THE STUDY ON SELECTED INDUSTRIAL PRODUCT DEVELOPMENT IN MALAYSIA

THIRD YEAR FINAL REPORT

NOVEMBER 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to a request from the Government of Malaysia, the Japanese Government decided to conduct a study on the Selected Industrial Product Development in Malaysia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Malaysia a study team headed by Mr. Heihachiro Aoki of Japan External Trade Organization from October 16 to December 14, 1989.

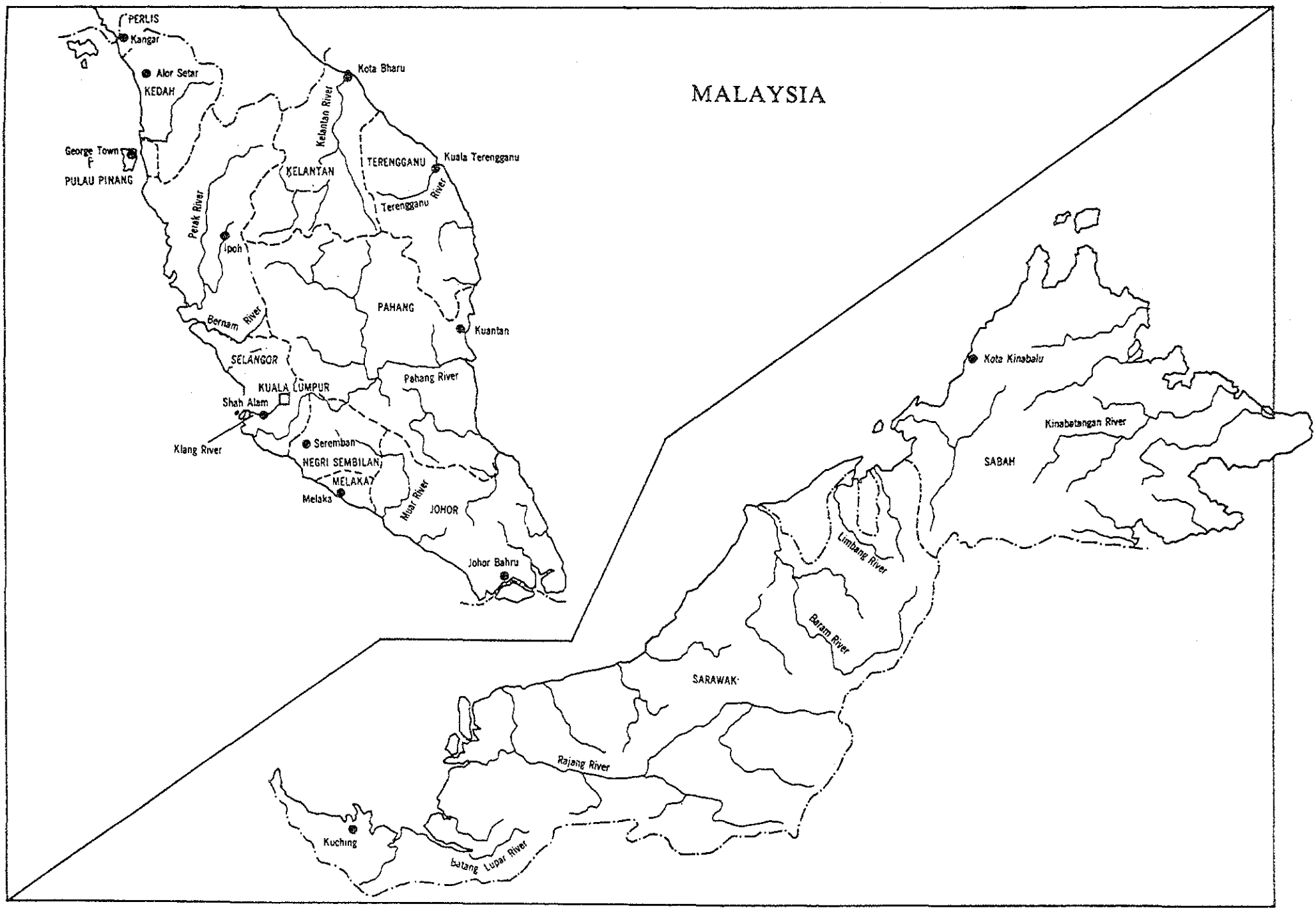
The team held discussions with the officials concerned of the Government of Malaysia, and conducted field surveys. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the development of industries in Malaysia and to the promotion of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Malaysia for thei close cooperation extended to the team.

November, 1990

Kensuke Yanagiya
President
Japan International Cooperation Agency


MALAYSIA
PERLIS
Kangar
Alor Setar
KEDAH
George Town
PULAU PINANG
Kota Bharu
Kelantan River
KELANTAN
TERENGGANU
Kuala Terengganu
Terengganu River
Perak River
Ipoh
PAHANG
Kuantan
Bernam River
SELANGOR
KUALA LUMPUR
Shah Alam
Pahang River
Klang River
Seremban
NEGRI SEMBILAN
MELAKA
Melaka
Muar River
JOHOR
Johor Bahru
Kota Kinabalu
Kinabatangan River
SABAH
Limbang River
Baram River
SARAWAK
Rajang River
Kuching
Batang Lupar River

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Abbreviations

AFS	American Foundrymen Society
AJDF	ASEAN Japan Development Fund
ASTM	American Society for Testing Materials
BIOS	Basic Input/Output System
BS	British Standards
CDT	Colour Display Tube
CGC	Credit Guarantee Corporation
CGA	Colour Graphics Adaptor
CIAST	Centre for Instructor and Advanced Skill Training
CPU	Central Processing Unit
CRT	Cathode Ray Tube
DIN	Deutsche Industrie-Norm
EDB	Economic Development Board
EPC	Export Promotion Council
EPU	Economic Planning Unit
ERSO	Electronics Research & Service Organization
FDD	Floppy Disk Drive
FIRR	Financial Internal Rate of Return
FOMFEIA	Federation of Malaysian Foundry & Engineering Industries Associations
FMM	Federation of Malaysian Manufacturers
FTU	Foundry Technology Unit
FTZ	Free Trade Zone
GSP	Generalized System of Preference
HDD	Hard Disk Drive
HICOM	Heavy Industry Corporation of Malaysia
HRD	Human Resources Development
ICA	Industrial Coordination Act
IKM	Institut Kemahiran MARA
IMP	Industrial Master Plan
INTAN	National Institute of Public Administration Malaysia
IT	Information Technology
ITA	Investment Tax allowance
ITI	Industrial Training Institute
JEEF	Japanese Electrical & Electronics Firms Group

JEIDA	Japan Electronics Industry Development Association
JIS	Japanese Industrial Standards
LMW	Licensed Manufacturing Warehouse
MAEI	Malaysia American Electronics Industry Group
MAMPU	Malaysian Administrative Modernization and Manpower Planning Unit
MARA	Majlis Amanah Rakyat
MEXPO	Malaysian Export Trade Centre
MIC	Marketing Information Centre
MIDA	Malaysian Industrial Development Authority
MIDEC	Metal Industry Development Centre
MIDF	Malaysian Industrial Development Finance
MIMOS	Malaysian Institute of Microelectronic System
MNC	Multi National Company
MNCC	Malaysian National Computer Confederation
MRPMA	Malaysian Rubber Products Manufacturers' Association
MS	Malaysian Standards
MTI	Ministry of Trade and Industry
NCB	National Computer Board
NEP	New Economic Policy
NIES	Newly Industrialized Economies
NIF	New Investment Fund
NITTCB	National Industrial Training and Trade Certification Board
NPB	National Productivity Board
NPC	National Productivity Centre
NVTC	National Vocational Training Council
OEM	Original Equipment Manufacturing
OS	Operating System
OSHA	Occupational Safety and Health Administration
PIKOM	Persatuan Industri Komputer Malaysia
PS	Pioneer Status
RICOM	Registry of Investors and Contract Manufactures
RRIM	Rubber Research Institute of Malaysia
SDF	Skill Development Fund
SEDC	State Economic Development Corporation
SIRIM	Standards and Industrial Research Institute of Malaysia
SISIR	Singapore Industrial Standards & Research Institute
STM	Syarikat Telekom Malaysia

STPB	Singapore Travel Promotion Board
TDB	Trade Development Board
UKM	Universiti Kebangsaan Malaysia
UM	Universiti Malaya
USM	Universiti Sains Malaysia
YTC	Youth Training Centre

I. Introduction

I. Introduction

This is the Final Report of the Third Year Study on Selected Industrial Product Development in Malaysia.

This study is based on the Scope of Work for the Study on Selected Industrial Product Development in Malaysia agreed upon by the government of Malaysia and the Japan International Cooperation Agency on August 1, 1987. The study began in the middle of October 1989 and the results of the study were compiled as the Final Report in November 1990.

I-1. Background and Objective of the Study

The Asian countries are striving to build up local industries so as to strengthen their economic structures and to push forward with aggressive programmes for the invitation of foreign investment in order to rapidly build up export-oriented industries contributing to the acquisition of foreign currency instead of promoting import-substitution type industries.

Malaysia is currently pushing forward with the promotion of 12 sectors, primarily export-oriented industries of the type using existing resources, in line with the "Industrial Master Plan (IMP) 1986-1995," which was officially announced in January 1986. The Malaysian Export Trade Centre (MEXPO) selected certain key products for export promotion. The IMP is envisaged as the pillar of the economic plan and aims at an annual 8.9% increase in exports of manufactured goods from 1986 to 1995.

Since the G5 conference of the financial heads of five advanced nations in September 1985, the yen has been appreciating in value and the U.S. dollar has been depreciating. The currencies of the Asian NIES are also under pressure for reevaluation upward against the U.S. dollar. This has led to a rapid change in the international environment for exports. In particular, in the highly labour-intensive manufacturing fields, Japanese and NIES' companies have been increasingly investing in the ASEAN region in export-oriented industries. Under the Fifth Malaysia Plan, which began in 1986, Malaysia has been striving to enlarge the role of the private sector, achieve greater efficiency in the management of its economy, and promote industrial development. In line with this, it has relaxed its restrictions on foreign investment for export-oriented manufacturing industries and has come out aggressively to promote foreign investment.

The present Study on Selected Industrial Product Development in Malaysia aims at comprehensive cooperation for the development of strategic export industries. The objective of this study is to survey and analyse the state of selected industries in Malaysia

and to formulate a comprehensive programme for industrial development with the aim of promoting exports. Further, it seeks to organize information on Japanese firms wishing to make investments or establish joint ventures in these industries so as to promote joint ventures and technological tie-ups between Japan and Malaysia.

I-2. Implementation of the Study

In April 1986, the Malaysian government submitted a request to the Japanese government for a "Technical Cooperation Project on Industrial Sector Development." Receiving this, the Japan International Cooperation Agency (JICA) sent a contact mission in September 1986 to deliberate with the Economic Planning Unit, Prime Minister's Department (EPU), the Ministry of Trade and Industry and the Malaysian Industrial Development Authority (MIDA) and reached agreement with them on the basic objectives and content of the technical cooperation in industrial sector development between Japan and Malaysia. Based on this, the JICA sent a short-term expert to MIDA from February to August 1987 to select the target industries, resulting in the selection of the later mentioned industries. JICA then sent the Preliminary Survey Team in August 1987 and signed the Scope of Work including the selected industries with the Malaysian side.

The First Year Study covered Moulds and Dies, Automotive Metal Parts, Chinaware and Glassware. The study began in the latter half of January 1988 and the Final Report was completed in September. The Second Year study covered Office Electronic Equipment, Cathode Ray Tube, Ceramic IC Packages/Substrates and Rubber Footwear. The study began in the middle of October 1988 and the Final Report was completed in July 1989.

As for the Third Year Study, of which the products to be studied are mentioned later, the field survey was conducted from October 16 to December 14, 1989. Then, the study was supplemented from June 3 to 22, 1990. Based on the results of these studies and through the analysis of the survey in Japan and surveys in the third countries, the comprehensive programmes were formulated. Thus, the Final Report was completed in November 1990.

I-3. Industries to be Surveyed

The industries to be surveyed for the Third Year are as follows:

Engineering: (a) Castings

Electronics: (b) Computers and computer peripherals

(i) Microcomputer

(ii) Monitors/video display unit
(iii) Printer
(iv) Keyboard

The industries surveyed were selected based on the list proposed from the Malaysian side.

As mentioned earlier, the Malaysian government has selected the following 12 industries for priority development in its Industrial Master Plan 1986-1995.

(1) Resource-based Industries
  [1] Rubber Processing Industry
  [2] Palm Oil Products Industry
  [3] Food Processing Industry
  [4] Wood-based Industries
  [5] Chemicals and Petrochemical Industries
  [6] Nonferrous Metal Products Industry
  [7] Non-Metallic Mineral Products Industry

(2) Non-resource-based Industries
  [1] Electronics and Electrical Industry
  [2] Transport Equipment Industry
  [3] Machinery and Engineering Products Industry
  [4] Ferrous Metal (Iron and Steel) Industry
  [5] Textiles/Apparel Industry

Further, the Malaysian Export Trade Centre (MEXPO) has designated the following as important items for export:

> Foodstuffs (including cocoa, seasonings, fruits, and seafood), feed, beverages, tobacco, cement, precious stones, ceramics, glass, furniture, wood products, rattan products, chemical products, fertilizers, pharmaceuticals, oils and fats, textiles, apparel, weaving thread, weaving cloth, carpets, handicrafts, jewelry, electronic and electric products and parts, musical instruments, machinery, metal products, sports goods, toys, cut flowers, rubber products, plastic products, footwear, leather goods, stationery, and auto accessories.

The Malaysian government proposed industries and items to be covered under this study by taking into consideration the priority industries identified under the IMP and the key items for export promotion identified by MEXPO as well as the recent trends in direct investment by Japanese firms and firms from NIES and other areas. A final decision on

which industries and items would be surveyed was made through negotiations between the Malaysian and Japanese sides based on the subsectors and products proposed by the Malaysian government.

I-4. Scope of Study

The details of the items of the survey under this study were decided as follows, based on the Scope of Work agreed on August 1, 1987:

(1) To overview the present situation of the selected industrial products:
   a) Production items and their production, trade and manufacturers; and
   b) investment, technological partnership, finance, taxation, introduction of foreign capital, etc.

(2) To study the existing status of manufacturing establishments in Malaysia for the selected industrial products. These studies are to cover the following areas:
   a) Manufacturing processes and specifications
   b) Technical level (quality control, etc.)
   c) Product development (designs, etc.)
   d) Business administration (business management, fund-raising, etc.)
   e) Sales strategies (market research, marketing, etc.)
   f) Relation with periphery industries (raw materials, equipment, etc.)

(3) To study the export markets of the selected industrial products:
   a) Supply and demand and import situations in major importing countries; and
   b) marketability of the selected industrial products in major importing countries

(4) To recommend policies and measures for development, technical upgrading and export promotion for the selected industrial products. The areas to be covered are as follows:
   a) Systems and policies
   b) Technical improvement
   c) Product improvement
   d) Sales strategies
   e) Business administration
   f) Manpower development
   g) Improvement of infrastructure relating to the selected products

(5) To undertake cost-analysis studies for the selected industrial products which are to include cost-comparison studies for the production of similar products in Japan.

(6) To undertake a study and survey to ascertain and identify Japanese enterprises for the selected industrial products which are keen to undertake direct investment and/or technical collaboration in Malaysia. The study/survey is to cover the following:

a) survey on enterprises intending direct investment and technical collaboration

b) List of enterprises

Separately from the Third Year Study, the programmes proposed in each product for three years are reviewed and compiled.

I-5. Survey Method

(1) Outline

Figure. 1.5-1 shows the procedure followed in determining the programme in the present survey. In the actual implementation of the study, the survey items and methods were changed slightly with each industry due to the characteristics of the industries targeted as well as the varying stages of development.

In particular, there is a great difference in the survey items and the emphasis of the survey between the casting industry, which is already engaged in production in Malaysia and supplies traditional Malaysian industries, and the computers and computer peripherals industry, which has only been partially established.

Regarding the detailed method of the survey, while there are already some companies in the field of computers and computer peripherals engaged in the production of personal computers and keyboards in Malaysia, the method used for the survey of the similar field of office electronic equipment in the second year study was applied.

In the field of castings, there is only a small scale of production of precision castings. Castings are basically produced for traditional industries. Therefore, the method used was that of the mould and die industry in the first year study. Castings are expected to enjoy increased demand and be improved in technical level due to the development of Malaysia's heavy industries, so the survey was designed to obtain the demand of the modern industries as well.

(2) Castings

Fig.I. 5-1 Process of Formulation of Comprehensive Industrial Promotion Programmes

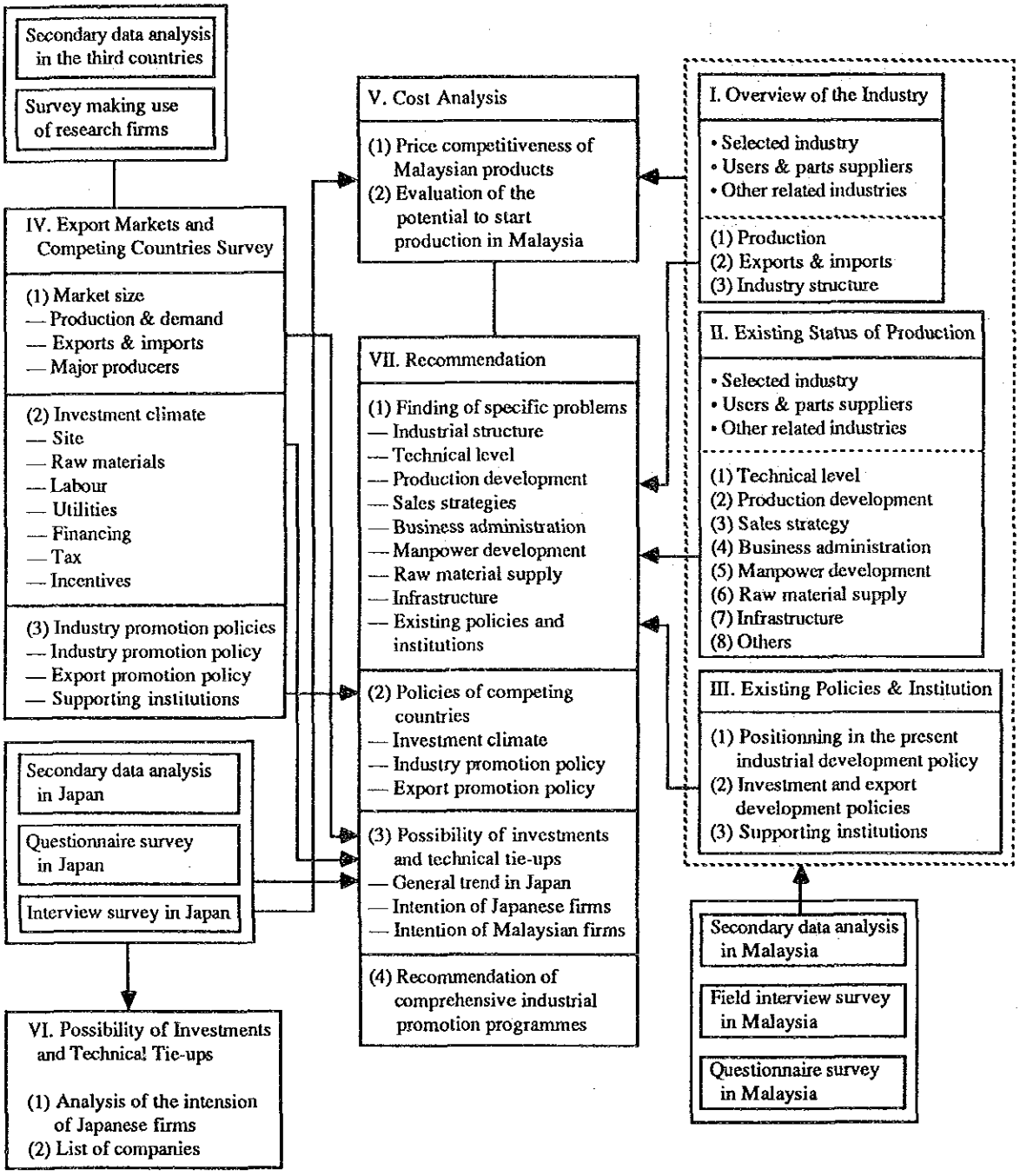


Figure I.5-2 provides a scenario for the development of the casting industry and promotion of exports of the same.

Castings have been produced domestically in Malaysia to supply traditional industries. The industry as a whole, however, is low in level and cannot meet the demands of modern industry. Therefore, the emphasis in this survey was on obtaining the present status of the Malaysian industry from a broad angle of the state of companies, production control, technical level and manufacturing costs and further on finding out current problems and means for their solution with the aim of further improving quality, increasing production, and expanding sales channels. Further, it is considered important to study the possibilities of capital and technical tie-ups with foreign companies as a means for developing Malaysian industry.

As shown in the scenario, the comprehensive programmes are proposed based on (1)measures for clearing up bottlenecks identified from the examination of current problems, (2)judgement of the feasibility of investment and technical tie-ups, and (3)judgement of the feasibility of industrial development.

The field survey conducted in Malaysia consisted primarily of direct visits to and interviews with casting manufacturers by study team members. The survey covered the present status of production from numerous angles, such as the (1)technical level, (2)product development. (3)sales strategies, (4)business administration, (5)development of human resources, (6)procurement of raw materials and parts, and (7)infrastructure, and the problems in the same.

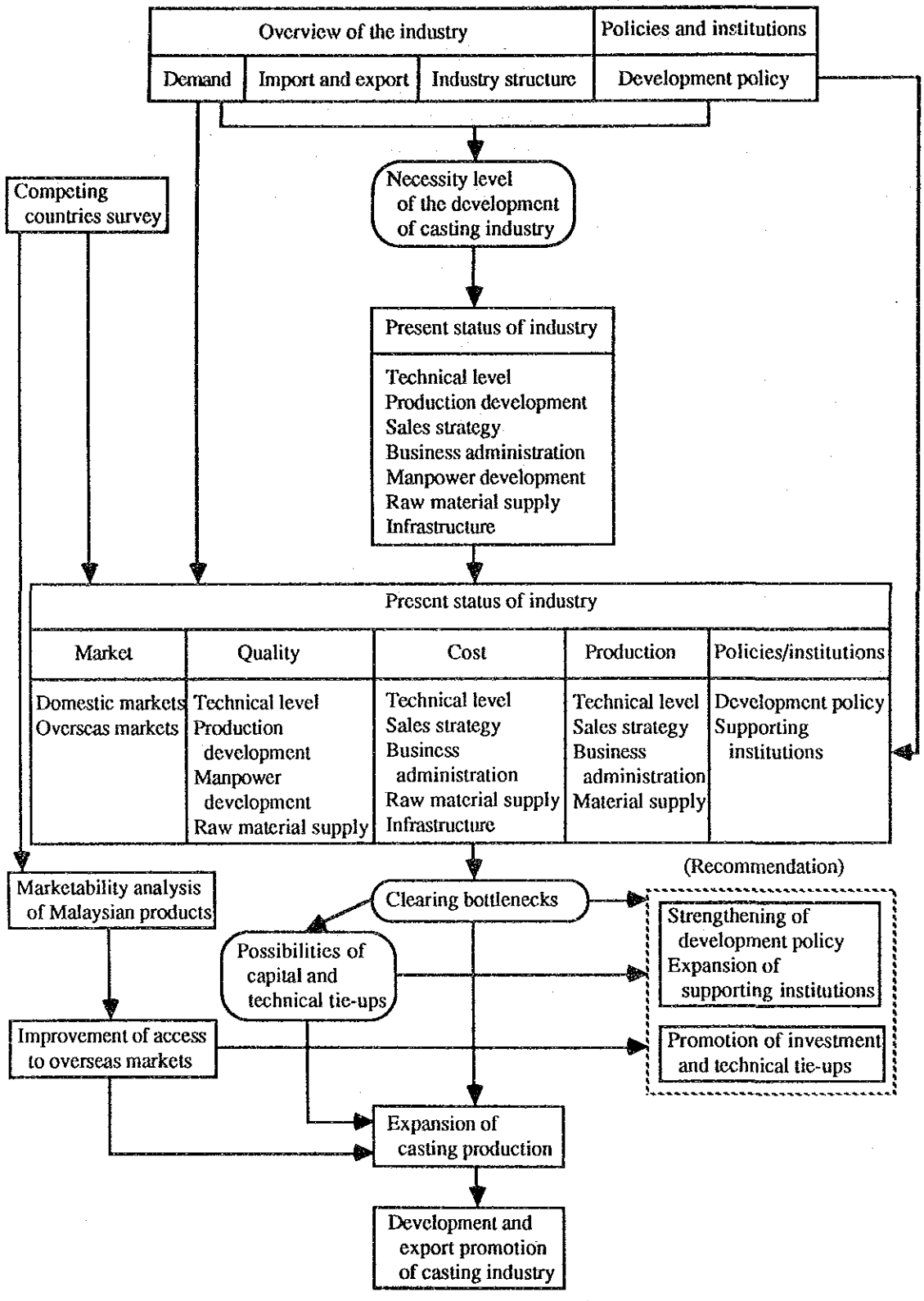
Almost no precision castings are being produced, but in this survey a basic feasibility study was attempted.

(3) Computers and Computer Peripherals (Monitor, Printer and Keyboard)

There are only a few companies engaged in the manufacture of computers and computer peripherals in Malaysia. The industry is thus in the starting stage in Malaysia. Production of personal computers is maximum 300 units a month per company. However, large numbers of keyboards are being produced and exported. Domestic demand for personal computers was estimated maximum 30,000 units in 1987. Considering just the domestic market, production is disadvantageous in cost and no expansion in volume can be expected. Therefore, for development of the industry, consideration must be given to production for export.

The biggest sources of demand for this industry are the advanced countries of Europe, America and Japan. In 1986, the U.S., Japan, and the European countries

Fig.I. 5-2 Scenario for the Development of the Casting Industry



accounted for about 81 percent of the global import market. These countries are simultaneously major suppliers, accounting for 91 percent of the world's exports.

To determine the possibilities of Malaysia developing into an exporter in this industry in the future, it is necessary to examine if Malaysian products can be competitive. Therefore, the possibilities of development of the industry in Malaysia will be judged based on the profitability assuming production in Malaysia and future trends in the world market.

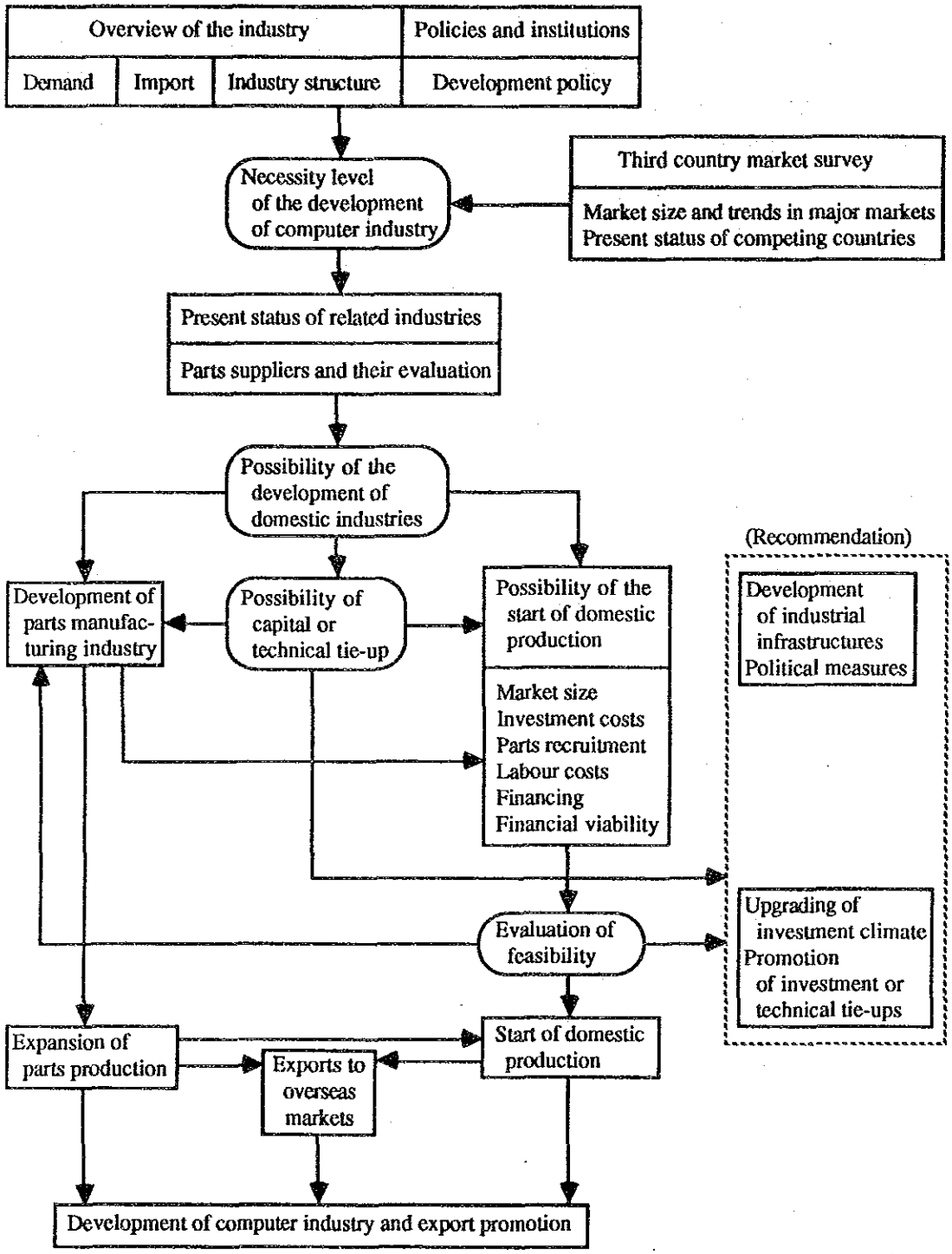
Figure I.5-3 shows the scenario for the development of the computers and computer peripherals industry (below, referred to merely as computer industry). The profitability of domestic production in Malaysia is largely related to the possibility of local procurement of component parts, so it was necessary to confirm first from the stage of development of related industries in Malaysia if there is a possibility for development of domestic companies into parts suppliers. Further, judging from the current level of technology in Malaysia and the state of local companies, introduction of foreign investment is essential for the fast development of the industry both for products and parts. It is, therefore, also important to examine the possibilities of investment and technical tie-ups from abroad.

In the scenario of Figure. I.5-3, three items are shown for judgement: (1)possibility of development of the local industry, (2)possibility of investment and technical tie-ups, and (3)feasibility of start of production. In particular, for (3) feasibility of start of production, a financial evaluation was made in accordance with the survey items shown in the upper row. This is because for the promotion of this industry, the key factor was believed to be the possibility of domestic production in Malaysia by the private sector rather than policies. While it is not possible to conduct a detailed feasibility study within the scope of the present study, projections was made of the long-term profit and loss assuming the start of the most optimum scale of production judging from the market and the feasibility of the same on the private financial level was examined.

If the conclusion is that there is little possibility of successful production based on the items for judgement in the scenario, examination was made of the possibility of export of parts or semi-finished goods as a next best measure from export of finished goods.

Computers and computer peripherals are not being produced in significant amounts. What is being produced is extremely limited, so the survey of the present status of production covered not only manufacturers of the products, but also parts and other related industries. The cost analysis, as mentioned earlier, was primarily concerned with the possibility of start of production.

Fig.I. 5-3 Scenario for the Development of the Computer Industry



Regarding institutions and policies, mention was made of industrial promotion programmes relating specifically to the computer industry, since the survey covering the general electronics industry was completed in the second year. The emphasis in the survey of institutions and policies was rather placed on areas related to the development of human resources, financing, development of the parts industries, and other programmes.

The field survey in Malaysia primarily consisted of mostly direct visits and interviews, but a supplemental survey was made by questionnaires and of the existing data. The interviews covered the companies currently producing the products in question and also parts suppliers considered necessary for the start of computer production. Evaluation was made of the current level of technology of the parts suppliers and a selection made of materials which can be procured domestically. Further, the supplemental questionnaire survey covered a wide range of companies engaged in the production of electronic equipment and components and aimed at the collection of information on the needs of private companies with respect to the envisioned programmes and information deemed necessary for formulating detailed programmes. In the interviews with government and other relevant organizations, the results of the second year study were considered and based on preliminary supposed programmes a survey was made of the position of the industry in Malaysia's industrial policies, existing development measures, details of the specific policies and institutions which can be used for industrial development, training programmes which can be mobilized, and other supporting facilities.

(4) Field Surveys

This study involved field surveys both in Malaysia and in Japan. It was conducted with the aim of formulating a comprehensive programme for industrial development and export promotion based on the survey and analysis of the present status of the selected industries. For the surveys in Malaysia, an interview survey done through direct visits to the companies in selected industries were used as the principal method. In order to get the maximum results from the short-time visits, a written interview guide and factory visit check lists were prepared. However, for actually performing the survey, the in-depth interview method was basically adopted in which the interviewees and interviewers exchanged opinions freely. The summary of the direct-visit interview survey is shown in Table I.5-1.

Table I.5-1 Number of Companies Covered by the Field Interview Survey in Malaysia

Industry breakdown	Number of companies
Castings	49
Casting Factories	32
Pattern Markers	1
Raw Materials Dealers	2
Trading Companies	2
User Companies	3
Related Organizations	9
Computers and Computer Peripherals	61
Computer Related Industries	17
Assemblers of Electronics Products	6
Manufacturers of Electronics Parts	10
Manufacturers of Metal Products	7
Manufacturers of Plastic Injection Moulding Parts	6
Others	15

Because the companies which were covered by direct visits were limited in number, a mailed questionnaire survey was conducted in Malaysia. Because of the necessity for tabulation, mailed questionnaires were also sent to the companies visited for interviews. The results of the mailed questionnaire survey in Malaysia are summarized in Table I.5-2. Mailed questionnaires are attached to Annex II-2 and III-2.

Table I.5-2 Number of Companies Covered by the Mailed Questionnaire Survey in Malaysia

	Number of Questionnaires sent	Effective Answers	Rate of Effective Answers
Castings	163	103	63 %
Computers and Computer Peripherals	192	123	64 %

For the questionnaire survey of castings, using the following lists, the questionnaire was prepared to get the information of the actual situation of the targeted industry.

"List of firms approved for production by MIDA"
"Directory of FOMFEIA"
"List of casting industries prepared by FOMFEIA"

For the questionnaire survey of computers and computer peripherals, the firms to be surveyed by questionnaires covered all fields of the electronic industry, in order to gauge the interest in the computer industry of the existing electronic manufacturers and to make reference for formulating the policies for the development of the targeted industry. To prepare the mailing list, a list of the electronics industries in operation was offered by MIDA.

For the survey in Japan, a questionnaire survey was conducted for the purpose of exploring the possibility of investment and technical cooperation from Japanese companies. Results of the mailed questionnaire survey in Japan are summarized in Table I.5-3. Additional information was collected where necessary by direct interviews and telephone interviews.

Table I.5-3 Number of Companies Covered by the Mailed Questionnaire Survey in Japan

	Number of Questionnaires sent	Effective Answers	Rate of Effective Answers
Castings	174	101	58 %
Computer	37	20	54 %

In conducting the questionnaire survey, the list of firms to be surveyed for castings was selected from "Directory of Cast Iron Factories in Japan" published by Japan Cast Iron Foundry Association and the Members List of the Materials Process Technology Center of Japan. For computers and computer peripherals, the list comprises the firms which produce any of four items for the study, selected from the members of Japan Electronic Industry Development Association (JEIDA).

For the purpose of identifying the targeted industrial export markets for Malaysia and the present status in competing countries, a survey plan was drawn up for third countries in addition to a survey of Japan, and it was carried out by using the services of specialized research agencies in the related countries. The names of the countries surveyed through overseas agencies are shown below.

Export Market Survey:
- Castings : -------
- Computers and Computer Peripherals : U.S.A.

Survey of Competing Countries:
- Castings : Singapore
  : Thailand
- Computers and Computer Peripherals : Korea
  Singapore

The JICA Industrial Product Development Study Team was composed of the members listed below.

Members of JICA Industrial Product Development Study Team

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	Oki Electric Industry Co., Ltd.
Masahiro SAITO	Industrial Engineer/Computers and Computer Peripherals
	NEC Corporation

II. Summary

II. Summary

II-1. Summary of the Study Results by Industry

II-1-1. Castings

(1) Overview of the Industry

The Malaysian casting industry has grown together with this nation's tin mining industry. The former industry began its existence relying on orders from the latter for repairs, parts procurement, building and repairs, mechanical processing, and welding, and this relationship has continued throughout the past seventy years. In the wake of a 26% drop in tin production in 1986 due to the breakdown of an international tin agreement in 1985, for example, 38 casting companies ceased production.

As will be shown in the analysis of cast metal demand that will follow, the tin mining industry provided the largest single source of demand for Malaysia's casting industry in 1988, with other traditional industries such as palm oil, rubber, and timber also accounting for large shares.

Since 1987, however, despite only slight growth in tin production, the number of foundries in Malaysia has increased markedly. This is indication of the rapid diversification being undergone by the industry as a result of increased demand from new, modern industries.

1) Production scale

Malaysian production of castings in 1988 was estimated at 55,884 tons. The three most common materials were cast iron, steel casting, and malleable iron casting, in that order, their respective shares being 59.8%, 24.7%, and 7.1%.

Production value for the same year totaled an estimated M$187.7 million. The breakdown by material is as shown in Table II.1-1.

Table II.1-1 Estimated Production of Castings in Malaysia (1988)

Material	No. of foundries: No. interviewed or responding to questionnaire		No. of foundries: Estimated total no.*		Production (tons): No. interviewed or responding to questionnaire		Production (tons): Estimated total no.*		Unit price (M$/kg)	Sales (M$1,000)
Cast iron	75	(53.6)	95	(59.0)	26,385	(58.9)	33,421	(59.8)	2.3	76,868
Steel casting	12	(8.6)	13	(7.9)	9,902	(22.1)	13,802	(24.7)	3.6	49,687
Malleable iron casting	2	(1.4)	2	(1.2)	3,960	(8.9)	3,960	(7.1)	4.3	17,028
Copper alloy	21		8		1,029	(2.3)	1,070	(1.9)	12.2	13,054
Aluminum	14	51	20	53	432	(1.0)	449	(0.8)	9.6	4,310
Aluminum diecast	16	(36.4)	25	(31.9)	3,060	(6.8)	3,182	(5.7)	8.4	26,729
Total	140	(100.0)	163	(100.0)	44,768	(100.0)	55,884	(100.0)	—	187,676

Figures in parentheses indicate percentage share of total.
*Estimates for the total number of foundries were provided by industry sources.

(Method of calculation)
Cast iron: 26,385 tons/year x 95/75 = 33,421
Steel casting: 3,900 tons/year (annual production at one large factory) added to the survey statistics
Copper, aluminum, diecast: 4% added to the survey statistics in each of these categories

Source: JICA Study Team estimates

2) Export-import and local sales

According to trade statistics, Malaysia exported M$1.27 million of castings in 1987 while importing M$2.83 million of the same.

It is considered that there is a high ratio of indirect trade, indicating cases in which castings are used as components in trade automobiles or machinery. Taking the indirect trade into consideration, imports appear to outpace exports considerably in Malaysia. Because of the high transportation costs required for these products, however, direct export ratios of castings are usually low in any country in comparison with those of other products.

In domestic markets, most of the foundries did business with customers in the traditional industries of tin, palm oil, rubber, and timber. Virtually all buyers were in the private sector. In a questionnaire survey, 99 (80.5%) out of 123 firms indicated that most of their business was done with private-sector firms, while 22 (17.9%) did more business with the public sector. Two firms did business with the others. In business with the traditional industries described above direct sale is the most common type of transaction regardless of whether the customer is in the public or private sector, but there vendor markets exist for motorcycle parts, daily goods, hardware, and some mechanical components.

Concerning the sales organizations of these plants, 40 of the 56 responding firms (71.4%) answered that they had one person employed as sales staff; 10 (17.9%), two people; three, three people; and three, four or five people.

3) Recent industry trends

The IMP (Industrial Master Plan) marked the first time that the casting industry was identified by the government as one of the key industries. Castings were classified under the "Machinery & Engineering" heading, one of the 12 industries in the IMP, a task force conducted surveys of castings, and working committees and subcommittees were created to work with the private sector on studying the establishment of the foundry and engineering parks. There have been other projects as well, including the HICOM projects, which will manufacture components for motorcycles and automobiles, and a machinery manufacture and training project currently under negotiation with India. Although details on these projects have yet to be made public, they represent new sources of demand for castings and hence are being watched with considerable interest.

The following four projects have received a great deal of attention as of late:

[1] Planned construction of foundry and engineering parks

[2] Establishment of HICOM Engineering Sdn. Bhd.

[3] Establishment of HICOM Diecastings Sdn. Bhd.

[4] Establishment of Advanced Training Centre, Engineering Industries Complex

(2) Results of the Survey on Manufacturing Method and Technique

1) Production by demand industry

Based on the results of the questionnaire survey, demand for castings can be broken down by industry and material as shown in Table II.1-2.

Table II.1-2 Production Share of Castings by Demand Industry and Material (1988)

(Unit: %)

Industry	Cast iron	Malleable iron casting	Steel casting	Copper alloy casting	Aluminum casting	Die casting
Rubber	13.0	—	9.5	24.0	20.0	—
Tin	24.3	—	33.3	20.0	30.0	—
Palm oil	13.9	—	28.6	12.0	0.0	—
Timber	13.0	—	4.8	0.0	0.0	—
Other	35.8	—	23.8	44.0	50.0	—
Total	100.0	—	100.0	100.0	100.0	—

As is clear from the Table, demand for cast iron and steel castings is concentrated in the rubber, tin, and palm oil industries; demand for copper alloy castings, in the rubber, tin, and shipbuilding sectors; demand for aluminum alloy castings, in the rubber, tin, and building sectors; and demand for die castings, in the electrical appliance, construction, and motorcycle industries. Demand for malleable iron castings was concentrated in the construction sector.

In essence, the Malaysian iron casting industry still remains heavily dependent upon traditional industries, with alloy and die castings only recently making inroads into new fields like the electrical appliance and motorcycle industries.

2) Production scale of factory

With the exception of malleable iron castings facilities, most of Malaysia's foundries have extremely small production capacities.

In the case of cast iron, for example, 14.7% of all foundries boasted annual production of less than 100 tons; 36.0%, production of 100-300 tons; and 27.4%, production of 300-500 tons. These small-scale facilities accounted for 79.4% of all cast iron foundries.

There were only two plants engaged in the production of malleable iron castings, and both of these were large facilities, one having annual production of 1,000-2,000 tons and the other production of 2,000-3,000 tons.

On the whole, steel casting foundries were somewhat larger than their cast iron counterparts.

In the non-ferrous castings sector, 76.2% of all copper alloy foundries were small facilities with annual production of less than 100 tons; all of the aluminum alloy foundries fell into this category as well. Seven of the die casting plants, or 43.8% of the total, also had annual production of less than 100 tons, although there were two large plants with annual production of 500-1,000 tons.

3) Manufacturing methods

a) Melting process

Virtually all of the cast iron foundries used cupola furnaces in the melting process. Some of the cast iron foundries used induction furnaces, but these facilities were also engaged in the production of ductile cast iron . Some of the relatively large-scale cast iron foundries used induction furnaces to manufacture auto parts, valves, piano frames, centrifugal cast iron pipe, diesel engine liners and valves, and metal moulds for glass.

Only two Malaysian firms were engaged in the manufacture of malleable iron casting, with one of them using cupola melting facilities and the other a low-frequency induction furnace. Arc furnaces are commonly used in the industrialized nations for the melting of steel castings because of their low power consumption and ability to use low-grade scrap. In Malaysia, however, high-frequency induction furnaces are the most common for making steel castings. The reason is that arc furnaces require a certain amount of technical expertise to operate, while high-frequency induction furnaces are easy to use.

Crucible furnaces were used for the melting of non-ferrous castings such as copper alloy castings, aluminum alloy castings, and die castings. This is true in the industrialized nations as well. Heat sources include petroleum, gas, and coke.

Melting furnace performance depends on the levels of technical knowledge and operational know-how on the main and subsidiary raw materials, refractories, and melting furnace. Malaysian foundries need a great deal more work in this area. As one example, presence in the main melting material of excess rust, oil, or foreign metals can lead to casting defects, thus making it important to remove rust, oil, and foreign metals with tumblers or shot blast machines. This and other basic procedures must be carried out without fail.

b) Moulding sand and sand reclamation

[1] Moulding sand

The leading types of moulding sand used in Malaysian casting plants are as follows: high-quality Johor sand, named for the Johor district from which it is taken; the tin mining sand produced in the tin mines of Kuala Lumpur and the Ipoh district; river sand; and soil sand. Johor sand has a silica content exceeding 98% and a round grain shape, but since grains are often smaller than 70 mesh the sand must be screened to 35-60 mesh. This results in increased costs. Therefore, Johor sand is often used in shell moulds and is generally held to be too fine without screening for use in general casting applications.

Tin mining sand has a sub-angular grain shape that results in poor fluidity during moulding and often leads to moulding defects. The use of a conical machine to round out the grains is therefore suggested.

[2] Sand reclamation

When moulding sand is used repeatedly, the concentration of mixed and added substances (clay, coal dust, starch, etc.) increases, and the silica sand itself can be crushed by the tremendous heat load, thereby impairing its properties as a moulding sand. The sand must therefore be monitored to keep additive content at a constant level. Small-scale Malaysian cast iron foundries are not very active in sand reclamation. This results in more casting defects due to deterioration of the moulding sand.

Most steel casting foundries use CO_2 moulds. Some of these facilities reclaim sand for use as back sand. In particular, steel casting plants with annual production capacities in the 2,000- and 3,000-ton classes use pepset moulds with chemical binders, in which all of the sand is reclaimed for reuse. In the case of non-ferrous alloys, where green sand moulds are most common, it is suggested that sand be reclaimed and occasionally supplemented with new sand to prevent aging.

c) Moulding process

(Types of moulds)

[1] Cast iron

The main types of moulds used in Malaysia for cast iron are green sand, CO_2, and cement. The green sand (semi-synthetic) skin-dry moulds are commonly used for the production of tin mine equipment; green sand moulds, for automobile parts, agricultural equipment, kitchen burners, valves, piano frames, and other mass-produced items; and cement sand moulds, for the production of low-volume mechanical components. In Japan and the other industrialized nations as well as in Asian NIEs like Korea and Taiwan, CO_2 moulds are now used only for cores, and

cement moulds have fallen completely out of use. Instead, organic chemical resin binder ("no-bake") moulds are used.

[2] Steel casting

Virtually all of the steel casting foundries in Malaysia used CO_2 moulds. Green sand and cement moulds could be found at relatively small-scale plants, while larger corporations tended to use pepset (no-bake) moulds.

[3] Non-ferrous metals

Virtually all of the copper alloy foundries used green sand moulds, with three of these facilities also using CO_2 moulds. None of the facilities used cement moulds. CO_2 moulds are used primarily for cores, while cement moulds are used for the manufacture of propeller components.

Malaysia's aluminum foundries use green sand moulds, with CO_2 moulds being used to produce cores.

(Moulding methods)

[1] Cast iron

According to a survey of moulding methods used at Malaysian cast iron foundries, 80% of the facilities used hand moulding, while the remaining 20% used machine moulding. Those foundries with annual production capacities exceeding 1,000 tons all used machine moulding. When classified by the use of moulding flasks, those facilities engaged in flask moulding outnumbered those not using flasks.

With the exception of the flaskless high-speed, high-pressure moulding system being used by one malleable iron casting foundry, all of the moulding machines used at Malaysian cast iron foundries were of the prototype jolt or jolt squeeze variety. Centrifugal casting machines were in use at two firms, one producing centrifugal cast iron pipe and the other small engine liners and related components.

[2] Steel casting

CO_2 moulds were by far the most commonly used for the moulding of steel casting. In Japan, no-bake moulding using organic chemical binders is the most often-used method due to considerations of pollution and productivity. Only two Malaysian firms were using no-bake moulds. The cement moulds and CO_2 moulds used at Malaysian foundries both require highly alkaline moulding sand with pH values in the range 10-11, thereby polluting rivers and lakes. This has been the reason for their gradual disappearance from Japanese foundries.

[3] Non-ferrous casting

Green sand moulds are most common in the moulding of non-ferrous castings in Malaysia. Large ship propellers and similar pieces are generally produced using cement moulds or CO_2 moulds.

Die casting is the technique in which molten metal is mechanically forced into a metal die. Most of the diecast machines in use in Malaysia have capacities of at least 100 tons.

d) Finishing process

With the exception of castings produced in Malaysia's larger foundries and non-ferrous castings, the external appearance of Malaysian products cannot be favorably evaluated. This is often due to a lack of understanding concerning moulding sand characteristics and insufficient knowledge and know-how concerning the use of the sand.

In the finishing process, unnecessary portions are removed from the surface of the casting. The manufacturer has a responsibility to provide the customer with a product that meets his needs and expectations. Several machines are used in finishing casting: shake-out machines, used to shake out moulding sand; and turn blast machines, shot blast machines, grinders, and swing grinders, used to remove sand attached to the surface and for polishing.

At Malaysian foundries there is a tendency for the larger facilities to have more of such machines, but the number remains insufficient when viewed in terms of total tonnage.

Further expansion of Malaysian casting's exports will require a more complete lineup of finishing machineries and equipments.

e) Raw materials

Many problems remain in the supply of raw materials to Malaysian foundries in terms of quality, quantity, and price. The scrap iron being used, for example, contains too many unsuitable pieces. Specifically, pieces are too large, contain too much rust, or contain foreign substances and are therefore unsuitable for use. On the cost front as well, prices have been rising at a fast pace in response to rapidly increasing demand. Due to the resulting uncertainty as to when ordered materials will arrive, practices such as early ordering and stockpiling have appeared on the steel scrap scene.

On the other hand, limestone is inexpensive and of good quality. High-quality silica moulding sand can be obtained from the Johor district, and recently high-silica sand with a silica content of at least 95% is being produced from the residual sand at tin mines. In its natural form tin mining sand has poor shape and grain size distribution, but it has the potential to become a valuable resource if suppliers made the effort to bring it up to the quality standards of the industrialized nations.

Of the energy sources used for melting metals, only coke, used in cupola furnaces, is imported. The electrical power used by electric furnaces and the petroleum consumed by non-ferrous metal furnaces are provided locally. Electrical power in particular is relatively inexpensive: with the basic rate of M$12/kw plus the usage fee of 16 cents/kwh in the daytime and half that at night minus the 20% discount offered to industry, the final cost of electricity is 13-14 cents per kilowatt-hour (equivalent to about 7 yen), far less than the 18-22 yen rate typical in Japan.

Brief summaries of the main raw materials used will follow.

[1] Pig iron

Some of the facilities visited kept big stocks of pig iron, but in fact it was seldom used. This is due to the lack of basic knowledge of why pig iron is required in manufacturing of pig iron. More specifically, both buyers and producers were unaware that castings must be capable of providing certain chemical, physical, and mechanical properties as machine parts.

[2] Cast iron scrap

Automobile engines appeared to be the most common source of cast iron scrap in Malaysia. This was followed by scrap from various types of light machinery. In general, these types are favored because of their small wall thickness, which facilitates melting in cupola or electric furnaces. On the other hand, they tend to be plagued by an abundance of rust and the presence of impurities. When using this type of scrap, therefore, it is important to remove rust with a shot blasting machine and eliminate any foreign substances.

[3] Steel scrap

Virtually none of the cast iron foundries used steel scrap. Naturally, this was the main material used at steel casting foundries. Unfortunately, it often comes in shapes that are not suited to the size (inner diameter) of the melting furnace — long, thin steel wire and excessively thick or thin plates, for example — resulting in thermal energy waste.

[4] Ferro-alloys

In order to allow ferro-alloys such as FeSi and FeMn to pass the material standards (e.g., JIS, BS, DIN, ASTM), a pretense is often made of calculating and adding the appropriate elements to the melting material. In fact, however, both buyers and producers pay relatively little consideration to this point, and as a result, the proper use of ferro-alloys are not made.

[5] Silica sand and additives for mould

When correct knowledge and technical know-how are not applied during the use of moulding sand, there is the danger that numerous defects will be generated in the resulting product. In many Malaysian foundries there appears to be no recognition of this very basic fact. Particularly in the case of green sand moulding, very few foundries performed reclamation of the moulding sand, and even at those that did insufficient control over the process negated any possible benefits.

Ordinarily, bentonite, starch (dextrin or a heat-treated starch), or coal dust is added to the green sand mould, but at virtually all of the facilities operations were being conducted without knowledge of why or how much should be added. A lack of understanding of these additives and the objective behind them resulted in significant material waste.

Overall, the following conclusions can be drawn concerning materials for making castings. First, it is difficult for foundries to obtain new iron and steel scrap from key industries such as machinery, shipbuilding, iron and steel, and automobiles as well as iron and steel scrap from the market. Second, there is a dearth of material suppliers possessing any degree of expertise in the field. Thirdly, the foundries themselves lack accurate information concerning materials.

Finally, they make material purchases, in an appropriate way, which are condemning the quality of their products. Particularly in the area of pricing, the practice of determining the quality grade of the material in question and then basing the price on this determination needs to be established.

(Standards)

The MS standards are being drawn up through the deliberations of committees comprising representatives from related government bodies, academic organizations, commerce and industry organizations, and consumers. Standards in certain area of castings have also been determined by SIRIM.

The main standards in use in Malaysia are MS, BS, JIS, and ASTM. At present, JIS appears to be most often used in day-to-day business. In fact, however, these standards are being used solely for appearance's sake and are not being applied in any meaningful way.

Chemical analysis is a common problem for all the materials used in castings and is absolutely necessary if products are to meet tensile strength standards. Despite this, virtually no such analysis is being performed except at steel casting foundries. Pre-cast ingots with chemical compositions already meeting standards are sometimes used at non-ferrous casting foundries. To take the example of ship propeller production, normally a test piece should be made from a test block attached to the propeller body and tests should be carried out for tensile strength, elongation, and hardness.

4) Technical standards

a) Technical management

The dependence of the Malaysian casting industry on traditional local industries, which are not strict about product quality, is often reported to have hindered the development of the industry. However, the following progress has been observed in the industry; cement press techniques have been adopted by cast iron foundries; CO_2 and the Pepset process by steel casting foundries; and both types of processes at non-ferrous metal foundries. These efforts of the industry that have struggled to compensate for the technical disadvantage caused by a limited volume of demand should not be overlooked.

Although it is extremely difficult to evaluate the technical level of the casting industry in one country, one method is to identify the decision-makers responsible for melting material blending and casting plans. In Japan, the days in which these decisions were made based on the experience and intuition of laborers under the guidance of a foreman are long gone. Since 1935 Japanese industry has worked to introduce scientific plant management theory and transform its management structure into one in which these decisions are logically made by managers or engineers and operators work in an atmosphere of thoroughgoing quality control.

Many cast iron foundries in Malaysia still depend on workers or foremen to make these decisions. At nearly all steel casting foundries, however, these decisions are made

by managers or engineers, and the same is true at most copper alloy, aluminum, and die casting facilities.

b) Quality level

[1] External appearance

While products at two or three of the larger cast iron foundries were acceptable in terms of international standards, those at most facilities were found to be unacceptable. This is due to the fact that existing shot blast and turn blast machines are unable to remove baked-on sand on casting surface, indicating a lack of basic knowledge and expertise concerning moulding sand and also suggesting that the basic trainings at vocational training institutions and schools in Malaysia are not putting efficient emphasis on this respect.

[2] Quality

Virtually no product testing or inspection is carried out, indicating the lack of concern for material standards among cast iron manufacturers.

[3] Defects

(a) Types of defects

The most common defect was blow holes, followed by sand inclusions, shrinkage, pin holes, slag inclusions, chill, misruns, and cracks.

The causes of these defects should be investigated using scientific quality statistics, but the following probable causes can be suggested:

· Molten metal-related

Melting temperature too low: blow holes, pin holes, misruns

Unacceptable materials: shrinkage, chill

· Moulding sand-related

Excess sand moisture: blow holes, pin holes, misruns, chill

Low strength: sand inclusions, blow holes

· Casting plan-related

Gating system defects: sand inclusions, blow holes, shrinkage, slag inclusions

· Moulding operation-related

Poor ramming: sand inclusions, shrinkage

Shrinkage was the most common defect at cast steel foundries, followed by blow holes, slag holes, slag inclusions, pin holes, sand inclusions, and misruns.

These defects are believed to stem either from unacceptable moulding sand, casting plans, and materials or from a lack of skills or laziness on the part of operators. SQC (systematic quality control) should be implemented in order to resolve these problems.

The most common defects at copper alloy foundries were blow holes and shrinkage, in that order. The former is due to improper deoxidation or excess moisture in the moulding sand; the latter, to excessively high casting temperatures or improper feeder head design.

Common defects at aluminum foundries included blow holes, pin holes, shrinkage, and misruns. These are due mainly to improper degassing and excessively high melting temperatures. Greater mastery is needed in this area.

Aluminum die casting plants suffer from fewer defects than facilities using sand moulds because the moulds are metal and the die temperature is maintained at about 300°C.

(Percentage of defective products)

When broken down by type of mould, green sand moulds were found to produce the highest average percentage of defective products (8.1%). They were followed by cement moulds, with an average rate of 5.5%, and CO_2 moulds, with a rate of 3.0%.

Overall, these figures are quite acceptable. Unfortunately, however, products are sometimes passed through the inspections and sent to the customer despite numerous defects. When viewed by international standards, the percentage of defective products would probably be much higher.

When taken out of the moulds, cast steel goods contained more defects than cast iron, but since repair welding is accepted on an international basis the percentage of defective products is relatively low.

Rates of defective products at non-ferrous metal foundries ranged from 1% to 20% with no relation to the size of the plant.

c) Testing and inspection

About 20% of all Malaysian foundries were found to be engaged in the testing of compression strength and permeability of moulding sand. 28.0% of all plants checked molten metal temperature; 17.3%, molten metal composition; and 32.0%, mechanical properties of the materials used.

The frequency with which these checks are performed is unclear, but overall it appears to be quite low.

At steel casting foundries, 25% test moulding sand; 83.3%, molten metal temperature; 66.7%, molten metal composition; and 83.3%, the mechanical properties of the materials used. These figures are significantly higher than those obtained for cast iron foundries.

Inspection of material properties is most common at non-ferrous metal foundries, followed by measurement of molten metal temperature. Those firms not checking the temperature are thought to be making estimates based on experience, but the adoption of measuring instruments would allow reduction of metal oxidation and hydrogen gas absorption as well as energy savings.

(3) World Markets

World Market Scale

The 1987 world market for cast metal products was estimated from supply statistics at roughly 45 million tons.

With the exception of the Soviet Union, the world can be broken down into three major markets — the U.S., Europe and Asia (excluding China) — each accounting for roughly 22% of the total market.

Fig. II.1-1 Regional Shares of Casting Production in 1987

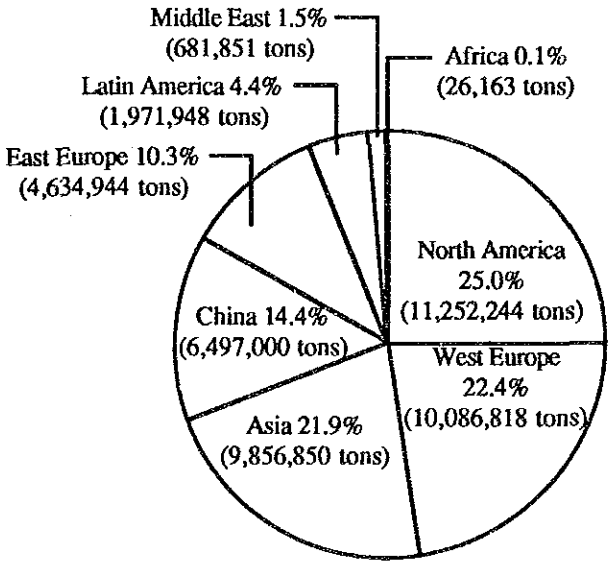


Table II.1-3 Production of Castings in the Asian NIEs and ASEAN Nations for 1987

(Unit: tons)

Country/region	Production	Share of Asian NIEs/ASEAN production	Share of production by 8 Asian nations/regions	Share of total world production
Asian NIEs	2,247,594		(86.3)	5.1
Korea	1,068,000	47.5	41.0	2.4
Taiwan	1,059,594	47.1	40.6	2.4
Hong Kong	80,000	3.7	3.1	0.2
Singapore	40,000	1.7	1.6	0.1
ASEAN Nations	355,984		(13.7)	0.7
Thailand	120,000	33.7	4.6	0.2
Malaysia	55,884	15.7	2.2	0.1
Indonesia	60,000	16.9	2.3	0.1
Philippines	120,000	33.7	4.6	0.2
Total	2,603,478			

Sources: APO and JPC casting technology seminars, JICA study team

The United States has experienced a major drop in production over the last ten years, with output in the European nations also slumping. Production in Japan has fluctuated, with good figures shown in 1987 and healthy domestic demand helping to boost 1988 production to the highest level ever, thereby breaking the previous record set in 1980.

Production in the Asian NIEs of Taiwan and Korea continues to rise but has yet to keep pace with domestic demand. Production by these nations for the last ten years is shown in the following Tables.

Table II.1-4 Production of Castings in the Asian NIEs and Other Nations

(Unit: 1,000 tons)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Korea	668	716	706	642	654	660	—	797	970	1,068
Taiwan	467	530	506	424	424	524	635	676	879	1,060
Mexico	—	619	939	—	—	—	—	634	434	405
Brazil	1,506	1,640	1,797	1,311	1,311	1,086	1,086	1,530	1,577	1,530

Source: Annual December issue of *AFS Modern Casting*

(4) Results of Cost Analysis

The following studies were carried out in order to determine the international price competitiveness of the Malaysian casting industry.

— An international comparison of selling prices for casting

— A feasibility study for a precision casting plant using lost-wax method

First, the selling prices of general castings currently being produced in Malaysia were compared with those of products being produced in other nations to determine their cost competitiveness, and selling costs were then broken down to determine the reasons behind the difference in selling prices.

Since there are as yet no foundries in Malaysia producing precision castings by investment casting, a model plant was posed and its financial viability was investigated.

1) Cost Analysis for Casting

a) Comparison of selling prices

It is difficult to carry out a fair comparison of the selling prices of cast metal products having differing specifications. Instead, it is common in the casting industry to compare selling prices per unit weight. The Table below offers a comparison of the selling prices of various Malaysian casting with their Japanese counterparts.

The figures in the Table were obtained from nationwide statistics in the case of Japan and by averaging values obtained from the questionnaire surveys in the case of Malaysia.

Table II.1-5 Comparison of Selling Prices of Castings in Malaysia and Japan

(Unit: M$/Kg)

Material	Malaysia	Japan
Cast iron (FC)	2.3	3.4
Malleable cast iron	4.3	6.7
Steel casting	3.6	—
Bronze casting	12.2	16.4
Aluminum alloy casting	9.6	14.7
Aluminum die casting	8.4	12.1

1M$=¥53

It can be seen that the selling price per unit weight of Malaysian casting is considerably lower than that of Japanese products. The following Table offers a similar comparison for products from Malaysia and other Asian countries.

Table II.1-6 Selling Prices in Malaysia and Neighboring Countries/Areas

(Unit: M$/kg)

Material			Malaysia	Korea	Taiwan	Thailand
Pig iron	FC		2.3	2.2-2.8	1.7-2.1	
	FC	15-20				1.5
	FC	25				1.9-2.6
	FC	30		3.4		
Steel casting	SC		3.6		2.5	

1M$=¥53, 4.6won=¥1.0, 1NT$=¥4.4, 1Baht=¥5.5

It can be seen from the Table that while Malaysian prices are lower than those of Japan they are in fact higher than those of products being manufactured in Taiwan and Thailand.

As a result, castings currently being exported from Malaysia are priced lower than the same goods on the domestic market in order to allow them to compete with products from neighboring countries/areas.

b) Cost breakdown

The following Table provides a breakdown of the selling prices of cast iron produced in Malaysia and Japan.

Table II.1-7 Cost Breakdown for Cast Iron in Malaysia and Japan

(Unit: M$/kg)

Breakdown	Malaysia	Japan
Raw material	1.104	1.122
Labor/outside order	0.644	1.428
Power	0.115	0.272
Depreciation	0.161	0.170
Other	0.276	0.408
Total	2.300	3.400

As can be seen from this Table, raw material costs are virtually the same, while labor and power costs are lower in Malaysia. Although there is no data for comparison with neighboring countries, it is thought that labor and power costs are not so much lower in Malaysia than in these countries/areas. In order for Malaysia to improve the cost competitiveness of its castings with respect to its neighbors, it will have to improve product quality and increase productivity.

2) Feasibility Study for Investment Casting Plant

At present in Malaysia, there are no corporations engaged in the manufacture of industrial products or components using investment casting. As a result, it is difficult to compare production costs with other major producing nations and access the suitability of Malaysia as a location for establishment of an investment casting plant. As an alternative method, a rough investment feasibility analysis was undertaken based on the assumption of a newly-built investment casting plant in Malaysia. The proposed model plant is as shown in the Table below.

Outline of Proposed Investment Casting Plant

Site area:	5,000 m^2
Floor space of plant and offices:	2,400 m^2
Initial investment:	Approx. M$6.5 million
Staff:	38
Production items:	18-8 stainless steel valves 18-8 stainless steel golf club heads
Production capacity:	valves 8,500 pcs./month Club heads 8,500 pcs./month

a) Production items

Use of investment casting method allows manufacture of the following types of products:

[1] Mechanical components having complex shapes and requiring high precision, such as sewing machine parts

[2] Mechanical components which are difficult to process mechanically (due to reasons of hardness or shape), such as complex-shaped stainless steel machinery parts

[3] Advanced engineering components made from alloys having superior resistance to wear

[4] High-precision engineering components made from heat-resistant alloys, such as aircraft components

Since there is virtually no demand on the Malaysian domestic market for these types of products, and since there is little accumulated know-how and technology in the field of investment casting, the following export-oriented products were selected for production at the model plant:

[1] 18-8 stainless steel valves for use at chemical plants

[2] 18-8 stainless steel golf club heads

These products were selected for two reasons: first, there is considerable demand in overseas markets for them; and second, it would be relatively easy to master the required technologies for plant startup. As technology is accumulated and domestic demand becomes more advanced, it is expected that production at the plant would gradually move to include a more diverse range of products with more complex shapes. To simplify calculations, however, it was assumed that there would be no changes in production items for the time being.

b) Long-term profitability forecast

A profitability forecast was carried out for the model plant based on estimated sales and expenses.

Table II.1-8 Long-term Profit and Loss Flow Forecast for the Proposed Plant

(Unit: M$1,000)

	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
Sales	2,310	2,598	2,887	2,887	2,887	2,887	2,887
Manufacturing costs	1,877	1,995	2,112	1,998	1,998	1,998	1,998
Sales and general administration costs	279	285	291	291	291	291	291
Operating income	154	318	484	598	598	598	598
Non-operating expenditure	304	277	228	182	151	68	0
Net profit	-150	41	256	416	447	530	598

(Results of the feasibility study)

The internal rate of return for the project was 8.2%; the loan repayment period, 6 years; and the investment recovery period, 9 years — tolerable figures for an investment in this field.

In the following Table, this project (after assumed operation for three years) was compared with X Corp., a Singapore investment casting plant engaged in the manufacture of aircraft and other engineering components.

	X Corp. (Singapore)	Current project
Site area:	4,200 m^2	5,000 m^2
Plant area:	2,800 m^2	2,400 m^2
Capital:	S$4.5 million	M$3.25 million
Products:	Aircraft components and other engineering components	Stainless steel valves Golf club heads
Annual sales:	S$6 million	M$2.9 million
No. of employees:	95	38

X Corp. expects 15% annual growth in sales and 15-20% annual growth in gross profit rate over the next three years. In the current project as well, diversification into more advanced engineering components would bring about great potential for future growth.

(5) Future Directions

1) Factors in development of the casting industry

The casting industry in Malaysia has long served as a kind of supporting industry for the traditional local industries such as tin, rubber, palm oil, and timber. In recent years, Malaysia's industrialization has proceeded with an emphasis on foreign-capital export-oriented assembly firms rather than import replacement, and development of casting as a supporting industry for the modern industries has fallen behind.

Recently, however, the following changes in the external environment have come to require the modernization and development of the Malaysian casting industry.

a) Changes in the Domestic Market

In the past, traditional local industries formed the main source of demand for cast metal products in Malaysia, with manufacturers of automobiles and industrial equipment turning to imports instead. Recent years, however, have seen considerable growth in the automobile and machinery industries, both of which are critical to the development of casting. In the electronics and electrical appliance industries, demand for air conditioners, refrigerators, and other products requiring large quantities of cast metal has been expanding, and casting demand from non-traditional modern industries in Malaysia is growing at a rapid pace. These industries currently rely mainly upon foreign-capital firms or new corporations that have brought in technology from foreign firms, but some are turning to existing small and medium-size foundries which previously dealt mainly in products for the traditional industries.

b) Changes in International Markets

Due to high labor costs, the casting of the U.S., Japan, and other industrialized nations have lost their cost competitiveness on the global market. Even the NIES, which in recent years have taken over as the main exporters of castings, are finding themselves beset by rapidly increasing labor costs. This phenomenon is serving to increase the local content ratio of casting of export-oriented assemblers in Malaysia on one hand and to promote investment in Malaysia by Taiwanese and Japanese casting firms on the other.

c) Changes in the Domestic Production Infrastructure

In the past virtually all of Malaysia's foundries were small-scale facilities concentrated in TOL (Temporary Occupied Land), and this was a major factor hindering the expansion of production and the modernization of plants and facilities. The recent

concretization of plans to construct foundry and engineering industrial parks is helping to improve the chances for modernization of the local casting industry.

d) Expansion of the ASEAN market

One of the leading factors inhibiting the development of the Malaysian casting industry has been the limited total domestic market size and the lack of demand in sizeable quantities for each specific product. Recently, however, a trend is visible among manufacturers of automobiles and home electrical appliances to expand their search for parts from the country of assembly to the ASEAN region as a whole. The possibilities for expanded casting production with an eye on exports to other ASEAN nations are increasing.

2) Directions for development of the casting industry

Malaysia is currently engaged in promoting the machinery industry together with numerous other demand sectors, making it difficult to make any accurate predictions concerning future growth. The following section will try to probe future directions for the industry from the standpoint of demand sectors and products.

a) Economic scale and casting production

Malaysia boasts the largest per-capita GNP among the four ASEAN nations,and as can be seen from the following Table per-capita cast metal production was also the largest in the region. In comparison with Asian NIEs, however, Korea had a per-capita GNP 1.6 times greater than that of Malaysia, while Taiwan's GNP was 2.9 times greater. An even larger gap could be seen in terms of casting production, where the respective multiples were 7.7 and 16.1. Table II.1-9 shows that Malaysia's casting industry have great potential for future development.

Table II.1-9 GNP and Casting Production in the Asian NIEs and ASEAN Nations (1987)

	Casting production (tons)	GNP (US$ billions)	Per-capita GNP (US$)	Population (millions)	Per-capita casting Production (kg)	Per-capita GNP index (in relation to Malaysia)	Per-capita casting Production index (in relation to Malaysia)
Korea	1,068,000	118.6	2,826	42	25.4	1.6	7.7
Taiwan	1,059,594	97.5	4,989	20	53.0	2.9	16.1
Hong Kong	80,000	46.5	8,230	5.6	14.3	4.8	4.3
Singapore	40,000	20.5	7,464	2.6	15.4	4.3	4.7
Subtotal	2,247,594	282.8	4,028	70	-	-	-
Thailand	120,000	45.4	857	53	2.4	0.5	0.7
Malaysia	55,884	28.6	1,729	17	3.3	1.0	1.0
Indonesia	60,000	71.6	421	170	0.4	0.2	0.1
Philippines	120,000	34.3	421	57	2.1	0.3	0.6
Subtotal	355,884	179.9	606	297	-	-	-

Note: GNP figures for Hong Kong represent GDP.
Source: Statistical Research Division, Asian Economic Research Institute (economic scale)

b) Demand industries

Directions for development of the casting industry in Malaysia will be heavily dependent on the future growth patterns of local demand industries. A breakdown of the major purchasers of cast in several leading nations is provided in the following Table for use as reference in predicting the same for Malaysia.

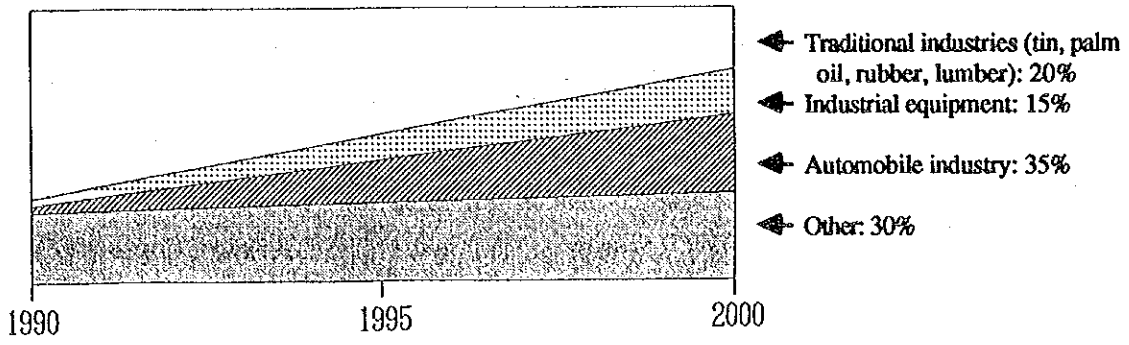
Table II.1-10 Breakdown of Demand for Cast Iron (1987)

(Unit: %)

	France	Italy	U.S.A.	Korea	Japan
Transportation equipment	37.8	32.8	44.0	18.2	53.7
Industrial equipment	14.9	30.1	6.6	18.0	16.9
Other	47.3	37.1	49.4	63.8	29.4
Total	100.0	100.0	100.0	100.0	100.0

As of 1987, four traditional industries — tin, palm oil, rubber, and timber — accounted for fully 65% of all cast iron demand in Malaysia. Fig. II.1-2 below provides a fairly subjective estimate of the breakdown of demand for castings in Malaysia in the year 2000 based on the current level of industrialization and expected future direction of industrial development. As can be seen from the Fig.II.1-2, the production of high-quality castings for supply to modern industries such as the industrial equipment and automobile sectors will be critical to the future development of Malaysia's casting industry.

Fig. II.1-2 Future Directions for the Development of the Malaysian Casting Industry



Figures in parentheses indicate predicted share in 2000.
Source: JICA Study Team

c) Directions in product development

It is difficult to predict with any degree of accuracy the types of products which will be in demand in the future. This list would also have to include products — such as the precision industrial casting produced by investment casting — for which there is no accumulation of technology within Malaysia and which will require the introduction of technology from abroad. The following is a list of products thought to offer realistic possibilities for development by the small and medium-sized foundries currently operating in Malaysia.

[1] Pulleys (flat, V-groove), bearings, gear materials (FC), manholes, etc.
[2] Valves
[3] Small compressor (1-10 hp) components, small blowers (1-10 hp), small pumps
[4] Small gasoline and diesel engine blocks (1-10 hp)
[5] Small pressed components (mechanical, friction, hydraulic)
[6] Machine tool components (drills, laces, shearings)
[7] Transmission components
[8] Roller conveyors, bucket elevator components
[9] Motor components
[10] Liners, brake drums, and brake shoe components for automobiles
[11] Components for tractors

Selection of the products listed above was based mainly on the following three criteria: [1] the ability of local small and medium-sized foundries to "catch up" in terms of

production technology; [2] the presence of demand in sizeable quantities; and [3] the ability to start production without large-scale capital investment.

d) Directions for Technological Development

Technological development in Malaysia should be investigated with the following main points in mind. First of all is the early preparation or adoption of the Malaysian Industrial Standards (MS). It is important that all concerned recognize the necessity of standards for functions and quality in the products and components demanded from the modern industrial sectors. According to the current survey, customers, manufacturers, and third parties have yet to agree on adoption of MS. This should be determined as soon as possible and the close cooperation system among industry, academia, and government be established.

Next is a mastery of basic casting know-how and technology. The only available option here is to be given assistance from experienced engineers and technicians. These people are needed to provide long-term education and job training.

It is necessary that the technological development in Malaysia through the above-described measures be promoted in accordance with the nation's basic industrial policies.

Specifically, the technological development in casting industry should be undertaken in accordance with the development of the following industries: automobiles, construction equipment, and agricultural equipment (all of which are mass-produced and have small engines) and their related parts; and machine tools and press machines (which are not mass-produced).

The domestic demand for investment-cast products, which offer dimensional precision and high quality, and similar products will remain limited for the time being, and it is therefore necessary to start R&D activities in the field. More practical, however, it could be recommended that the government put more focus on the development and promotion of the existing casting industries.

3) Strategies for development of the casting industry

a) Industrial Policy Framework for Promotion of the Casting Industry

As Malaysia's industrialization proceeds, demand for castings and the quality required of these products will increase, and products will become more diverse. This new demand can be met in two ways. The first is the construction of new plants aided by the introduction of foreign capital and technology. The second is the expansion of production capacity at existing foundries. If either of these two options is depended too heavily upon, there will be a polarization into two groups, one dependent entirely on the traditional industries and the other on the modern industries, thereby delaying

development of the industry as a whole. Thus it is important that any industrial promotion policies take fully into account the management and technological capabilities of existing casting companies and the potentials thereof.

b) Promotion of Existing Casting Factories

It is necessary to transform the existing local casting factories, which in the past have relied mainly upon orders from the traditional Malaysian industries, into companies capable of producing cast metal products for supply to such modern industry as machinery or automobile industry. However, product standards in these modern industries are far higher — in terms of quality, delivery time, and price — than in the traditional industries. In order to be able to satisfy these standards, the casting industry will have to (1) improve current production technology; (2) refurbish and expand machinery and other elements of the production infrastructure; and (3) promote modernization of corporate management itself.

c) Attraction and Promotion of New Casting Factories

Many Taiwanese and Japanese casting firms have become enthusiastic about moving operations abroad. In order to promote Malaysian industrialization, there is a great need for attraction and promotion of such firms, particularly in fields in which the Malaysian industry lacks technology and experience.

4) Measures for promotion of the casting industry

a) General

Various measures for promotion of the Malaysian casting industry are outlined in Fig. II.1-3 and Fig. II.1-4. These can be broadly divided into measures dealing with (1) enlargement of the industrial infrastructure and (2) internationalization.

b) Measures for Enlargement of the Industrial Infrastructure

There are four main measures for enlargement of the industrial infrastructure: (1) improvement of technological standards; (2) modernization of management; (3) enlargement of the production infrastructure; and (4) market expansion.

[1] Improvement of technological standards

In order to improve technological standards at existing Malaysian casting factories, it will be necessary to introduce scientific plant management methods and transform the current manufacturing process, which relies on operator experience and intuition, into one based on rationally designed management manuals under the guidance of

In order to improve technological standards at existing Malaysian casting factories, it will be necessary to introduce scientific plant management methods and transform the current manufacturing process, which relies on operator experience and intuition, into

[2] Modernization of management

With few exceptions, Malaysia's casting factories are small outfits managed by individuals or families. It is seldom that these factories have the management initiative to move into new demand sectors. First of all, the training of small business managers is needed. One effective means for achieving modernization of the industry as a whole would be the strengthening of exchanges of knowledge, experience, and know-how among Malaysian factories. In addition, the use of traveling seminars to provide factories with advice on new demand markets would be helpful.

[3] Enlargement of the production infrastructure

Virtually all Malaysian casting factories are located on Temporary Occupied Land (TOL) or in city suburbs where there is no room for further plant expansion. As a result, plans to build foundry and engineering parks should be promoted in order to assist factory expansion and modernization. In addition, credit programmes for the modernization of plants and facilities should be expanded. Finally, inter-corporate cooperation should be promoted in the following areas: shared use of modern manufacturing facilities and product inspection facilities; joint purchasing of raw materials; and joint receipt of orders for production.

[4] Market expansion

The limited scale of the market for castings in Malaysia has inhibited development of the casting industry. One method of solving this impasse would be to collect information regarding overseas markets and attempt to break into these markets. Another would be to attract firms in industries having high demand for castings, such as the machinery sector. Finally, it is important to establish linkages between local buyers and casting companies.

c) Measures for Internationalization

Measures for the promotion of internationalization include (1) greater efforts to attract investment; and (2) promotion of capital and technological tie-ups with foreign manufacturers.

[1] Greater efforts to attract investment

An increasing number of overseas casting factories are considering moving their production bases abroad. Consequently, it is hoped that investment attraction efforts by MIDA will be strengthened with a focus on these corporations.

[2] Promotion of capital and technological tie-ups

[2] Promotion of capital and technological tie-ups

The promotion of capital and technological tie-ups between foreign casting factories and Malaysian firms will require strengthening of programmes such as MIDA's RICOM and MEXPO's Trade Inquiry Service. In addition, Malaysian industry efforts should be increased to promote cooperation not only between factories but between industry groups as well.

Fig. II.1-3 Framework for Promotion of the Casting Industry

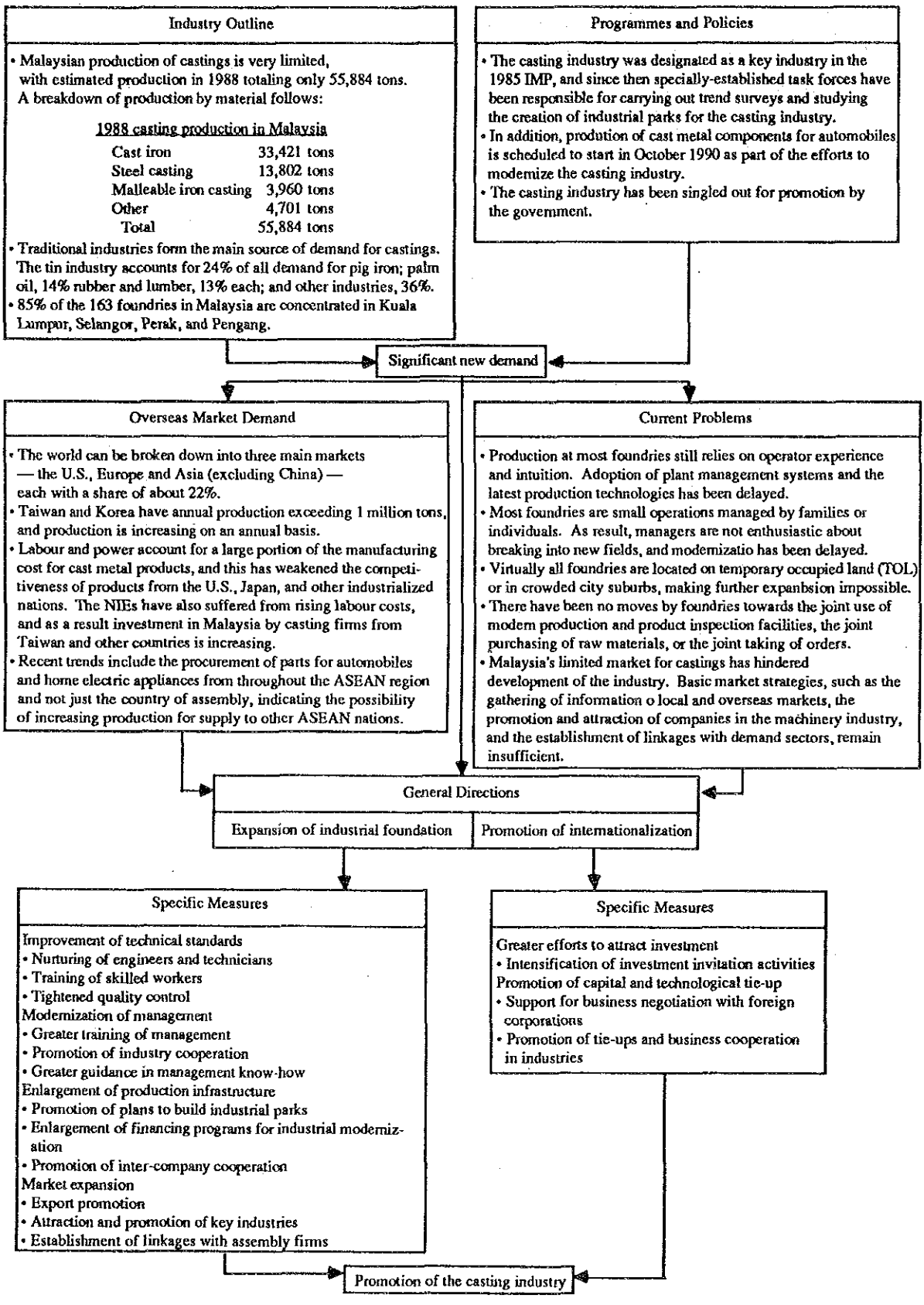
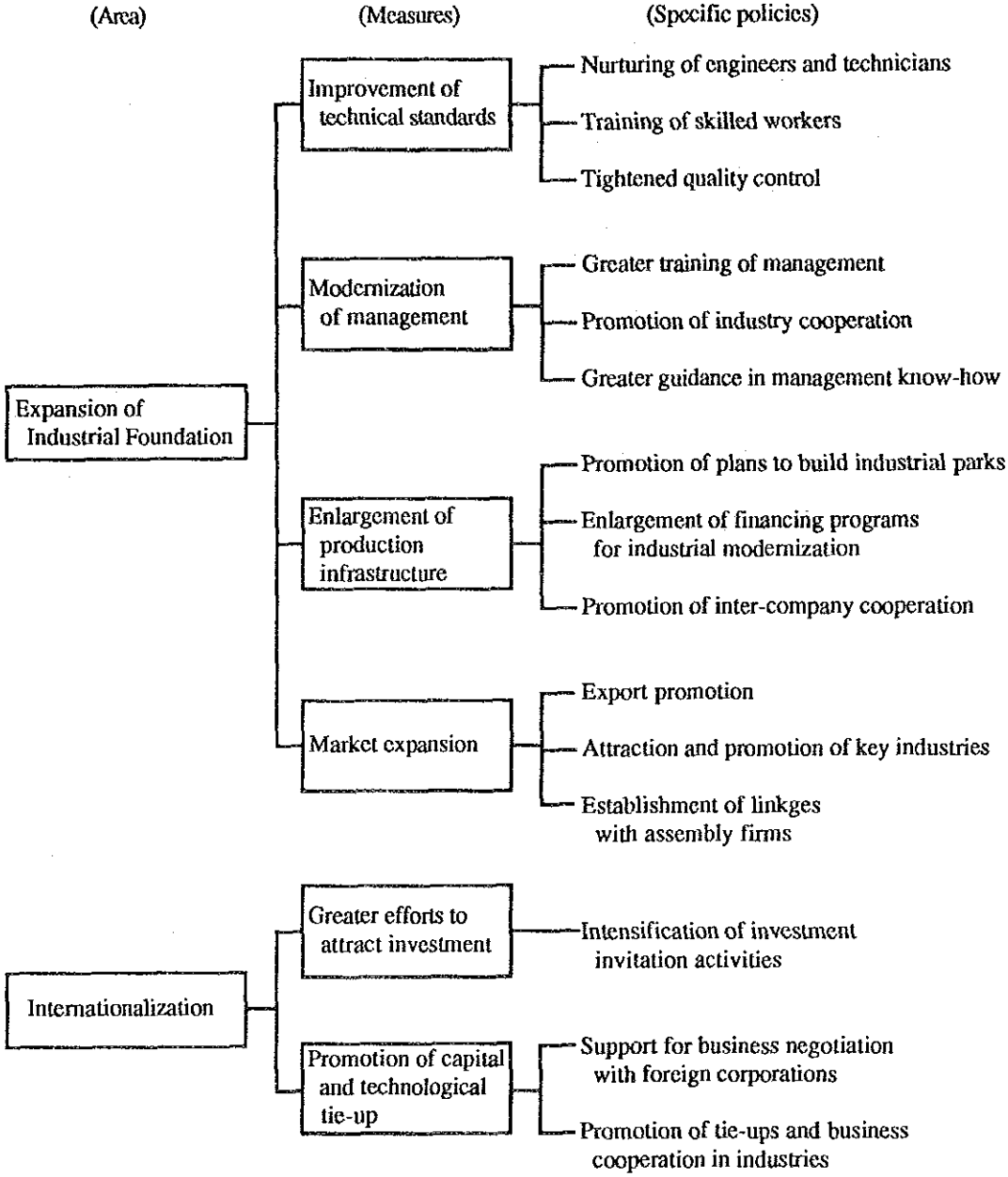


Fig. II.1-4 Policies for Promotion of the Casting Industry



II-1-2. Computers & Computer Peripherals

(1) Present Status of the Domestic Market

With approximately 30,000 units sold in 1989, the domestic market for personal computers (P/Cs) is still small. However, it is expected to grow at an annual rate of 20-30 percent over the next few years. Users of P/Cs can be divided into business users and personal users. The market for personal use is strongly oriented toward low priced products and IBM convertibles dominate the market as standard systems. The breakdown of the market is 20 percent for upper-end products (U.S., European and Japanese manufacturers' products), 40 percent for medium-range products (Japanese manufacturers' products, Taiwanese/Singaporean-made major brand products and large domestic manufacturers' products) and 40 percent for low-end products (Taiwanese/Singaporean/Malaysian-made products). While the market is small, manufacturers are in stiff competition with each other because of the lack of policies to protect the domestic industry. P/C manufacturers from all over the world have made inroads into the Malaysian market.

The domestic market for printers amounts to 24,000 units a year, the majority of which are products of Japanese manufacturers.

(2) Present Status of Domestic Production

1) Outline of Manufacturers

Personal Computers

At present, seven local manufacturers are engaged in assembly of P/Cs using imported components. The present status of these manufacturers is described below:

(Production)

Even large manufacturers assemble only about 300 units a month. Their operations are limited to assembly technology based on manual work. Currently, none of them have the facilities or technology for mass production.

Not surprisingly, a great gap exists between the manual operations of Malaysia's small assemblers and the automated mass production technologies adopted by major brand P/C manufacturers.

(Parts procurement)

Almost all components are being imported from overseas, mainly from Taiwan and Singapore. The high dependence on imported components is one factor in the weak price competitiveness of Malaysian products in comparison with Taiwanese products. It appears to be difficult to compete with low-priced Taiwanese products in the price competitions in the domestic market. It may be necessary to strengthen the price competitiveness of domestic production by promoting domestic production of components and thus enabling domestic procurement.

(R&D)

There are two manufacturers with engineers engaged in the design of print circuit boards for the development of motherboards using their own specifications. Generally speaking, however, Malaysia's P/C assembly manufacturers are in the infancy stage when it comes to R&D. Their R&D capability is not developed enough to allow them to make strides toward designing their own products with sophisticated functions or designing their own IC technology.

(Sales)

Most products are IBM convertible. Although some are being exported, almost all of them are produced for the domestic market. Manufacturers which have production licenses have their own sales staff and in line with their strategies to establish market position, they are targeting the market for medium-range IBM convertible products equivalent to the 386SX or niche markets for small-sized products. On the other hand, manufacturers which have not acquired production licenses are selling products through their own computer shops. They function as value-added dealers.

(Management)

Most manufacturers were founded by engineers or people with experience in the computer business. Accordingly, many of them lack sound management ability.

(Capital sourcing)

Manufacturers under the umbrella of large business groups do not have problems with capital financing. New ventures, however, have difficulty in this area.

(Future requirements)

Existing P/C assembly manufacturers in Malaysia still strongly resemble value-added dealers. There are great barriers for Malaysia's microcomputer assembly

manufacturers to overcome in terms of product, technology, market, sales capability and financing if they are to start commercial production of microcomputers. For commercial production, a mass production system is an absolute necessity.

Because the market is small, it is difficult for microcomputer assembly manufacturers to move toward the stage of autonomy and continual growth which comes through the continuous cycle of investment of profit in production facilities, technology development and market development. In this regard, the industry faces significant difficulty because in order to ensure a sales level which would allow it to reap the benefits of economy of scale production, it would be required to enter overseas markets.

Monitors

(Production/technology level)

One manufacturer which is engaged in mass production of TVs produces 12,000 monitors a month. The company has adequate experience for the production of TVs and its technology level is high. Another manufacturer is conducting pilot production of monitors at a monthly rate of 2,000 units. The firm is at the stage where it receives technology guidance in the area of engineering and quality assurance.

(Parts procurement)

Because of the dependence on imports of components from Taiwan and Japan, Malaysia's manufacturers are in an unfavorable position in the price competition with Taiwanese- or Korean-made products. In particular, color CRTs, which constitute a large component of the cost of monitors, are not produced in Malaysia. This results in dependence on imports from Japan and Taiwan, creating a distinct disadvantage in price competition.

(R&D)

Transfer to Malaysia of product design processes for TVs is underway. In the case of monitors, transfer of product design functions to Malaysian factories is desirable. Recruitment of capable engineers and technicians and the training of the same will be required to heighten design and development capability. Support in this respect is also necessary.

(Future requirements)

In a world market where demand has shifted toward high quality monitors, Malaysia produces only color monitors of the CGA standard. It appears necessary to embark on production of high quality monitors in the future.

For the production of high quality monitors, it would be important to start domestic production of key components such as color CRTs.

In Malaysia, monitors are being produced only by foreign affiliated computer and peripheral manufacturers and the country is viewed as a production base for the export of products such as keyboards. It would be desirable if monitor manufacturers proceeded with technology transfer to Malaysia in order to upgrade the technology level of the entire electronics industry in the country.

Printers

At the moment, there is no production of printers in Malaysia.

Printers are produced through the assembly of fine precision mechanical components. As a result, high precision metal processing of components and moulds and dies are necessary. It is also important that a supporting industry which is capable of producing high precision components exists in the country. In the assembly process, high precision is also required. As a result, capable technicians and engineers will be required in the area of production management.

Keyboards

Keyboards are being produced by two foreign affiliated manufacturers in Malaysia. Both of them are subsidiaries of Japanese firms. One is producing keyboards for its own computers while the other is producing on an OEM contract. All of their products are being exported.

(Production/technology level)

Each manufacturer has a factory equivalent in production technology and production scale to factories in Japan.

(Parts procurement)

In production of key switch type keyboards, key switches, which account for about 30 percent of the total raw material costs, must be imported from Japan.

It is necessary to upgrade the technology level of the domestic supporting industry to solidify its competitive edge in keyboard production in the country. It is very important to develop manufacturers which can supply fine precision moulds and dies, fine precision stamped metal components and fine precision plastic components.

(Future requirements)

In terms of keyboards, Malaysia is competitive in terms of quality and price as a production base for the world market. Its total production reached 3 million units in 1989, nearing 40 percent of the production level of Taiwan, now the world's largest supplier of keyboards.

However, Malaysia's keyboard manufacturers are foreign affiliated parts manufacturers or computer manufacturers' affiliates. They located their production base in Malaysia in pursuit of lower production costs. Although the keyboard is a computer peripheral, production in Malaysia is mainly by assembly which does not requires a high technology level. Malaysia's manufacturers strongly resemble subcontractors which produce products based on orders placed by computer manufacturers. As a result, although the production of keyboards has contributed greatly to the country's earning of foreign currency, keyboards can be said to be one of the products for which it is difficult to increase the added value.

2) *Evaluation of Technology Levels of P/C and Peripheral Manufacturers*

Evaluation of production technologies was conducted for factories engaged in production of P/Cs and peripherals in Malaysia. In a field survey, evaluation of technology levels was done after an evaluation of the operating conditions of factories and a comparison with the level of excellent manufacturers in Japan.

i) A checklist for factory visits was prepared and included several small categories which can be group into larger categories such as facilities, operation management, production control, distribution/inventory, quality assurance, safety/health and motivation in workshops.

ii) Scores for the small categories, calculated by multiplying the results of the evaluation of each small category by a weight based on the degree of importance of the category, were totaled up for each large category. The figure obtained by dividing the resulting totals by the maximum possible scores was used as the evaluation score for the large categories.

Therefore, when the level of technology of a company earns it the maximum evaluation in any one large category, the evaluation points of that category are 1.00. If

such an evaluation is given, that company may be considered to have reached the technical level of the top electronic equipment manufacturers of Japan.

The results of the evaluation are as shown in Table II.1-11.

Table II.1-11 Evaluation of Technical Level of Manufacturers

Item	Monitor (incl. 1 foreign affiliated firm)	Keyboards (2 affiliated firms) average	Power supplies (2 local firms) average	Average home electric appliances (6 Japanese affiliated firms) average
Facility	0.44	0.89	0.45	0.95
Operation management	0.43	0.78	0.56	0.86
Production control	0.42	0.60	0.47	0.87
Distribution/inventory	0.40	0.53	0.47	0.80
Quality assurance	0.54	0.74	0.61	0.99
Safety/health	0.33	0.75	0.50	0.87
Motivation in workshops	0.33	0.56	0.50	0.62

(3) Future Investment Plans

A look was taken, for each product, at the companies scheduled to engage in production in Malaysia in the future and those interested in the same based on MIDA lists of approved investment projects and interviews with and questionnaires from electronics companies in Malaysia. Among finished products, new investment can be hoped for the most for keyboards and monitors. Five and three companies, respectively, have obtained licenses and are planning to begin production. Regarding printers, there are no prospects for production in the future. Personal computers are starting to be produced by Taiwan's largest manufacturer, Acer, after peripherals. This is expected to be the first mass production of such equipment in Malaysia.

According to the results of a questionnaire survey conducted on existing domestic electronic companies (hereinafter referred to as the questionnaire in Malaysia), there are 26 companies interested in producing computer related products and 18 companies with specific plans for the same. Among these, however, were many companies already engaged in the production of computer related products which were considering diversifying their lines. As a general trend, it may be considered that there is high interest in entering the field among companies with fewer than 500 employees, basically local capital, and existing production of components.

(4) Possibility of Local Procurement of Parts

1) Evaluation of Possibility of Parts Procurement

In the promotion of the personal computer and peripherals industries in Malaysia, a key issue is the promotion of supporting industries to raise the rate of domestic procurement of parts.

Production of personal computers and peripherals first becomes possible through support from existing linkage industries such as the metalworking, mould and die, metal pressing, plastic, and electronic component industries. Manufacturers of industrial use electronic equipment, which includes personal computers and peripherals, consider the existence of such supporting industries to be an important determinative factor in their selection of sites for establishing overseas production bases.

Table II.1-12 shows the results of the evaluation of the possibility of procurement of parts and raw materials required for production of personal computers and peripherals in Malaysia.

Table II.1-12 Availability of Parts and Components in Malaysia

(Unit: %)

Name of parts	Personal computer				Colour monitor			
	At present		*In future		At present		*In future	
	Proportion of Malaysian part	**Sources except Japan & Malaysia	Proportion of Malaysian part	Sources except Japan & Malaysia	Proportion of Malaysian part	Sources except Japan & Malaysia	Proportion of Malaysian part	Sources except Japan & Malaysia
Mechanical parts								
Precision stamping parts	100	—	100	—	100	—	100	—
Roll milling parts	***N.U.	—	N.U.	—	N.U.	—	N.U.	—
Precision plastic parts	N.U.	—	N.U.	—	N.U.	—	N.U.	—
Electronic parts								
PCB	0	T,S	0	T,S,K	90	—	100	—
IC/LSI	0	—	60	K,T	0	—	60	K,T
Transistor/diode capacitor/resistor	Small-sized standard tpes are available in Malaysia, but large-sized standard types and special types ac not available in Malaysia.							
Switch	30	T	50	T	100	—	100	—
Connector	50	S	100	—	50	S	100	—
Special parts								
Motor	N.U.	—	N.U.	—	N.U.	—	N.U.	—
FDD/HDD	0	S,T	50	S,T	N.U.	—	N.U.	—
Printer head	N.U.	—	N.U.	—	N.U.	—	N.U.	—
Colour CDT	N.U.	—	N.U.	—	0	T,K	0	T,K
Deflection yoke /flyback transformer	N.U.	—	N.U.	—	0	T,K	40	T,K

Name of parts	Printer				Keyboard			
	At present		*In future		At present		*In future	
	Proportion of Malaysian part	**Sources except Japan & Malaysia	Proportion of Malaysian part	Sources except Japan & Malaysia	Proportion of Malaysian part	Sources except Japan & Malaysia	Proportion of Malaysian part	Sources except Japan & Malaysia
Mechanical parts								
Precision stamping parts	20	S,T	50-70	S,T	100	—	100	—
Roll milling parts	10	T,Th	50-70	T,Th	N.U.	—	N.U.	—
Precision plastic parts	20	S	100	—	N.U.	—	N.U.	—
Electronic parts								
PCB	50	T,K	100	—	100	—	100	—
IC/LSI	60	—	80	K,T	60	—	80	—
Transistor/diode capacitor/resistor	Small-sized standard tpes are available in Malaysia, but large-sized standard types and special types are not available in Malaysia.							
Switch	80	T	100	—	20	—	100	—
Connector	50	S	100	—	50	S	100	—
Special parts								
Motor	50	S,Th	50	S,Th	N.U.	—	N.U.	—
FDD/HDD	N.U.	—	N.U.	—	N.U.	—	N.U.	—
Printer head	0	T	0	T	N.U.	—	N.U.	—
Colour CDT	N.U.	—	N.U.	—	N.U.	—	N.U.	—
Deflection yoke /flyback transformer	N.U.	—	N.U.	—	N.U.	—	N.U.	—

Note: This table excludes those parts which are considered completely available in Malaysia.
* This means the expected availability in 3-5 later.
** S: Singapore, T: Taiwan, K: Korea, Th: Thailand
*** N.U.: Not used.

In Malaysia, the parts industries necessary for supporting an electronics assembly industry are not that well developed except in the fields of standard semiconductor products, electronic components, and large sized plastic moulding.

General use ICs and transistors, diodes, capacitors, resistors, and other general use electronic components also do not present a problem in procurement as production has begun through Singapore.

On the other hand, the mould and die, metal machining, metal pressing, plastic, and other such supporting industries have been late in developing in Malaysia. A look at the precision components required for the manufacture of many industrial use electronic products, including personal computers and peripherals, in particular printers, shows the existence of only a very limited number of manufacturers. These have also not yet reached the highest levels of precision and quality demanded for computers and peripherals.

Domestic procurement of moulds and dies, which constitute basic technology for the parts industries, is a strong desire of not only manufacturers of industrial equipment,

but also manufacturers of consumer goods. In plastic moulding, there is a demand for advancement into the field of engineering plastics, and in metal pressing, there is a demand for greater precision of machining of progress dies.

The almost complete lack of manufacturers of the precision parts necessary for supporting the industrial electronic equipment industry constitutes a major obstacle to the development of that industry. Therefore, the promotion of high tech parts manufacturers is an urgent task. The synergistic effect on other industries is also great.

2) Issues in the Promotion of Supporting Industries

To promote the supporting industries and raise their technical level, it is necessary to foster design and production engineers, train skilled workers, improve factory control, and renew and improve production facilities.

[1] Human Resource Development

Regarding human resource development, it is necessary to have in-house training of engineers and technicians to handle design and production control.

There are limits, however, to the education and training which can be provided inside a single company, so it would be desirable to have some positive support from official training organisations for such education and training of engineers and technicians. It is important to provide practical curriculum meeting industry needs and to augment and improve training facilities.

It is also necessary to study, at the industry level, measures for the resolution of the problem of the shortage of technicians and skilled workers in the different fields of the supporting industries.

[2] Improvement of Factory Management

With the exception of several foreign capital affiliated companies, there is large room for improvement in factory management and production control. Guidance and consulting will be required in these areas. The problems seen in the areas of factory management and production control are basic ones and are easy to be resolved, so guidance should result in immediate improvement.

Technical guidance provided by user companies to parts suppliers would be effective for the improvement of the factory management of the supporting industries in that it s taken seriously by both the side providing the guidance and the side receiving it.,

it is easy to propose and implement specific measures for resolution of problem, and immediate improvement may be expected in daily operations. Measures are desirable for stimulating and encouraging technical guidance by user companies.

The dissemination of quality control techniques through the NPC could also be expected to contribute to the improvement of the level of factory management and quality control in the supporting industries.

[3] Support in Introduction of the Latest Facilities

Production facilities are in general becoming old. It is becoming necessary to renovate existing facilities and introduce the latest facilities for production of high quality products and high tech goods. In some cases, however, it is impossible to introduce the latest facilities due to funding problems. To deal with this situation, consideration should desirably be made of the strengthening of preferential treatment financing for the modernisation of facilities.

Further, for large sized facilities for which individual companies would find the investment burden too great, it will be necessary to give consideration to a system under which a public organisation would purchase the equipment and lease it out to the private sector in areas important and effective for the development of the supporting industries.

[4] Measures for Improvement of Technical Capabilities

It will be necessary for public organisations to strengthen their research and development activities in the area of the latest technology and precision technology and to expand their technical guidance services and technical information services to industry.

Further, exchanges within the industries and exchanges with overseas industries would improve the access of companies to the latest technical information.

[5] Promotion of Joint Ventures with Foreign Companies and of Foreign Investment

In fields of high tech parts which domestic companies cannot produce at their current levels of technology, it would be desirable to encourage and promote joint ventures and technical tie-ups with foreign companies or investment by foreign manufacturers.

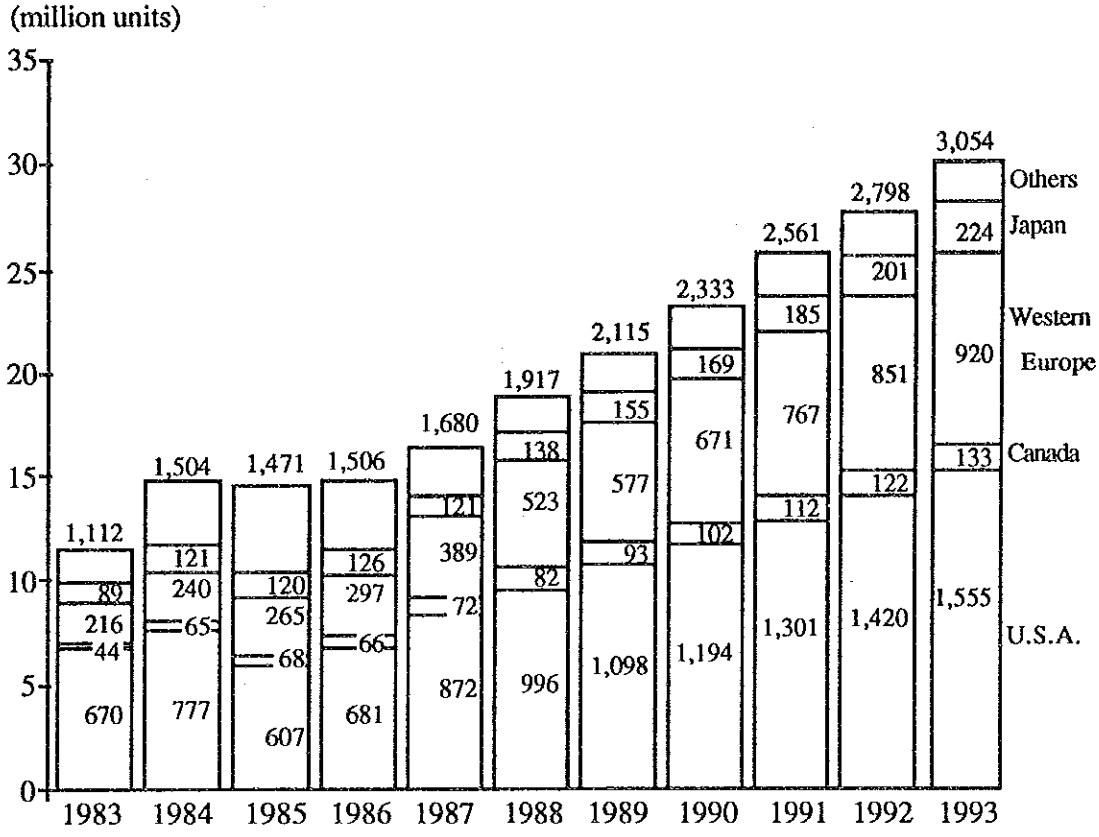
(5) Present Status of World Market

1) Market

Demand in major countries/regions is as shown in Fig. II.1-5. The U.S. constitutes the largest single market for personal computers and peripheral equipment, followed by Europe. The second half of 1988 saw a downturn in U.S. demand for personal computers, but Japanese and European demand remained healthy. In particular, the European market, which is said to lag behind the U.S. by two years, is experiencing a major increase in demand. During the period 1983-1989, the European market grew at an annual rate of 17.8%, significantly higher than the worldwide average of 11.3% for the same period. However, Dataquest predicts that during 1990-1993 U.S. demand will pick up again, with European market growth to drop off somewhat. Although small in terms of absolute size, Asian market demand is increasing at a rapid pace, with growth rates in Korea and Taiwan exceeding 50% for each of the last three years. The world market is expected to continue expanding, with annual growth of 9.4% predicted for 1990-1993.

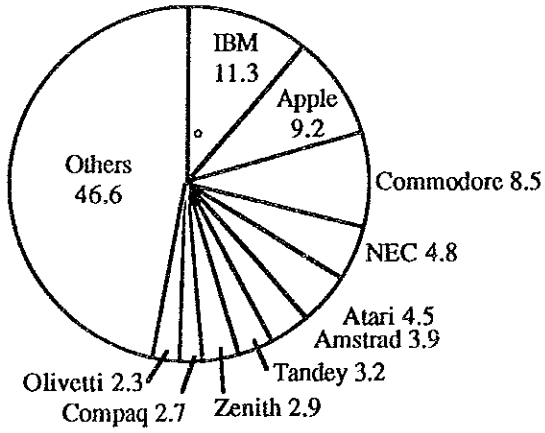
The shares held by manufacturers in the global market for personal computers are shown in Fig. II.1-6. The share of manufacturers classified under "Others" has been growing with each year, increasing from the 38.6% of 1987 to 46.6% in 1988. Japanese, Taiwanese, and Korean manufacturers account for the majority of these. Asia is estimated to supply about 25 percent of the world's personal computers.

Fig. II.1-5 Domestic Demand for P/Cs by Country/Region



Source: Dataquest: May 1989

Fig. II.1-6 Share of World P/C Market (on a volume basis), 1988



Source: Dataquest: May 1989

The markets for printers in key regions are shown in Table II.1-13. The size of the markets for monitors and keyboards is not available.

Table II.1-13 World Demand for Printers by Country/Region

(Unit: million units)

	1987	1992 (forecast)
U.S.A.	6.90	9.94
Europe	4.20	6.77
Japan	1.43	2.34
Others	0.27	0.45
World	12.80	19.50

Source: Dataquest

2) Competition

The products competing with Malaysian products would probably be from Korea, Taiwan, and other Asian NIEs. Table II.1-14 shows the current state of the computer industries in key competing countries.

In mass marketed type personal computers and monitors, Korea and Taiwan have been overwhelming strong competitively, but violent changes in their production environments since 1988 have shaken their positions and are improving the chances for Malaysian products to enter the western markets. Regarding keyboards, the biggest supplier is Taiwan, which exports even to Korea and Japan, but there are great opportunities for Malaysian products to eat into these markets as well. Due in part to the activity of Taiwanese companies in overseas production, a pattern of increased products made by Taiwanese companies in Malaysia could be realistic. The major competitor with Malaysia in keyboards, on the other hand, is Thailand. Thailand produced 2.4 million keyboards in 1989.

Table II. 1-14 Computer Industries in Competing Countries/Regions

	Korea	Taiwan	Singapore
1. History of development	1975: Production starts 1981: Export starts 1984: Korea becomes the largest P/C exporter in the world	1980: Production starts 1981: Mass production of monitors starts 1982: Mass production of P/C starts	In early 1980s: Foreign affiliated manufacturers of computer-related products moved into the country.
2. Industrial structure	The industry involves 70 major manufacturers, mainly large business group manufacturers. Since the middle of the 1980s, moves by foreign affiliated manufacturers have increased as shown in the case of approval of IBM. Almost all major international firms are represented in Korea.	Including small and medium-sized firms in related industries, the number of manufacturers is estimated at 600. The industry is characterized by the dominance of small scale firms with about 50 employees. At the same time, because of the open door policy for foreign investment, there are many foreign-affiliated manufacturers.	Except for Wearnes, there are no domestic manufacturers of any considerable size. The industry is characterized by offshore production bases of foreign affiliated firms.
3. Main manufacturers	Daewoo Communications Samsung Electronics Sampo Computer Hyundai Electronics Goldstar Dongyang Nylon	Acer Mitac Plus & Plus Daido Zenith Philips	Warnes HP DEC Apple Compaq
4. Production volume in 1989 (1,000 units)			
P/C	2,500	1,800 (semifinished products: 2,300)	888 (semifinished products: 720)
Printer	800	100	240
Monitor	Colour: 4,000 Monochrome: 4,200	Colour: 4,200 Monochrome: 3,800	Colour: 360 Monochrome: 24
Keyboard	—	7,500	480

	Korea	Taiwan	Singapore
5. Exports and Imports in 1987 (computer -related items)	Exports: US$250 million of which, U.S.: 23.6% Imports: US$180 million of which, Japan: 46.3%	Exports: NT$67,410 million of which, U.S.: 48.0% Imports: NT$19,760 million of which, Japan: 55.2%	Exports: S$960 million of which, U.S. 61.8% Imports: S$310 million of which, Japan: 38.0%
6. Domestic market size (P/C) in 1989	US$173.79 million	100,000 units	37,000 units
7. Features of production	The government has been systematically raising the required local sourcing ratio for components. The current local sourcing ratios stand at 80 percent for P/Cs and 50 percent for printers. Overall, Korea is lagging two years behind Taiwan. In terms of quality control, Korea is ahead of Taiwan. Orientation toward the production of completed product is strong.	Supply of main components such as ICs is heavily dependent on imports. Taiwan has strength in intermediate components such as power supplies, keyboards and motherboards with exports of these showing a rapid increase. The industry is very labor intensive.	About 90 percent of components are imported. Singapore is the largest supplier of hard disc drives in the world.
8. Features of sales	Exports started with the United States as the main target market. Development of the European market has been underway in recent years as part of plans to diversify markets. OEM sales to major P/C dealers are dominant. OEM production for shipment to the U.S. by Japanese manufacturers is conducted. A main selling point is the low price and profit deteriorates substantially.	Exports started with the United States as the main target market. Development of the European market has been underway in recent years as part of plans to diversify markets. Taiwanese products have penetrated the U.S. direct mail market, relying on low prices as a selling point. Although the ratio of OEM sales to exports is declining, it remains at as high as 70 percent. acer is faring well in sales of its original brand products.	Because most manufacturing is dominated by foreign affiliated firms, products are sold under parent firms' brands and through their distribution channels. Small domestic manufacturers are producing under OEM contract except for Wearnes, which has already established its own brandname in the Southeast Asian market.

	Korea	Taiwan	Singapore
9. Present status of R&D	Almost all major manufacturers have their own research institutes. ETRI, a government R&D organization, has provided support to the private sector through joint development programmes. In the early stages, a large bedget was allocated based on government sponsored development programmes. At present, ETRI's activities focus on developing general-purpose computers	Because the industry is dominated by small and medium-scale firms, domestic R&D activities take place mainly at ERSO, a government research institute. Hsinchu Science-based Industrial Park was built to attract the R&D sections of foreign firms and to provide support for technology-oriented local manufacturers. To make use of the expertise of the large number of students who study abroad, students are encouraged to return home after study.	There are no large scale R&D activities under government initiative. Because the manufacturing industry is dominated by foreign affiliated firms, the government is using promotion measures such as tax incentives and the construction of a science park to attract the R&D sections of foreign firms in Singapore. Subsidies for product development are provided to local small & medium-sized firms.
10. Problems	• Related industries such as mechatronics and device industries are lagging behind • Insufficient exploitation of domestic demand • Competitiveness erodes with the labor shortage and higher exchange rate	• Except for a limited number of firms, most manufacturers are small in size and have problems in the area of R&D, quality control and productivity improvement. • Competitiveness erodes with the labor shortage and higher exchange rate	• The industry is still relying heavily on foreign affiliated firms • As a result of the tight supply of labour, the manufacturing sector is shifting abroad.

Note: ETRI: Electronics Technology Research Institute
ERSO: Electronics Research & Service Organization
Source: Production volume: Electronic Industries Association of Japan
Export & import: Trade statistics of each country/region

(6) Profitability of Investments

1) Evaluation of Profitability of Investments

To throw light onto the possibility of promotion of the personal computer and peripheral industries in Malaysia, an evaluation was made of the profitability of investment in the case of construction of a factory in Malaysia. The results are as follows:

Basis for Analysis of Investment Profitability

Period of project	10 years	
Prices	Fixed price as of 1989	
Exchange rate	1US$ = ¥142.52, 1US$ = M$2.7027	
Production items	Personal computers	IBM-AT convertibles
	Monitors	Color monitors for IBM type P/C (14 inches, VGA convertible)
	Printer	Printers for IBM type P/C (24-pin, dot matrix system)
	Keyboards	Keyboards for IBM type P/C
Production volume	Personal computers	12,000 units per month
	Monitors	22,000
	Printers	15,000
	Keyboards	20,000

Outcome of Evaluation of Investment Profitability

	P/C factory	Monitor factory	Printer factory	Keyboard factory
Total initial investment (M$thousand)	14,254	13,997	40,343	13,227
Annual sales (10th year, M$thousand)	260,471	136,935	78,529	22,824
Annual sales/total initial investment (10th year times)	13.8	9.8	1.9	1.7
Net operating profit	From 4th year of operation	From 3rd year of operation	From 3rd year or operation	From 2nd year of operation
Operating profit ratio (10th year, %)	6.4	5.2	6.9	7.0
Year when accumlated losses are wiped out	8th year	5th year	7th year	5th year

The financial internal return rate (FIRR) in the case of a 10-year project period was calculated. The FIRR for different products was as follows:

	FIRR
P/C factory	11.83%
Monitor factory	10.58
Printer factory	6.57
Keyboard factory	7.22

When the internal rates of return are compared for four assumed factories, the investment in the personal computer factory is the most favourable, followed by the monitor factory, the keyboard factory, and the printer factory.

The ratios of annual sales to total initial investment of the personal computer factory and the monitor factory are comparatively high. 18.3 times and 9.8 times respectively, against 1.9 times for the printer factory and 1.7 times for the keyboard factory. The difference in these ratios has an influence on the results of financial analysis of the assumed factories.

For indices concerning annual operating profits, the profitability of the personal computer factory is low compared to the printer factory and the keyboard factory however the personal computer factory has the highest internal rate of return among the four factories. The second highest rate of return is shown by the monitor factory in spite of the fact that its operating profit, just like that of the personal computer factory, unfavourable compared to the printer factory and the keyboard factory. The keyboard factory shows the most favourable result for indices related to annual operating profits, but it marked the third best rate of return. The internal rate of return of the printer factory is the worst among four, which is considered to be attributable to the necessary initial investment which is relatively large against the size of sales and the operating profit ratio.

(7) Possibility of Foreign Investment

A questionnaire survey was conducted on computer-related industries in Japan on interest in investment in Malaysia. According to the results, there was only one company with specific plans for investment. As a future trend in overseas investment in industry as a whole, it has been projected that there would be an increase in production of personal computers and printers in the West and of keyboards and monitors in Malaysia and Thailand. As a production base for such products, including intermediate parts, Malaysia was judged in nine responses to "be a possible candidate site in two to three years" and in

14 responses to "have possibilities after five years" - with most companies envisioning investment in intermediate parts.

According to data on MIDA approval of investment projects, investment in computer related products, in particular components, is increasing as a general trend.The current international situation is favorable to Malaysia as an overseas production base for these industries in that (1) the current largest suppliers of mass marketed products, Korea and Taiwan, are suffering from falling competitiveness due to shortages of labor and rising production costs and therefore are active in overseas investment, (2) the need for intermediate parts in the West, where many of the finished product factories of Japanese affiliated manufacturers are located, is rising, and (3) Malaysia has a greater ability to supply parts relative to the rest of the Southeast Asian region.

(8) Comprehensive Evaluation

Table II.1-15 puts together the evaluation of the possibilities for development from the present status of six areas including the current state of production and investment profitability.

Table II.1-15 Possibility of Development

	Completed products				Intermediate components			
Items	P/C	Monitor	Printer	Keyboard	Power supply	HDD /FDD	Motherboard assembly	Printer head
1. Present status	Δ	o	Δ	oo	o	o	Δ	Δ
2. Investment plan	Δ	oo	Δ	oo	Δ	o	Δ	o
3. Local sourcing ratio	o	o	Δ	o	oo	o	o	Δ
4. Marketability	o	o	Δ	oo	o	o	oo	o
5. Investment profitability	oo	oo	Δ	o	—	—	—	—
6. Possibility of foreign investment	Δ	o	Δ	oo	o	oo	Δ	o
Comprehensive evaluation	o	oo	Δ	oo	o	oo	o	o

Note: oo = Strong possibility of development, o = some possibility of development, Δ = Slight possibility of development

Seen overall, large possibilities for growth are shown for keyboards, monitors, HDD/FDDs. On the other hand, it would be most difficult to promote production in Malaysia of printers, which consist of large numbers of precision mechanical parts.

The possibilities for development and the conditions required for the same are explained below by product.

1) Personal Computers

Production of personal computers by local companies would probably be of the level of assembly of kits by the knockdown system, with the number of computers assembled each month being only several hundred, in view of the level of technical expertise and the size of the market, even with new entries in the future.

To achieve full-scale production of personal computers in Malaysia, investment by foreign manufacturers with accumulated development technology and with markets for products of their own in the West will be necessary.

As for production of microcomputers, price competitiveness could not be achieved if parts were imported from Japan, Taiwan, etc. Therefore, the procurement and the procurement costs of multi-layer PCB, IC/LSIs, power supplies, cases, keyboards, disc drives, and general electronic components determine cost competitiveness.

2) Monitors

Monitors are technically not very different from color televisions, so existing television assembly manufacturers could easily start assembling the same. The keys to the possibility of the start of new production are production costs and the existence of markets.

Taiwan and Korea currently enjoy the merits of scale in the world market due to their mass production systems. Due to this situation, it is necessary to reduce the cost of parts procurement until sufficient price competitiveness can be achieved. In particular, a major issue will be the procurement costs of CDTs, which account for about half the prime costs of manufacture, that is, whether these can be procured domestically.

In such a case, since price competitiveness could not be achieved through mass production if targeting primarily the domestic Malaysian market, it would also be necessary to secure sales outlets in the West or in Asia.

3) Printers

Printers are assemblies of numerous mechanical components requiring extremely high precision technology, so advanced manufacturing technology is required for their production. Therefore, Japanese companies are key suppliers in the world market. Even the NIEs are not currently able to produce printers sufficiently well.

As a result, considering the current gap in technology, the fastest strategy, in the short term, would be to promote investment by foreign printer manufacturers. Due to import restrictions in the advanced countries, however, Japanese companies are establishing production bases in the West. The possibility of them moving their production bases to Southeast Asia is considered lower than that of other products.

Still, if Japanese companies continue to increasingly specialize in higher grade items, ASEAN may come into its own as a base for production of the lower grades. In such a case, the question will be whether the indigenous companies can reach the technical level enabling OEM production through technical tie-ups with foreign printer manufacturers.

Looking at costs, the key to whether production of printers is possible in Malaysia lies in wether the heads and other key components can be produced domestically. The supporting industries will have to improve their technology to do this as the gap between the level of technology of the supporting industries and the level of technology demanded is great.

4) Keyboards

Keyboards are currently being produced domestically in Malaysia and represent a field enabling easy entry by other companies in the future.

The production of keyboards is an extremely labor intensive process. There are few technical limitations, even judging from the technical level of Malaysia's assembly manufacturers.

The key to whether there will be more active production of keyboards in Malaysia in the future lies in whether price competitiveness can be maintained with respect to other low labor cost countries.

5) Disc Drives

Hard disc drives and other disc drives are already being produced in Southeast Asia. A the present time, several powerful foreign manufacturers are establishing disc

drive component factories in Malaysia as branch factories of disc drive factories in Singapore. If production of hard disc drives themselves is shifted to these factories,one may expect to see increased exports, improved local procurement of parts by computer assembly manufacturers (hard disc drives accounting for about 30% of the prime costs of a personal computer), and ripple effects to peripheral industries.

(9) Measures for Promotion of Computer Industry and Support Systems

At the present time, there are no industrial development measures specifically for the computer industry or the electronics industry. Support measures are applied horizontally in the form of investment promotion measures, export promotion measures, and research and development assistance. Current measures of support relating to the computer industry are as shown in Table II.1-16. As evidenced by the introduction of incentives for R&D and in-house training in 1986, support has changed to meet with the situation and problems of the industry at the time. While some support measures have not revised fast enough to keep up with the changes in the industry and have therefore fallen in effectiveness, it is important to continue to reevaluate measures in the future so as to properly reflect the current industrial situation. In the table, problems in existing support measures and measures for improvement envisioned for the same are shown.

Table II. 1-16 Sub-sector Promotion Measures for Computer Industry

	Present supporting system/programmes	Problems	Presumed additional measures for support/improvement
1. Investment	• Investment incentives through pioneer status and ITA		
2. Export	• Exemption from and reduction of duties on intermediate goods at FTZ and LMW • Export Credit Refinancing (ECR) • Abatement of adjusted income for exports • Information supply, inquiry services and holding of exhibitions by MEXPO	• All of these are small in scale	• Expansion of MEXPO
3. Financing	• MIDF loans	• High interest rates • Access is difficult for small and medium -scale firms	• Creation of low interest rate loan scheme for industry • Strengthening credit guarantee scheme
	• CGC loans	• Ceiling on loans is too low • Applicants are limited to small firms	• Expansion of qualified applicants and loan limits of CGC loan scheme
4. Human resource development	• Tax deduction for building and costs required for in-house training	• Difficulties in obtaining approval	• Review of current application standards and announcement of new standards
	• Fostering of skilled workers at vocational training schools/Politechnics	• Mismatched with needs of the industry, insufficient numbers • Obsolete curriculum	• Examination of establishment of government /private technical training centers • Expansion of vocational training schools
	• Fostering of engineers through education at universities	• Electronics education lagging behind at universitied	• Review of curriculum • Strengthening of electronics courses in universities' curricula
	• Widespread use of P/Cs at primary and junior high schools	• Insufficient number of instructors • Low level of utilization	• Fostering of instructors • Review of plans for widespread use of P/C

	Present supporting system/programmes	Problems	Presumed additional measures for support/improvement
5. R&D	• Tax deduction of building and cost required for R&D	• Difficulties in obtaining approval • Small number of companies with R&D divisions	• Review of current application standards and announcement of new standards • Strengthening of incentives • Creation of research funds
	• Joint research by MIMOS	• Small capacity at MIMOS	• Review and expansion of MIMOS functions • Training of MIMOS staff • Invitation of engineers from overseas
	• Establishment of technology park	• Small benefits for companies located in the park • Temporary operation	• Preparation of blueprint for the future technology park
	• Fostering of system engineers at INTAN	• Training of SEs and programmers, for which strong demand exists, is lagging behind due to a reduction in basic courses	• Expansion of basic courses
		• Training is limited to government officials	• Reception of instructor-trainees from firms
6. Quality control activities	• Establishment of courses and holding of seminars by NPC	• Limited coverage area • Many firms lack know-how	• Implementation of guidance through visits to firms • Increase in the number of seminars and preparation and supply of manuals • Introduction of consultants
		• Unclear quality standards	• Introduction of inspection system • Promotion of guidance and support for parts manufacturers by assembly manufacturers
7. Development of supporting industry and others	• Subcontracting scheme by MTI	• Low level of utilization	• Expansion of schemes and PR • Preparation and supply of directory of parts manufacturers
	• Tax incentives and financial support scheme for small and medium-scale firms		
	• MIDA services for introduction of technological tie-up and joint venture partners	• Low level of utilization	• Expansion of services and PR
	• Establishment of industrial technology assistance fund	* At the moment, details of the plan are undecided.	

(10) Future Directions

The Possibility for development of the computer and peripherals industry in Malaysia is shown in Fig. II.1-7. The final goals of the development are the achievement of export of the products made in Malaysia and the promotion of higher activities including R&D. To achieve the goals, the successful invitation of the investment of overseas computer-related manufacturers and their starts of mass production in Malaysia are necessary.

The measures which would considered to be effective in order to achieve the development of the industry are shown in Fig. II.1-8. The measures are largely divided into i) those for the intensification of investment promotion activities, ii) those for the amelioration of production condition in Malaysia, iii) those for the development of the foundations of the industry.

1) Intensification of Investment Promotion Activities

In light of the current situation of the computers & computer peripherals market and technology therein, the invitation of foreign investment is crucial if Malaysia's computers & computer peripherals industry are to be developed at a rapid pace. Thus the first priority of a development policy should be measures to promote foreign investment.

Specifically, measures should be considered to (i) strengthen activities to promote foreign investment and (ii) improve the production environment. In view of the broader possibilities for investment in Malaysia and the far-reaching impact it would have on industry as a whole, wide range of manufacturers, including related parts manufacturers, should be covered by measures for the promotion of foreign investment.

2) Amelioration of Production Conditions in Malaysia

In terms of the improvement of the production environment, targets should include (i) development of human resources and (ii) a higher ratio of local sourcing of components. In the area of human resource development, it is necessary to improve training of supervisors, skilled workers and engineers, particularly in design. For the development of the components industry, efforts must be made to improve technology, marketing and quality control.

3) Development of the Foundations of Computers and Computer Peripherals

It is necessary to create a more encouraging environment for R&D to reverse the current trend toward insufficient R&D activities at the level of domestic private firms, to accumulate original technologies and to develop human resources through the strengthening of R&D activities by government organisations.

Fig. II. 1-7 Possibility for Development of Computers and Computer Peripherals Industry

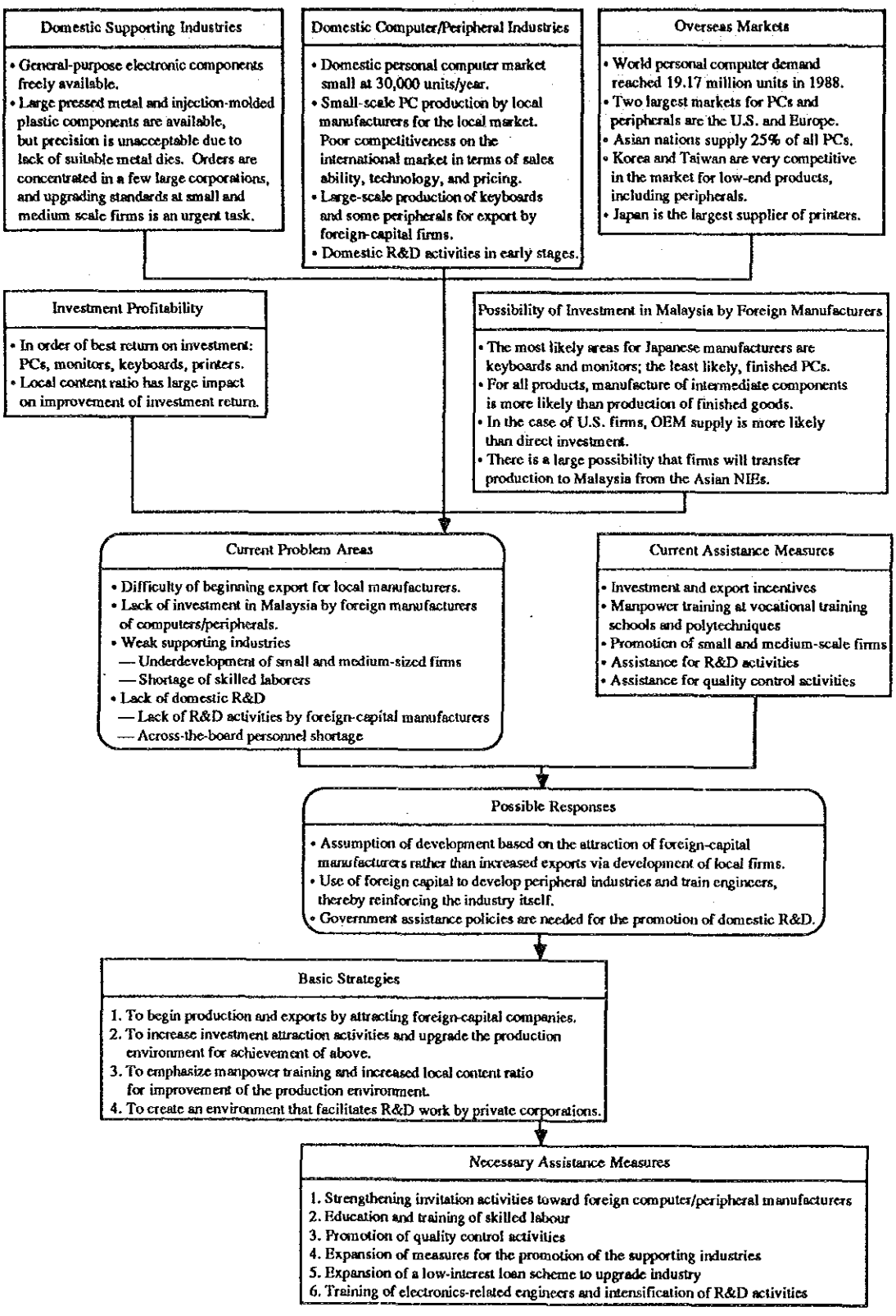


Fig. II. 1-8 Necessary Measures to Realise the Development Scenario of Computers and Computer Peripherals Industry