Wamgviwat, President of Chiang Mai Chamber of Commerce (and Managing Director, Raming Tea Co. Ltd. and ceramic factory)

Mr. Thawil Boucheen (Marketing Director, Umbrella Making Centre and Sudaluk Furniture Factory, San Kamphaeng Rd.)

Mr. Prawin Nivaswat (Chairman, Brotherhood for Agriculture Co. Ltd., Chiang Mai)

TANIN CONDENSER CO. LTD.

Mr. S. Mizushima, Director - Factory Manager

MENGRAI PAPER BOX CO.

Mr. Montri Wongkasem, General Manager

CHIANG MAI SUDALUK, SAN KAMPHAENG RD. (FURNITURE)

Mr. Thavil Buacheen, President

PREMPRACHA'S COLLECTION CO. LTD., SAN KAMPHAENG RD. (CERAMICS)

Dr. Yoshimori Kato, Technical Adviser

LAMPHUN

NORTHERN REGION INDUSTRIAL ESTATE

Mr. Udom Tanpao, Manager

Mr. Yukihiro Moriyama, Assistant Manager, F&M Corporation, Industrial Estate EPZ, Lamphun

LAMPANG

TIGER ENGINEERING LTD., PART

Dr. Krayim Santrakul, Manager
Ms. Chantra Santrakul, Sales Manager
Mr. Katekarintr Karnying

THAI CERAMIC LTD.

Mrs. Somchai

SARABURI

THE SIAM NAWALOHA FOUNDRY CO. LTD.

Mr. Chamlong Peganan, Managing Director

PATHUMTHANI

NARONG INDUSTRY CO. LTD. (SIAM MOTORS GROUP)

Mr. Bundith Phisolyabutra, Managing Director [and member of the Board of FTI]
Mr. Kirati Nagaviroj, Deputy Managing Director
Mr.Pichai Burapavong, Factory Manager
Flt. Lt. Chonlavit Trivitayakhun, Administrative Manager

NAVA NAKORN

NAVA NAKORN CO. LTD. (PRIVATE INDUSTRIAL ESTATE)

Mr. Prakaipet Inchusophon, Managing Director
Dr. Nopporn Chandawanich, Engineer (pollution control)

THAI ENGINEERING PRODUCTS CO. LTD. (TEP), NAVA NAKORN INDUSTRIAL ESTATE

Mr. Somsak Bualamyai, Machining Plant Manager

Annex III

COMMENTS ON THE DRAFT REPORT BY THE MINISTRY OF INDUSTRY

Detailed comments were made by the Ministry of Industry on the draft version (dated 9 June 1989) of the report regarding those project concepts which are directly relevant to the Ministry of Industry. These comments are presented herewith:[1/]

Project No.1 Assistance to promote foreign investments in selected technology-intensive supporting industries

MOI supports the project in the sense that, while BOI will be co-operating agency, the activities of IEAT regarding EPZ and industrial estate development planning will also be assisted indirectly.

Project No.3 Promotion of supporting industries in connection with industrial development in provincial areas (outside Bangkok and its neighbouring provinces)

This project aims at creating infrastructure necessary for the development of supporting industry in the provinces which is in line with the Government's strategies regarding rural industry development. The project will be beneficial to selected regions where industrial estates development for any specific type of industry is planned. The output of the project can be further adjusted to be a master plan for industrial development on national basis. Furthermore, the project will not only be of assistance to the establishment of regional industrial estates but also will be able to identify the appropriate industry to be located in those particular regions. However, in carrying out this project, the details should be further considered and discussed among relevant agencies as to what extent they should be concerned.

Project No.4 Assistance to the establishment of private industrial estates

One of the Government's current policies is to pursue the private sector to get involved in establishing industrial estates. This project will assist IEAT in promoting the effective participation of private sector to establish and develop industrial estates nationwide.

Project No.5 Study on scope, structure and determinents of linkages between enterprises in export processing zones and the domestic Thai economy

The scope of this project should be expanded to cover the study on the following:

[1/] In addition, the specific suggestions for additional tasks put forward by the Ministry of Industry in respect of project concepts 5 and 14 have been incorporated in the texts of these projects concepts as given in the present report.

1. Manufacture of products on subcontract basis.

2. Comparison of the benefits gained from producing the same products in EPZ with non-EPZ.

3. Identifying various factors which affect the selection of local or imported raw materials/parts.

4. Recommendations on the improvement and development of related industries to help increase their export potential taking into account the experiences of various countries.

Considering the functions of respective departments, MOI is of the view that IEAT is in a good position to take part in the project by providing useful information related to export processing zones located in its industrial estates.

Project No.6 Policy-oriented study on potential expansion of auto parts production

MOI supports the implementation of this project.

Project No.7 Assistance for the development of the capabilities to manufacture components for selected industries such as automotive, electric and electronic industries

The project will obviously promote DIP's role in developing components manufacturing industry. The available information resulting from the survey will not only help entrepreneurs in making decision' on investment and developing their own capabilities but also help DIP in formulating measures for entrepreneurship development. We are also of the opinion that, to give assistance to the entrepreneurs either directly or through government agencies, what the government needs is adequate well-trained co-ordinating officials as well as a clearly defined method of technology transfer.

Project No.8 Assistance for a study on the prospects and potentials for production of components and other requisites for electric appliances and electronics industry

MOI supports the implementation of this project.

Project No.10 Assistance for the establishment of a Packaging Design Centre for the Thai Packaging Association

This project will be of much benefit to Thai packaging industries which have currently not yet been up to the level of international standard. Since the project will upgrade packaging design technology by introducing and developing the application of computerized packaging design technique, it will, therefore, contribute greatly to the modernization of this industrial sector. DIP, as a co-ordinating agency, will gain benefits in terms of upgrading its officials' knowledge and experience as well as strengthening their capabilities in providing assistance to the private sector which is the DIP's main responsibility.

Project No.13 Identification of opportunities for new investment in supporting industries for the textile and garment sectors

The identification of opportunities for new investment in Thailand's garment industry will help reduce dependence on inputs from foreign countries. Such dependence, if too much, will have an adverse effect to the production cost and competitiveness in the world market. Training of Thai designers in Japan will strengthen their capabilities in designing appropriate products which can attract Japanese customers more effectively, resulting in the enlarged markets for Thai textile and garments.

Project No. 14 Promotion of textile finishing companies working on commission basis

The idea of establishing specialized textile finishing plants as proposed in the project is very constructive. It will solve the problems in this sector regarding the lack of advanced machineries and water pollution. MOI is of the view that it is not enough to have only one short-term international consultant and that the project will be more beneficial if the assistance input of an establishment of a pilot plant will be included. This pilot plant will have demonstration effect to all concerned and help fulfil the objective on human resources development in this particular field.

Project No. 16 Assistance in the manpower development at industry level

MOI supports the project concept and would like to recommend that, to identify the companies' needs for the preparation of the project, UNIDO should co-operate directly with the private sector so that the information will be more reliable in nature, while MIDI of MOI will consider taking further actions from the study report.