4. PLASTIC MOLDING INDUSTRY

4.1 OUTLINE OF THE PLASTIC MOLDING INDUSTRY

4.1.1 Development History of the Plastic Molding Industry

The major plastic molding products in Indonesia include furniture, sundry goods, tableware, sheets, and fishing nets, which are made of general purpose plastic resins.

Recently, the production of high value-added products, such as automotive parts, parts for industrial machinery, and parts for household electrical products, has begun. These parts are mainly supplied to foreign affiliated large-scale automotive assemblers and electrical/electronic manufacturers, which are located in Indonesia and neighboring countries. Keeping pace with the expansion of automotive production and electrical/electronic production, demand for parts is considered to keep growing.

In addition, many assemblers located in Indonesia are trying to increase the localization of plastic parts. After all, the expansion of the plastic molding industry, the development of plastic molding technology, and the improvement of quality are strongly requested.

4.1.2 Size and Location of the Plastic Molding Industry

The flow of the number of companies and the number of employees in the plastic molding industry in Indonesia are shown in Table 7-4-1. In 1994, there were approximately 800 companies, and about 80 thousand employees are engaged in the industry. In the last 10 years, the industry has kept growing , and is expected to show an upward trend through the end of this century.

Table 7-4-1 Size of the Plastic Molding Industry in Indonesia

	1986	1987	1988	1989	1990	1994
Number of Companies	544	558	654	663	687	800
Employees (000)	50	51	60	62	76	80

Source: CIC Report; Interview with APINDO by the Study Team

As shown in Table 7-4-2, there are approximately 30 to 50 plastic mold makers in Indonesia. The size of each company varies from 10 to 50 in terms of the number of employees.

Table 7-4-2 Plastic Mold Makers in Indonesia (1996)

Number of Companies	Location
30 to 50	Jakarta, Bekasi, Tangerang, Bogor, Bandung, Semarang, Surabaya, Medan

Source: Interview survey by The Study Team

More companies in both the plastic molding industry and the plastic mold making industry are located in JABOTABEK than any other region. This is because many assemblers, which are customer companies of the both industries, are located in the area.

Besides JABOTABEK, some plastic molding companies are located in Bandung, Surabaya, Semarang, and Batam. They mainly supply assemblers in these areas with their products. Plastic mold makers are located in Surabaya and Semarang, but have so far not located in Batam.

4.1.3 Production and Demand

Demand for plastic resins in Indonesia in 1995 reached 700 thousand tons as shown in Table 7-4-3.

Table 7-4-3 Flow of Demand for Plastic Resins in Indonesia

Year	1986	1987	1988	1989	1990	1992	1995
Plastic Resin (000 tons)	165	246	356	458	550	650	700

Source: JETRO Report

Table 7-4-4 summarizes the kind of plastic resins used in Indonesia. Approximately 90 to 95% of the plastic molding products are made of general purpose plastic resins, while 5 to 10% of the products are made of engineering plastic resins.

Table 7-4-4 Kind of Plastic Resins Used in Indonesia

Category	Representative Product	Market Share
Ordinary Plastic Resin	PP, PE, PVC, PS, ABS	90 to 95%
Engineering Plastic Resin	PA6, POM, PC, PBT	5 to 10%

Because there are no nation-wide industrial associations in the plastic mold making industry, the Study Team could not obtain the exact production volume of plastic molds. Only seven leading companies in the industry participate in APINDO (Indonesia Plastic Manufacturing Association).

According to the interview survey with those companies by the Study Team, the demand for plastic molds in Indonesia is about to show a substantial increase. Further, according to the interview survey, approximately 90% of molds are imported from countries such as Korea, Taiwan, and Singapore. From Japan, used molds for household utensils and sundry goods are imported. In many cases, these imported molds are returned to the manufacturers in foreign countries for maintenance.

According to the interview survey with assemblers, it is considered that the demand for domestic molds is likely to expand very rapidly because an increasing number of assemblers are eager to increase local procurement from the point of view of production period and cost. Therefore, the expansion of production capacity of plastic molds in Indonesia is strongly requested by them.

4.1.4 Production by Type

Plastic molding products manufactured in Indonesia are categorized as follows:

1) Pipes, sheets, etc.
2) Products made of thermo-plastic general purpose plastic resins
3) Products made of thermo-plastic engineering plastic resins
4) Products made of thermosetting plastic resins
5) Metal insert products
6) Other plastic molding products

Among them, products, which fall in categories (1) and (2), account for the majority, while products in categories between (3) and (6) are small in quantity. Some representative product items in the categories are as follows:

Category 1): PVC pipes for piping work, PVC sheets, Building materials
Category 2): TV cabinets, Radio-cassette housings, Parts of washing machines, Parts of refrigerators, Battery cases, Household utensils, Tableware
Category 3): Parts of switches, Parts of counters
Category 4): Insulating parts, Melamine tableware
Category 5): Bolt caps, Rollers
Category 6): Styro-foam packing materials, Toys

As far as molds are concerned, the following types are produced in Indonesia.

(i) Size: 20 tons to 350 tons
(ii) Material: Non-heat treated carbon steel (S20C class), Prehardened steel
(iii) Structure: Monoblock structure, Engraving mold
(iv) Standard parts: Mostly imported from Korea and Taiwan. Some parts imported from Japan.

4.2 EVALUATION OF MANAGEMENT AND PRODUCTION

4.2.1 Business Management

(1) Labor Management

In the plastic molding industry, two-shift operation and three-shift operation are the norm. In the plastic mold industry, one-shift operation with overtime is widely adopted. Part-time employees are often used at the divisions of product inspection and assembly. High turnover of employees is observed in the plastic molding industry, and companies cope with the problem through the standardization of work processes. However, many companies struggle to secure supervisory level employees, who are indispensable for the plastic molding of new products.

In general, the development of mold engineers takes time. Further, the recruitment of engineers is quite difficult because they are lacking in the country. As a result, especially at factories owned by Chinese merchants, relatives of owners often take the positions as heads of technical divisions, and try to reduce the turnover in engineers.

(2) Human Resource Development

Operators of plastic molding are generally trained through on-the-job training (OJT). On the other hand, many companies have difficulties in the development of supervisors because of the lack of appropriate education/training institutions, technology information, and experts.

Fortunately, APINDO has a plan to open plastic training schools in late 1996, aiming at the development of basic skills of plastic injection molding operators. The training schools will give short-term training programs to employees of companies. The details of the curriculums taught at the schools are presently being worked out with the support from Australian government. At this moment, they are planned in Jakarta and

Surabaya.

For the human resource development of the plastic molding industry, the Japanese government may give support such as the dispatch of experts through JODC as well as the AC scheme of JETRO.

The development of mold engineers is made through OJT at each company. Besides, POLMAN (Politeknik Manufaktur Bandung) has a plastic injection mold design course and a machining course in the field of plastic molds. Training at POLMAN is practical yet effective human resource development, but the number of students is limited because the courses are long-term and carried out in Bandung.

In addition, the lack of magazines and textbooks of plastic molding hampers the smooth human resource development in the industry.

(3) Financial Management

In many companies, used plastic injection molding machines and machine tools are used to reduce initial investment costs. A large amount of used plastic injection molding machines are imported via Jakarta and Surabaya. New machines are often determined based on cost against performance. As a result, the latest machines made in Japan, Europe, or the U.S.A. are rarely imported. Instead, Taiwanese and Chinese machines are often chosen. Some companies borrow money from banks after their customer companies stand surety for them.

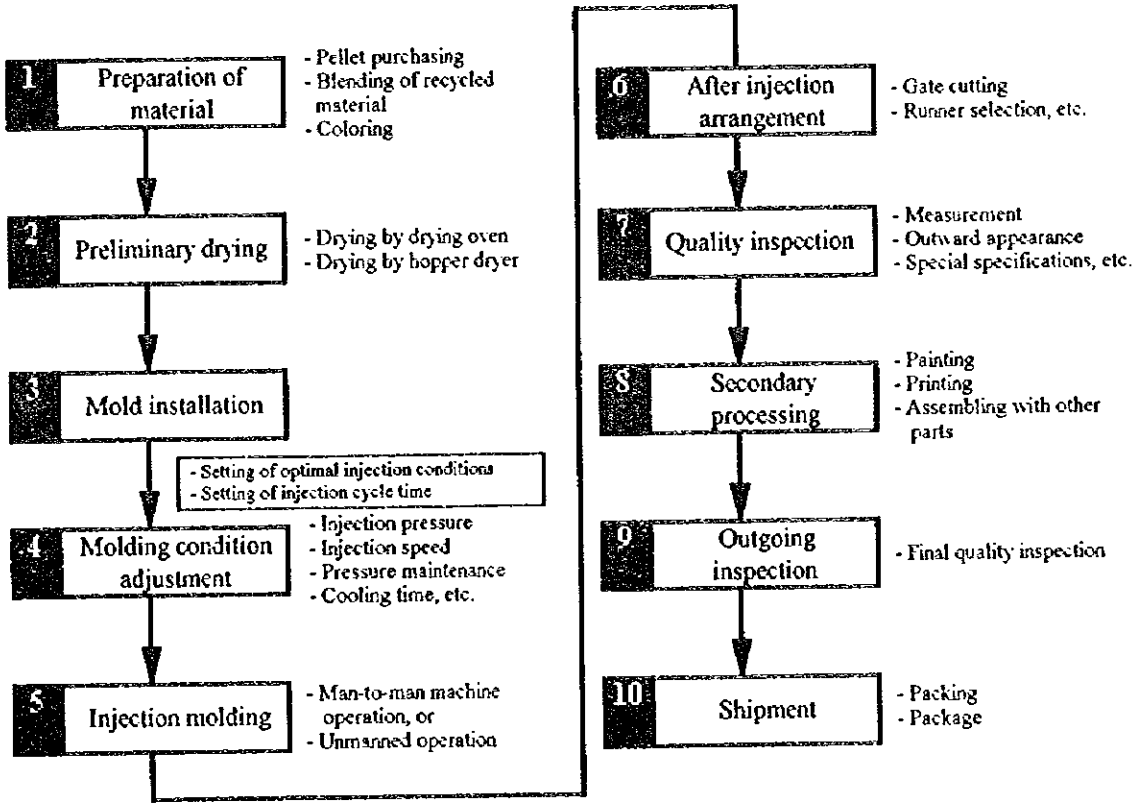
Plastic injection molding companies have to maintain high levels of stocks of materials, steel, and articles of consumption, considering the underdeveloped distribution system. This causes companies difficulty in financial management under the present conditions of high interest rates.

4.2.2 Production Management

(1) Plastic Molding

The production flow of plastic injection molding in Indonesia is illustrated in Figure 7-4-1.

Figure 7-4-1 Production Flow of Plastic Injection Molding



In the above process flow, it is suggested, as a result of the Study, that the following problems be solved.

a. Although engineering plastic resins are totally imported, appropriate inventory control methods are not adopted.

b. The stability of the quality of domestic resins is not quantitatively measured. Data such as mixed foreign matter, coloring, and MI values are not measured.

c. In the case of recycled resins such as ground runners or domestic resins being mixed with imported virgin resins, the study on the correlation between the rate of mixing and the quality of products is ignored.

d. Knowledge about how to decide the appropriate conditions of plastic molding is lacking. In addition, the training of such knowledge is not carried out.

e. Most companies are not equipped with thermoregulators or surface thermometers to control the temperature of molds.

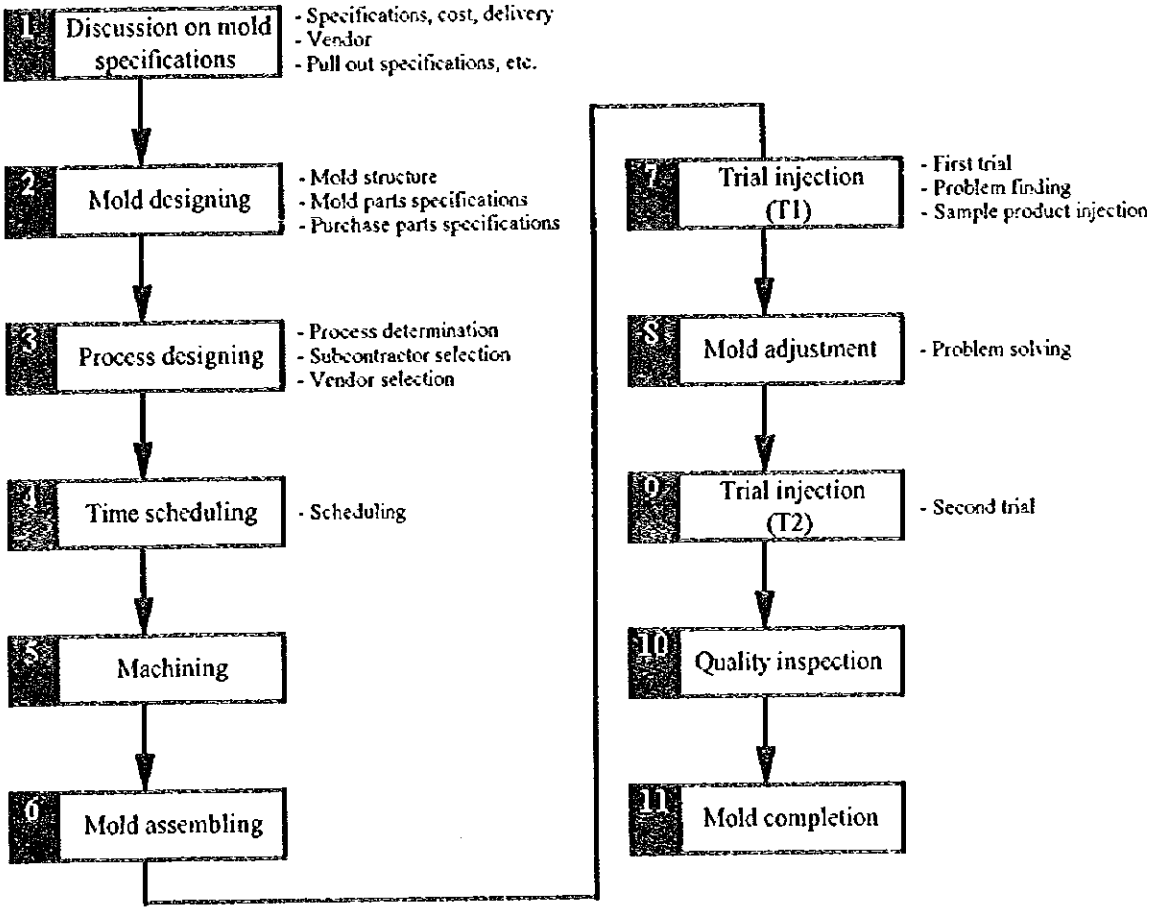
f. Measuring technology and measurement equipment such as slide calipers, micrometers, and stereoscopic microscopes have not spread.

g. Problem solving capability on technical troubles is very low.

(2) Plastic Mold Making

The production flow of plastic molds is illustrated in Figure 7-4-2.

Figure 7-4-2 Production Flow of Plastic Molds



In the above process flow, it is suggested, as a result of the Study, that the following problems be resolved.

a. Smooth discussion on mold specifications with foreign affiliated assemblers, including Japanese affiliated assemblers, is often disturbed because of poor communication (language) capability.

b. The number of mold engineers is limited. In addition, the development of such engineers is not systematically done at most companies.

c. Machining skill is generally low. Because standard processing time is not set, production scheduling is not properly made.

d. In many cases, machining condition, tool selection, and tool grinding are not properly done.

e. Special steel for molds is totally imported.

f. There are few heat treatment factories in the country.

g. There are few plating factories which can conduct hard chrome plating.

h. The polishing and adjustment of molds are not properly conducted.

i. The capability of troubleshooting after a trial injection is very low. There are few engineers, who put together parts into molds with strong leadership. Mold engineers are lacking in experience, and do not have good judgment.

j. Quality inspection standards are not established at many companies.

4.2.3 Production Facility

The present situation of production facilities in the plastic molding industry and the plastic mold making industry is as follows:

a. Plastic injection molding machines

Many Japanese machines and Taiwanese machines are used. More than one half of all machines in the country are used ones.

- 10 to 75 tons : small plastic parts
- 75 to 350 tons : parts of audio and visual equipment, etc.
- 350 to 2,000 ton class : parts of TVs and air conditioners, etc.

b. Thermoregulators

Diffusion rate is low; 30 to 70% of the number of injection molding machines.

c. Preliminary drying ovens for resins

Some kinds of ovens are installed.

d. Surface thermometers

Surface thermometers are rare.

e. Milling machines

Many machines are used ones imported from Taiwan, China, and Japan. Only a limited number of companies are equipped with NC milling machines and machining centers.

f. Surface grinder

Taiwanese and Japanese used machines are the mainstream. Diffusion rate is still low.

g. Lathes

Chinese and Taiwanese machines are widely used. Lathes are popular, and spread more than any other machine in terms of volume.

h. Electric discharge machines

Electric discharge machines are rare. Machines made in Japan, Taiwan, and Switzerland are used by some companies.

i. Wire cut electric discharge machines

Same as the case of electric discharge machines, the diffusion rate is very low. Some companies use machines made in Japan, Taiwan, and Switzerland. In addition, Chinese machines are used for rough cutting.

j. CAD/CAM

Only a few excellent companies have introduced CAD/CAM systems.

4.2.4 Source of Material

The present situation of the availability of materials in Indonesia is as follows:

a. General purpose plastic resins

As of 1996, plastic resins such as PP, PE, PVC, PS, and AS are produced in Indonesia. Besides the domestic resins, these types of resins are imported from Japan and the USA. Imported resins are often used for parts, which are supplied to foreign affiliated assemblers, based on their long experience.

The price level of domestic HDPE resins is Rp. 2,650/kg, while that of Taiwanese ABS resins is Rp. 3,500/kg.

Table 7-4-5 Major Manufacturers of Plastic Resins in Indonesia

Name of Company	Plastic Resin	Brand Name
P.T. Petrokima Nusantra Indo	PE	
P.T. Tripolyta Indonesia	PP	
P.T. Chandra Asri	PP, PE	
P.T. Polychem Lindo	PS	Polyron
P.T. Pacific Indomas Plastic Indonesia	PS	Styron
P.T. Strindo Mono Indonesia	PS	
P.T. Asahimas Subentra Chemical	PVC	Asnyl

b. Engineering plastic resins

As of 1996, engineering plastic resins such as POM, PBT, PC, PA6, and PA66 are totally imported. The major exporting countries of engineering plastics to Indonesia are Singapore, Japan, and the U.S.A. There are no production plans of

engineering plastic resins in Indonesia.

c. Thermosetting plastic resins

Polyurethane resins and unsaturated polyester resins are domestically produced. Melamine resins wholly depend on import.

d. Steel materials for molds

Special steel for molds is totally imported. The major exporting countries of special steel to Indonesia are Japan, Singapore, Sweden, and Germany. There are several steel wholesalers in the country, and they distribute special steel to customers through regional domestic wholesalers.

e. Mold bases

Mold bases made in Taiwan, Hong Kong, and Singapore are popular. Some Japanese affiliated automotive parts manufacturers import Japanese mold bases.

f. Sandra parts of molds

Most standard parts are imported from Taiwan and Korea. Recently, Japanese standard parts have been introduced.

4.2.5 Factory Operation and Quality Control

The major sales promotion activities of plastic molding companies and plastic mold making companies are done by the top management of these companies so as to gain strong relationships with foreign assemblers. Many companies wish to receive JODC experts so that stable business relationships especially with Japanese companies can be maintained.

Concerning factory operation, the difficulty of securing and training middle class managers is pointed out as one of the major problems. As far as quality control is concerned, intermediate inspections in the production process are rarely carried out. Inspection is done by many workers at the last stage of the production process. Since general workers

hardly understand the basic knowledge of quality control, the dissemination of scientific quality control is required. In addition, general purpose measurement equipment is insufficient. The delay of the integration of industrial standards is pointed out as another problem.

4.2.6 Research & Development and Design

The research and development ability of companies, in general, heavily depends on the skills and the number of engineers. Especially in the field of the research and development of plastic molds, it is quite difficult to secure engineers. As a result, the research and development ability of plastic molds in Indonesia is regarded as being extremely low. The plastic injection mold design course of POLMAN is one of the producers of plastic mold engineers. APINDO has a plan to hold seminars of plastic mold design in the future although it is yet to be realized.

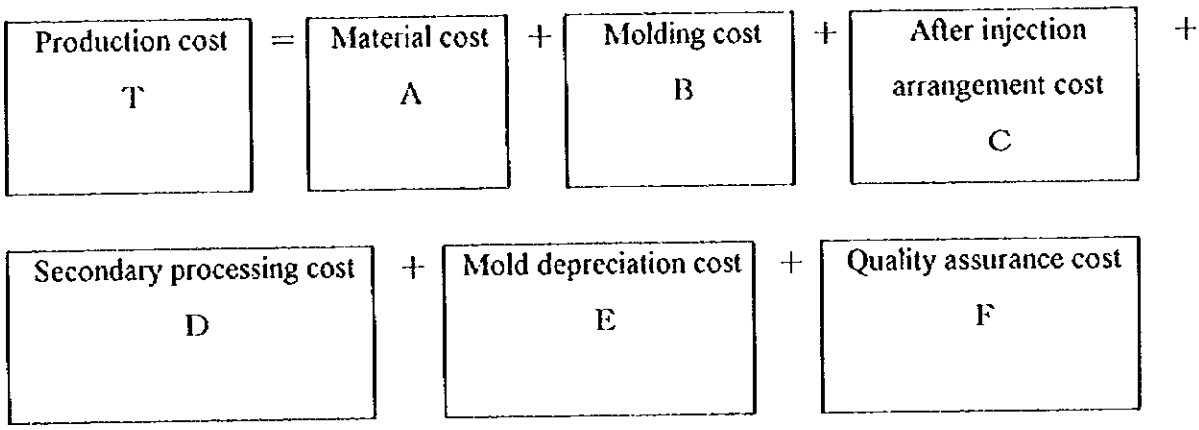
The Study Team observed graduates from Politeknik Elektronika Surabaya designing plastic molding products at assemblers. They have obtained machine design skill through OJT training because they did not study mechanical drawing and machine design at college. Generally mechanical drawing or machine design is not taught at the electrical and electronic engineering divisions of colleges. It is considered to be effective for higher education in electrical and electronic fields to adopt some courses of mechanical engineering so as to increase the research and development capability of the Indonesian plastic molding industry.

4.2.7 Cost Analysis

(1) Plastic molding

Figure 7-4-3 gives the cost structure of plastic molding products.

Figure 7-4-3 Cost Structure of Plastic Molding Products



The characteristics of each unit cost are summarized as follows:

A (Material cost): There is some room to reduce material cost by switching from imported material to domestic material.

B (Molding cost): Direct labor cost in Indonesia is lower than that in Thailand, Malaysia, or Singapore. However, this advantage is, in many cases, canceled out by the lack of skills to shorten the cycle time, to improve defect ratio, and so on.

C (After injection arrangement cost): This cost relates to work such as gate cutting and runner selection. These are simple jobs, which do not need special skills, and therefore Indonesian companies can fully take advantage of cheap domestic labor.

D (Secondary processing cost): This cost includes work such as painting and silk printing. Although cheap labor contributes to cost reduction, loss caused by defecting products offsets the reduction.

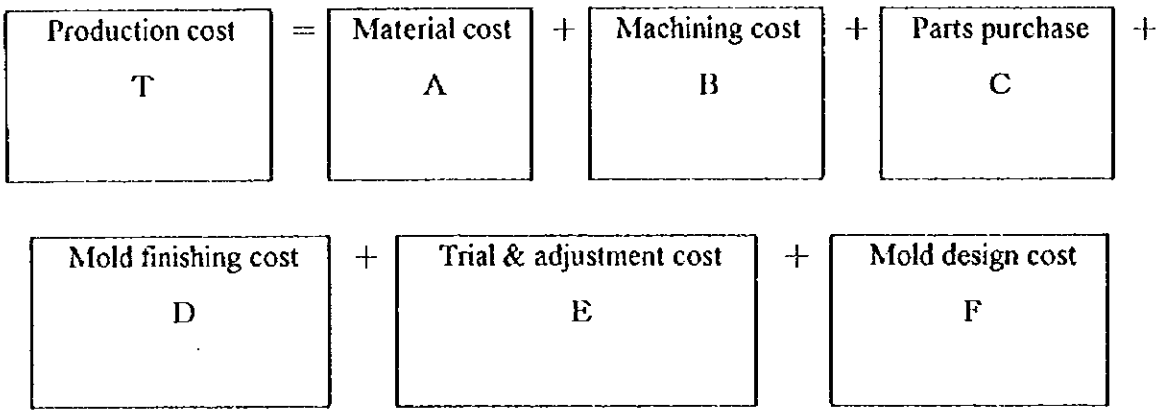
E (Mold depreciation cost): When imported molds are used, this cost wold be very high. Of course, the cost would not be incurred if plastic molding companies borrowed molds from customers.

F (Quality assurance cost): Because the defect ratio of molding is generally high at domestic companies in Indonesia, this cost tends to be higher than that in other countries.

(2) Plastic Mold Making

Figure 7-4-4 gives the cost structure of plastic molds.

Figure 7-4-4 Cost Structure of Plastic Molds



The characteristics of each unit cost are summarized as follows:

A (Material cost): Although special steel for molds totally depends on import, material cost is nearly as much as that in other countries.

B (Machining cost): Machining cost is basically lower than that of other ASEAN countries because depreciation cost is kept low and direct labor cost is cheaper in Indonesia. However, time for machining is twice to three times that of advanced countries because of underdeveloped machining skill. Consequently, total machining cost has become a little bit lower than that of other ASEAN countries.

C (Parts purchase): In the short-term, standard parts imported from Taiwan or Korea

may lower parts purchase cost. Taking the life and reliability of parts into consideration, however, Japanese standard parts, of which initial purchase cost is higher, are considered to lower the total cost in the long run.

D (Mold finishing cost): Indonesia has a competitive edge in works such as low level polishing and simple assembling using cheap labor. However, high level skills such as mirror-like finishing depend on foreign companies, and this may increase mold finishing cost.

E (Trial & adjustment cost): Because Indonesian domestic companies, in general, do not have enough expertise to design and make molds, they are not capable of trouble solving which is often fournd after the first trial (T1). Subsequently, they are obliged to modify molds several times. This pushes trial and adjustment cost upwards. In other words, if they could solve this sort of problem, they could definitely lower the trial and adjustment cost.

F (Mold design cost): Because mold engineers are in extremely short supply in the country, their wages tend to be higher than other kinds of engineers. As a result, mold design cost tends to increase.

4.2.8 Marketing and Product Distribution

A problem common to both the plastic molding industry and the plastic mold making industry is insufficient sales promotion capability. It is necessary for domestic companies to secure those who are proficient in foreign languages and are skilled in management so that they can receive orders from foreign affiliated large-scale assemblers. However, there are very few of those types of persons nationwide, and that has become one of the major marketing problems for domestic companies. There are some cases that orders from assemblers were taken away by newly established foreign affiliated competitors because of the lack of able marketing persons in domestic companies.

Plastic molding companies are often located near their customer assemblers, and parts are distributed to the neighboring customers by automobile. Sometimes, air transportation is employed for small parts.

4.3 EVALUATION OF TECHNOLOGY LEVEL

Based on the diagnostic check by the Study Team, the technology level of Indonesian domestic companies is evaluated as given in Table 7-4-6.

Table 7-4-6 Technology Level of Indonesian Domestic Companies

Industry	Points	Evaluation	Note
Plastic Molding Manufacturers	2 to 3.5	C	Low to medium level in ASEAN
Plastic Mold Makers	2 to 3	D	Low level in ASEAN

4.4 IMPROVEMENT TARGETS

Based on the results of the Study, the improvement target is determined as shown in Figure 7-4-5 for the plastic molding industry and Figure 7-4-6 for the plastic mold making industry. It is suggested that the Indonesian government take measures to achieve the target so that the industries can develop.

Figure 7-4-5 Improvement Target of Priority Essential Technologies (Plastic Molding)

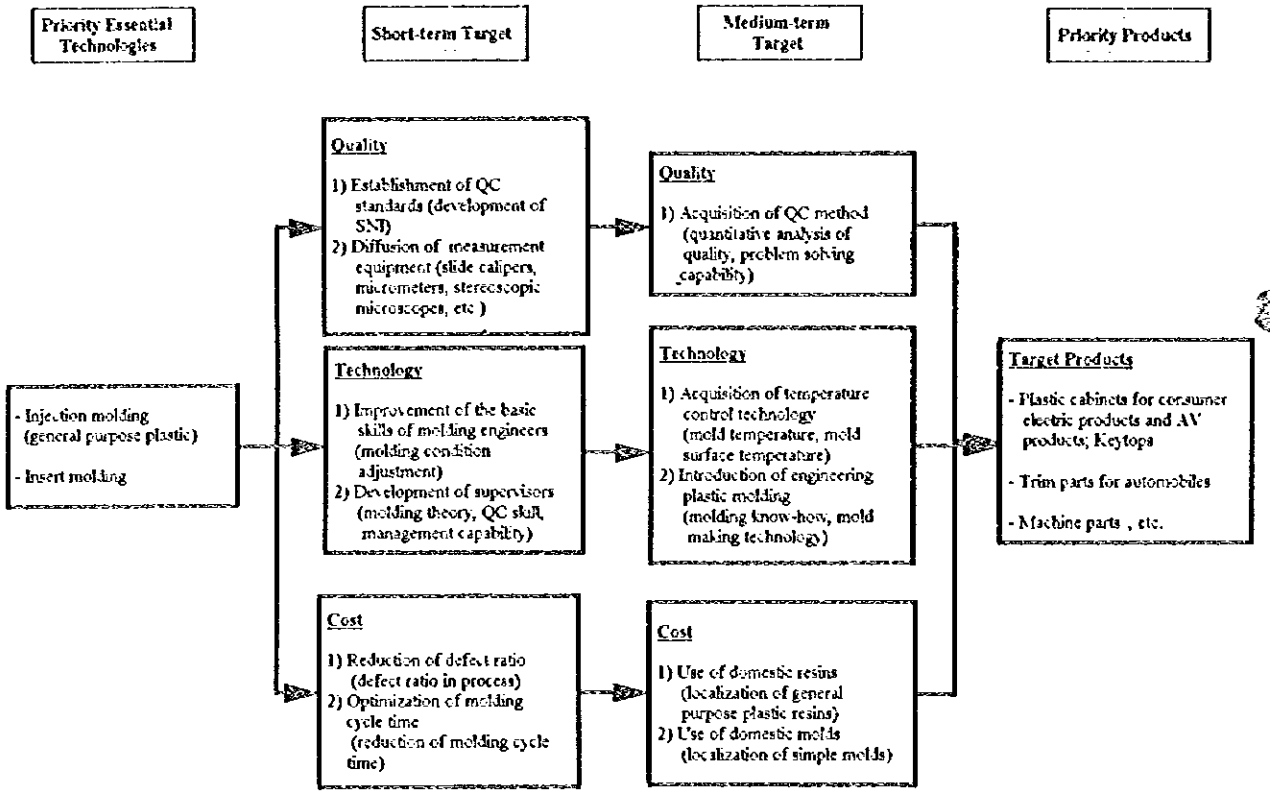
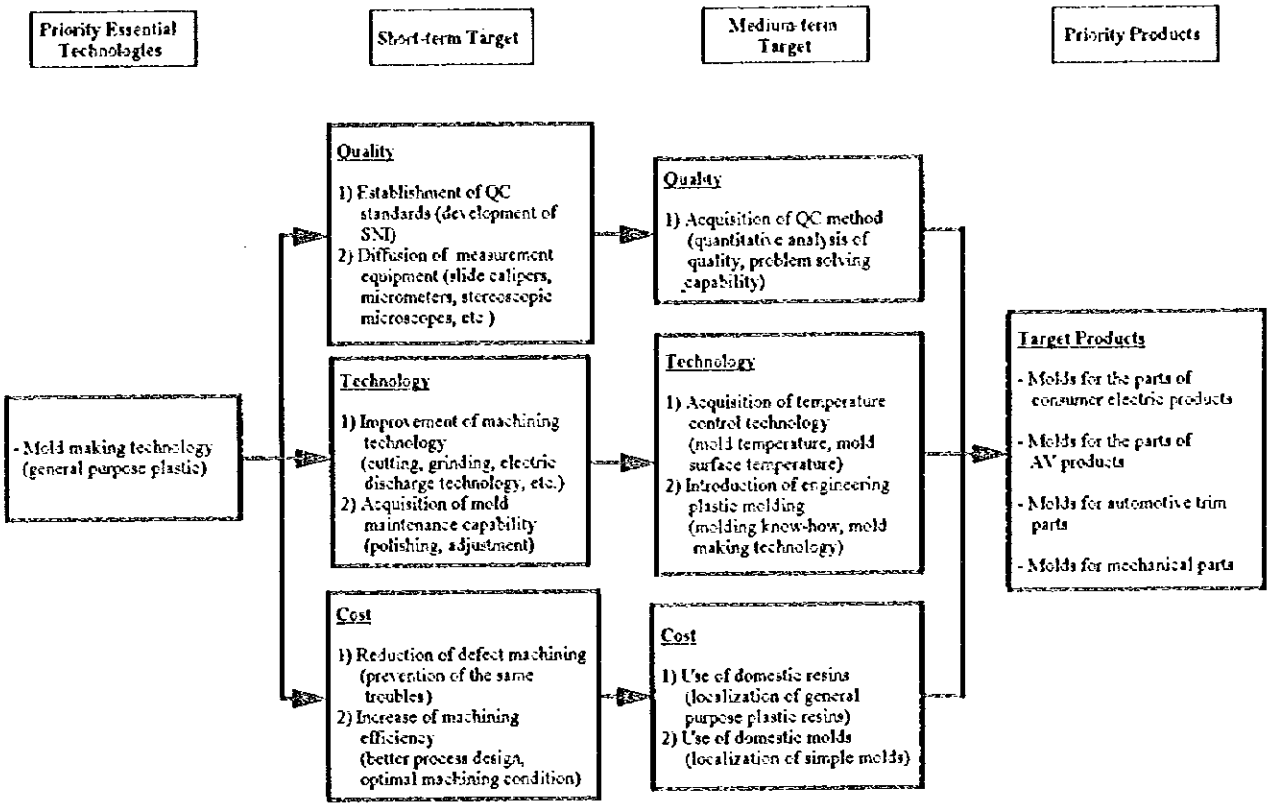


Figure 7-4-6 Improvement Target of Priority Essential Technologies

(Plastic Mold Making)



5. MACHINING

Machining can be defined as the machine processing of metal by tools (cutting) based on the drawings. Therefore, in this section machining is mainly cutting and grinding work.

5.1 OUTLINE OF THE MACHINING INDUSTRY

5.1.1 Historical Transition of the Machining Industry

It seems that the machining industry of Indonesia historically began with the process of exploiting the country's plentiful natural resources (primary products). Equipment for processing the primary products was imported from advanced industrial countries.

Periodical maintenance of the equipment was implemented for sound operation. Therefore, supply of spare parts for the equipment was necessary. It can be considered that the machining industry in Indonesia was structured to meet the demand.

At the early stage of the machining industry, parts production was carried out without any product drawing, but with just by copying the actual parts provided from the client as product samples. A small amount of products were produced by this method.

Therefore, the machining industry had been using universal equipment so far. However, in accordance with the emergence of mass production products such as cars and electric household appliances, etc., the machining industry in Indonesia is now at a turning point of installing specialized and automated equipment in order to maintain high product quality and to improve productivity.

5.1.2 Number of Machining Companies, Production Ability and Scale of Demand.

The exact total number of machining companies in Indonesia is not clear, as there are many individual owner businesses. For example, in setting up individual businesses, there are

many cases of starting in the business by renting machining equipment from lease companies.

In accordance with mass production industries being established in some metropolitan areas such as Jakarta and Surabaya, related industries also developed locally around those areas.

In the future, exact information on the machining industry should be prepared in order to maintain a smooth supply of relevant information and instructions by governmental organizations and/or industrial associations for the industry.

5.1.3 Production Type

Based on the characteristics of the business, production types of the machining industry can be categorized as follows.

i) Production oriented for primary products
ii) Production intended for repair parts (production of automobile parts, etc.)
iii) Production oriented for mass production

Each company in item i) above is established at the relevant natural resource location depending on the production type.

Companies of item ii) are established in high population urban and/or industrial cities.

The above two types of companies are involved mainly in small lot production or intermediate scale mass production.

Companies of item iii) are the supporting industry investigated in this study, supplying high quality parts based on specific production plans.

5.2 FEATURES OF THE AUTOMOTIVE INDUSTRY AND MACHINING INDUSTRY

5.2.1 Machining for Automotive Parts

Automotive parts are largely divided into the following.

(1) Functional Parts

Exclusive parts makers supply automotive parts such as fuel pumps, tires, batteries, electrical apparatus, etc. Assemblers purchase the parts in accordance with technical specifications for their own cars.

There are many functional parts makers producing such specialized parts on a continuing basis. There are several large makers such as NIPPON DENSO in Indonesia.

(2) Standard Parts

Standard parts, such as fasteners; bolts, nuts, washers, springs, etc., are produced in compliance with JIS or other national standards.

Standard parts are used to reduce product cost at the design stage. Specialized makers of standard parts can reduce costs and maintain a stable supply of particular products by automated large-volume production. However, considering the level of industrialization in the developing countries, imports are cheaper because of the small-volume of commercial transactions. In the case of Indonesia, assemblers and exclusive parts assemblers import standard parts where high quality is required.

(3) Exclusive Parts

Exclusive parts are developed by the assemblers based on their own design. Each

assembler is trying to procure domestically exclusive parts on a constant basis. In order to procure these parts with more consistency, assemblers can maintain production of their products by the following methods in less developed technology areas or less developed regions in Indonesia.

i) Request the existing company to establish a factory as a Joint Venture in Indonesia, and the assembler can procure parts from the new company.

ii) To find appropriate local companies and develop them by provision of technical know-how through business transactions.

However, exclusive parts developed by one assembler are not changeable with the parts of other assemblers. It impossible to procure the parts from the other assemblers. Accordingly, urgent parts for production depend on imports.

The field survey results show that assemblers need to promote the upgrading of technology which is discussed in this report.

5.2.2 Features of Machining (Automotive Parts)

(1) Type of Management

Automotive parts suppliers are divided into the following types from the viewpoint of marketability.

i) Parts production for assemblers
ii) Parts production for the after-market
iii) Repairing parts for the after-market

In the case of item i) above, parts for new car assembling are supplied to assemblers. Parts can be divided into functional, standard and exclusive parts.

In the case of item ii) above, parts consist of several types of different size to be used for repair purposes.

In the case of item iii) above, parts such as crankshaft pulleys, cylinder heads, etc. are repaired and overhauled for resale. Because of the highly individualized nature of such repair, it is difficult to achieve large-volume production.

In the case of item i) above, parts suppliers should produce parts in accordance with the assemblers production conditions. For this purpose, they need to raise the level of their management technology in order to carry out harmonious business transactions with the assemblers. To solve this problem in a short time, there are several business strategies for the development of the automotive industry in machining. In Indonesia, business strategies are divided into 4 cases as mentioned below.

a. Joint venture with a foreign company

Especially for functional parts such as starters, shock absorbers, batteries, etc., there are many examples of companies that establish factories for production of special parts through introduction of management know-how and technology transfer under joint venture with foreign companies.

b. Technical collaboration with a foreign company

The interview survey identified almost no technical collaboration with a foreign company in a specialized machining product except for one pump manufacturer.

c. Use of a foreign consultant

Some Japanese experts are involved in the raw materials, surface treatment and heat treatment areas, however, there is no information about contributions of technical guidance from Japanese experts in the local machining industry. It is expected that

process design, and jigs and tools will be developed through foreign technical guidance in the future.

d. Individual technical improvement

In the automotive industry (refer to Fig. 7-5-1), local primary subcontracting companies are improving production technology by providing guidance to assemblers. Secondary subcontracting companies are receiving technical guidance from the primary subcontracting company. This means that the automotive parts industry develops within a grouping of manufacturers and there is almost no company that can develop technical improvement by itself.

(2) Type of Production

Production of automotive parts is characterized by the continuing production of equal quality products made in mass production. Thus, production process should be suitable for large-volume production in the factory.

Accordingly assemblers require that the subcontracting companies implement a number of measures as follows.

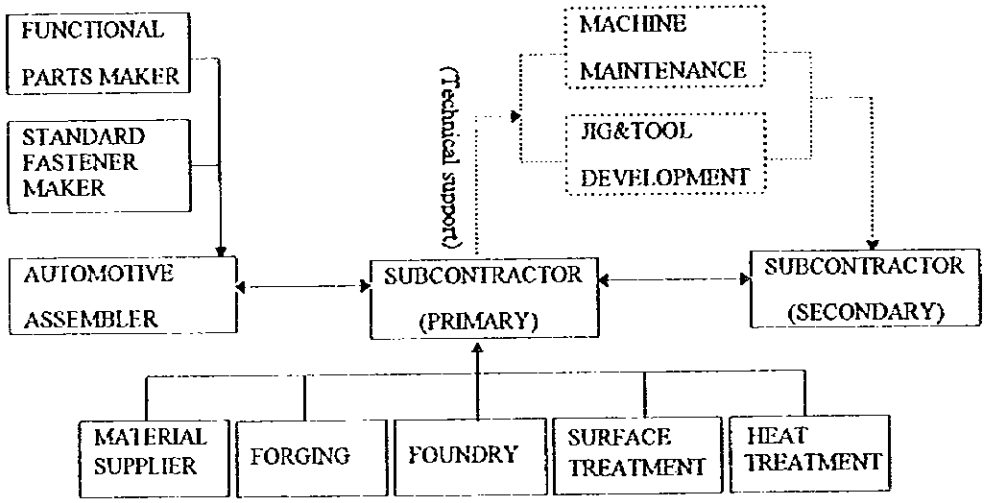
i) Development of jigs and tools (fixtures)
ii) Development of specialized inspection equipment
iii) Implementation of facility maintenance
iv) Reinforcement of production management

5.2.3 Supplementary Relationship of Companies

Fig. 7-5-1 shows the relationship in the machining industry among primary, secondary and other companies in Indonesia.

Assemblers procure component parts and standard parts from the manufacturers of such parts and they order exclusive parts from the primary subcontracting companies of the machining industry. Primary subcontracting companies manufacture these parts by procuring materials from steel distributors. Then they process the materials by machining. Sometimes heat or surface treatment is required. Such steps are usually subcontracted to specialized companies. In other words, supplementary work is often required in the machining industry.

Fig. 7-5-1 Industrial Linkage Among Metalworking Manufacturers



In many cases, as shall be described hereafter, secondary subcontracting companies with orders to produce parts from the primary subcontracting companies have the following disadvantages.

i) No technical know how
ii) Lack of production capability
iii) No profit because of receiving low quantity order

Many of the secondary subcontracting companies in Indonesia are small sized companies with 3-5 employees. Most of the factories are inconveniently located in terms of realizing a

supplementary relationship among companies. There is insufficient maintenance of facilities because of the difficulty in procurement of capital due to the small scale of operations.

These conditions are largely responsible for the production of defective parts and delays in deliveries. In order to improve this situation, the primary subcontracting company should provide technical guidance to the secondary subcontracting company. This action is shown in the upper part of the Figure. illustrated with a dotted line.

Considering the assemblers, primary and secondary subcontractors, the secondary subcontractors have the most serious management problems. A short term solution would be to rely on receiving assistance from the primary subcontracting companies. However, a guidance system should be established by a grouping of small companies, perhaps within a small industrial estate to provide long term solutions.

5.3 EVALUATION OF MANAGEMENT AND PRODUCTION (CASE STUDY)

5.3.1 Objectives of the Case Study

Based on the field survey in the Phase -1 study, interviews with assemblers and primary subcontracting companies and problems of local subcontracting companies were extracted. These problems can be summarized as follows.

i) Quality level is low (defect ratio is high)
ii) Lack of delivery schedule

These problems are out not only relevant to Indonesia but are common in developing countries. The Study Team attempted to study the occurrence of and reasons for these problems in greater detail in Phase-II of the study.

i) The production of defective parts is due to defective materials, processing faults, handling faults and poor workmanship.

ii) Lack of a delivery schedule is due to poor production planning, delay in material procurement, short shift duration, and lack of management system.

In order to better understand these problems, it is necessary to study the process through the phases of receiving orders, production, inspection and delivery at the local companies.

Two companies have been selected as case studies.

5.3.2 Case of Company "A"

(1) Company Outline

- Year of establishment: January 1989

(Automobile jacks produced since the company establishment and production of forged tools and automotive parts began in 1992.)

- Capital : Rp.8150 million
- Number of employees: 392 (which includes administration/management staff:115 and others:79)
- Annual sales amount: US$ 8,500,000 in 1995.
- Major products: mechanical jacks, hand tools, forged parts (under brackets, kick starters, bushings, spring hubs)

(2) Technical Features

This company produces automotive parts by forging and molding and spanners in the forging factory. Heat treatment is done by a specialized company affiliated with a Japanese maker. Forging is produced in the next process in the machining factory. Furthermore, manufacturing and repairing of molds and manufacturing of jigs and tools are done at the workshop. Management technology is of a high level because they receive technical guidance from assemblers such as Toyota and they have Japanese expert in the forging factory.

(3) Parts which are objects of the study

Although various kinds of parts are produced, the product to be studied has been selected from the following process.

i) Parts from the forging process
ii) Parts from the machining process
iii) Parts from the assembling process

Based on the above conditions, kick starters produced for a motorcycle assembler were selected.

(4) Inspection conditions

a. Material inspection

The company purchases steel materials designated by brand by the assembler. Material inspection was carried out on 5 samples from among 130 at Indonesian University.

b. Process inspection

The forging process is implemented by 5 operators from heating to trimming. After this, visual inspection is made. Final inspection in this process is made on samples by visual inspection.

c. After-processing inspection

Process inspection is obligatory after each processing stage at the processing line. Cutting tools have to be changed after a specific number of uses.

(5) Conditions Leading to Defective Parts

Factors causing defective parts to be produced in the forging process are as follows.

- Damage by striking
- Lack of material (die setting)
- Die life
- Die strip (maintenance, etc.)
- Material overheating

Maintenance of press dies is made after every 5,000 products.

a. Forging process

The average defect ratio of forging was 2.5% in May and 2.75% in July. Even in Japan, the defect ratio is about 3%. Thus, it can be said that this company has no specific technical problem.

The defect ratio of arm products (kick starters) which are technically very difficult to produce was as follows.

	Production volume	Defective products	Ratio
May 1996	44,519	1,649	3.70%
July 1996	38,937	1,606	4.12%

b. Machining process

At the time of observation, defective bending was observed in the forging process during machine assembling. Generally, bending measurement is made with special inspection tools after shot blasting in Japan. However, the measurement was not carried out in the company observed. In order to reduce the defect ratio in the machining process, these measurements should be done. Defective arm products are being produced due to insufficient jigs, fixtures and other tools in the machining process.

As mentioned above, there are problems of the inspection before the machining process and of the process design. These problems raise the defect ratio of arm products.

The average defect ratio of machining was 0.94% in May 1996 and 1.16% in July 1996. Following is the defect ratio of arm products.

	Production volume	Defective products	Ratio
May 1996	46,705	1,006	2.15%
July 1996	42,328	635	1.50%

c. Claims from assemblers

The claim ratio of components from assemblers was 0.36% in June 1996. Following is the claim ratio of kick starters investigated in this study.

	Delivered Products	No. of Claims	Ratio
July 1996	27,800	48	0.17%

The claims in July 1996 stemmed from insufficient machining.

(6) Conclusion

a. This company has sufficient technical capability. To further accelerate lavel of technology, it has to develop an inspection system for jigs and tools. Especially to upgrade the inspection accuracy, specialized inspection tools should be developed for each process.

b. In this case study, problems of " Frequent occurrence of defective products " and "Lack of delivery schedule" were studied. In the case of this company which has a high level of management capability, the company can sufficiently comply with assemblers need, if improvement is made by the introduction of better production technology, and research and development of jigs and tools.

5.3.3 Case of Company "B"

(1) Company Outline

- Year of establishment: April 1985
- Capital: Rp.150 million

- Number of employees: 149 (including temporary staff: 21)
- Sales amount: Rp. 300~400 million/month

(2) Major Products

Mainly parts for two-wheel vehicles such as grip sides, hook covers, end plates, etc. and wiring harnesses.

(3) Technical Features

This company uses technical processes with SPCC materials in steps, such as "shearing" → "blanking" → "bending" → "piercing" → "welding". Plating and painting are done by outside facilities.

More than 90% of the dies required for this company's manufacturing process are procured from outside. Recently, repair technology for dies has become available and dies not requiring high accuracy are produced in house.

(4) Defective Products

The clients submit reports on defective products on a monthly basis. Incorrect measurement of the inside diameter is ranked 1st or 2nd in the defective items. It is possible to solve this matter by improving the dimension control of tools. Frequently occurring defective parts are displayed along with reasons for the occurrence so as to draw the workers attention.

Some of the counter measures taken by a large electric goods maker to reduce the production of defective parts, such as preparing a bordering sample of a certain quality level do not take into consideration whether the available technical level can actually meet that standard (probably Japanese quality level is applied) in Indonesia. Both parties should revise these levels through mutual negotiations. It is necessary to make

this effort from now on.

(5) Conclusion

a. One problem of defective products is defective welding. The defects are caused by the voltage drop which occurs when a number of welding devices are operated at the same time. As a temporary measurement, in order to reduce the number of defective products, voltage stability should be implemented by avoiding operating of the welding devices at the same time.

b. A storage place is available for press molds. However, the anticorrosive treatment may not be completely done. Placing a good sample produced at a previous production run where the workers can see it may lead to facilitating the current operation. Making such samples available to be seen has not been carried out.

c. Labor consciousness and working skill appear to be low. Regular education and training of the laborers are required through OJT.

d Many scratches have been seen on the metal surface. One of the reasons for these scratches is the defective metal plating and painting produced by the subcontractor. Based on the study of three subcontractors, it seems that this defect problem may not be easily solved simply by the improvement of unsuitable packing, because of the poor road conditions during transportation.

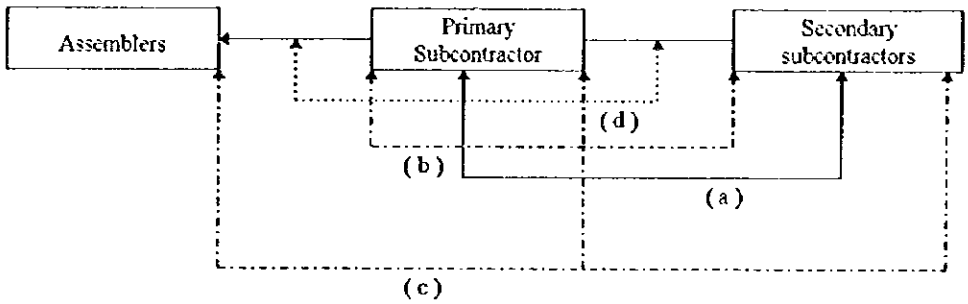
e. In this study, a metal plating firm answered that the final treatment of the wastewater produced had been operated by the firm itself. As a matter of fact, however, desludging activities were not seen. The wastewater is discharged without any treatment. The laborers are working without gloves and shoes in the metal plating process. As an urgent issue, not only environmental protection but also preventive measures against health hazards have to be

improved.

5.3.4 Spots Where Defective Products within the Industrial Cycle Are Generated

Based on this study, the spots where defective products occur within the Industrial cycle can be represented schematically as shown in Fig. 7-5-2.

Fig. 7-5-2 Spots Where Defective Products Occur



(a) indicates output of defective products during in-process production. At the secondary subcontractor, there is only a low possibility of finding defective products, except in special cases, because in-process inspection is not efficiently carried out. As for the primary subcontractors, in-process inspection is carried out that is when the defective products are found and removed.

(b) is the final inspection. The final inspection should expected to be done by the primary and the secondary subcontractors, respectively. As a matter of fact, however, this inspection is not done by the secondary subcontractors. There are many subcontractors which do not have the exclusive inspection jig in the final inspection stage, and in this case the inspection depends on the acceptance inspection stage.

(c) is the acceptance inspection. The material acceptance inspection is expected to be carried out by the secondary subcontractor. As a matter of fact, however, this inspection is not done by the secondary subcontractor. This inspection is carried out by the primary subcontractor and the car assembler. As mentioned above, the defective

product rate is high at the stage of inspection by the primary subcontractor. This is one of the reasons for delayed delivery to the car assembler.

(d) indicates the spot where defects such as scratches caused by unsuitable packing occur during transportation between the secondary subcontractor, the primary subcontractor and the car assembler.

Finally the products are inspected by the assembler after three steps of various inspections (except inspection at the secondary subcontractor). Evaluation of the results of inspection by some of the subcontractors is not good. In addition, it is regrettable that defects result from the transportation stage.

5.4 The Current Status and Improvement of the Methodology of the Machining Industry

There is a big gap in management and technology levels between primary and secondary subcontractors. Therefore, the machining industry has been studied for each.

5.4.1 Primary Subcontractors

(1) Source of Technical Information

In recent years, the changes and progress in the world economy and technology innovation have continued at rapid speed. Under these circumstances, collection and application of relevant information is exceedingly important for companies.

In this study, 13 companies in Indonesia were asked where they obtained their technical information. The answers given are shown in Table 7-5-1.

Table 7-5-1 Sources of Technical Information

	Sources of Information	Frequency
1	Clients	5
2	Machinery & Equipment suppliers	5
3	Books & brochures	3
4	In-house	2
5	Firms in same group	2
6	Educational institutions	1
7	No answer	1

Note: Multiple answers by 13 Companies

Source: Interview survey

The answers that were given with the greatest frequency were clients, machinery and equipment suppliers, and foreign books and brochures.

In industrially advanced countries, governmental agencies, local public bodies and industrial associations play an important role as sources of information. The situation in Indonesia is as described below for each of these organizations.

a. Governmental agencies: MIDC is an important source for machining information, however, it seldom provides the latest foreign technical information. MIDC's activities are holding seminars, issuing publications, and consultation.

b. Local public bodies: In Indonesia these organizations do not supply technical information to companies.

c. Local commerce and industry cooperatives: Do not exist.

d. Industrial associations: These associations do not issue circulars, as the like.

Under these circumstances, suppliers are expected to receive external information from the clients and subcontractors.

In the future, technical information should be actively disseminated by the existing organizations. Most companies are located in the industrial estates, therefore, it is possible to organize the companies to exchange information or to gather the information received and disseminate it among them.

(2) Process Design

Primary subcontracting companies are improving their technology by receiving guidance from the assemblers. On the other hand, it is noted that many companies have problems as mentioned below.

a. Accuracy guarantee for tools is not identified because jigs and fixtures are manufactured in the production site.

b. The period for changing cutting tools is not designated by the number of processing parts.

c. Repair of cutting tools is done by the operator as he wishes.

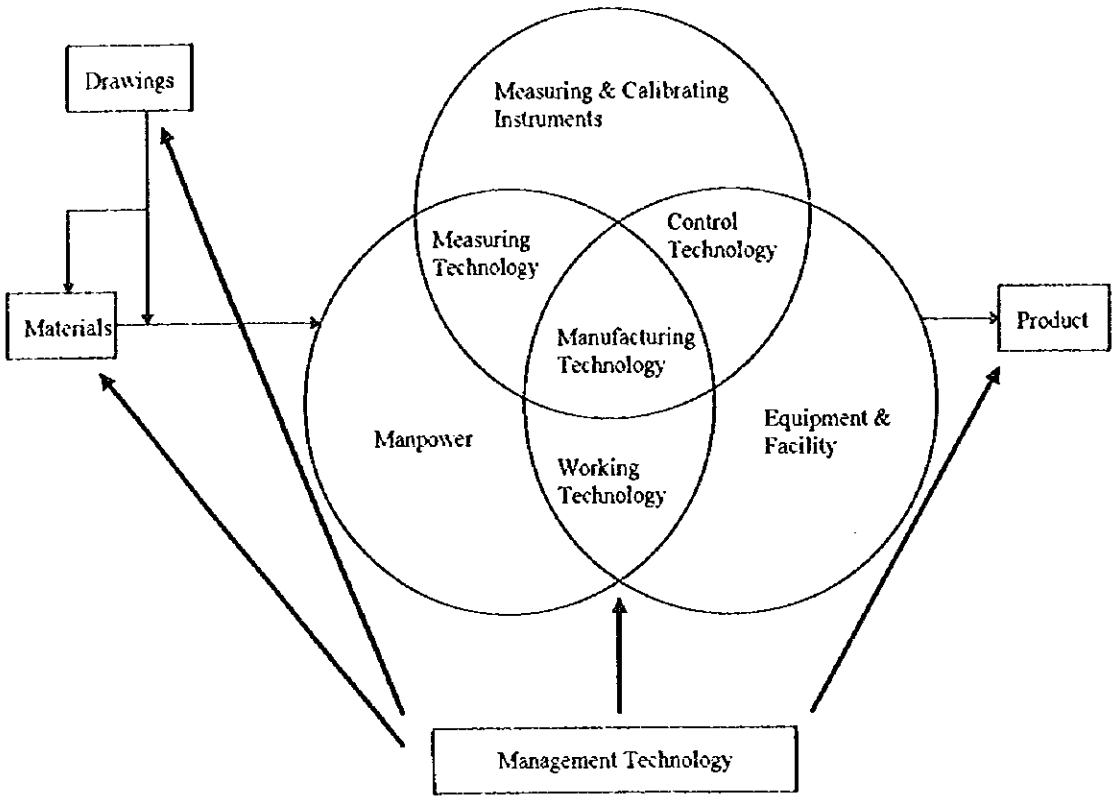
In the case of large lot production, it is not possible to process unified parts under the variable conditions. At the beginning of production, processing steps and procedures are established, calculation for the development of jigs is done and the use of tools is designated. In this way, unit production planning can be implemented. Process design should be included in the quality control system. To establish this design technology, it is necessary to gather information every day.

(3) Training for employees

Many assemblers pointed out that local machining companies had various problems with their production activities. Production activities involve three components: "Manpower", "Material" and "Money". In addition to these three, machining production technology is composed of working technology, control technology and measuring technology, which also involves manpower, equipment and facilities. Further, the production activities are controlled by management technology. The correlation between these technologies is shown in Fig. 7-5-3.

Management technology, especially, is controlled by manpower. Accordingly, adequate production activities depend on manpower. Thus, manpower training is an important issue for industry in Indonesia.

Fig. 7-5-3 Correlation between Production Activities and Management Technology



(4) Development of jigs and tools

In the case of local companies, process design is made by universal machine tools. Thus, development of jigs and fixtures is essential for lot production. Sufficient time is required for the training of specialized engineers.

For urgent countermeasures to correct problems in this area, the assistance of assemblers is needed. In the long term, specialized companies should be created with the support of industrial associations.

5.4.2 Secondary Subcontractors

(1) Technical Guidance by Primary Subcontractor

The present production activities require the development of the technologies mentioned below through guidance provided by primary subcontracting companies or clients.

i) Selection of tools
ii) Selection of inspection tools
iii) Maintenance methods for production facilities
iv) Provision of jigs and tools with maintenance services

(2) Material Procurement

In order to upgrade management efficiency, it is preferable that materials be supplied by the primary subcontractors.

(3) Introduction to Industrial Estates or Cooperative Factories

It is a difficult to collect technical information and to procure materials for small scale companies that are scattered at present. In the future, small scale companies should be shifted to common cooperative factories or small sized industrial estates.

5.5 Improvement Targets

5.5.1 Improvement Targets for Production Management and Technology

Short and long term targets for the improvement of production management and technology in the machining industry are recommended as follows.

(1) Small Scale Industry

a. Short term targets

- Facility operation ratio to achieve management efficiency should be upgraded.

- Frequent occurrence of defective products due to lack of processing technology should be prevented by upgrading the technology in order to decrease defect ratio.

- Measures to be taken

  Mainly primary subcontracting companies should conduct guidance concerning facility maintenance and processing technology.

b. Long term targets

- Cost reduction should be achieved by upgrading management efficiency.

- Measures to be taken

  Management know-how is to be provided mainly by industrial associations.

  Common use of facilities should be accelerated to reduce investment costs.

(2) Medium Scale Industry

a. Short term targets

- Quality should be upgraded.

- Measures to be taken
  Jigs and tool development should be promoted under the guidance of foreign consultants.

b. Long term targets

- Productivity should be upgraded.

- Measures to be taken
  MIDC should research and develop automation technology and design technology of tools and provide their technical information to companies.

5.5.2 Necessary R&D Activity

(1) Short Term Targets

- Quality and productivity should be improved by improvement of universal machine tools that are commonly used in Indonesia.

(2) Mid-Term Targets

- Design know-how on efficient tools should be developed for introducing NC machine tools.

(3) Long Term Targets

- Upgrading of metal working accuracy and application of new industry are to be achieved by the introduction of such new technologies as laser processing technology.

5.5.3 Necessary Governmental Supports

For the development of small scale industry, effective governmental support and assistance is required as follows.

(1) Short Term

Periodic guidance conducted by governmental agencies.

(2) Mid-Term

Promoting joint venture businesses or using common facilities by combining small and medium scale industries.

(3) Long Term

Upgrading of operating conditions by locating companies in industrial estates.

6. SURFACE TREATMENT AND HEAT TREATMENT

6.1 OUTLINE OF THE SURFACE TREATMENT AND HEAT TREATMENT INDUSTRY

Surface treatment and heat treatment are used to improve corrosion resistance, surface strength, and material characteristics of parts and components. Plating represents surface treatment, and it is roughly divided into two categories; decorative plating and industrial plating. Decorative plating, which includes gold plating of rings and necklaces, and chrome plating of tableware, is excluded from the Study.

Industrial plating imparts corrosion resistance, surface gloss, and anti abrasion to industrial parts and products made of steel. Industrial plating is further classified into the following three categories. Dip plating is widely used to plate mass-produced steel products for corrosion resistance.

a. Dip plating of zinc, aluminum, tin, lead, etc.
b. Electroplating, Electrolytic plating
c. Surface cementation of zinc, chrome, aluminum, silicon, etc.

Heat treatment is usually applied to steel to give it certain characteristics by heating and cooling, and is classified as follows:

a. Increases hardness and tension strength (quenching, tempering)
b. Obtains fine structure, puts directions of crystal grains, eliminates segregation, and normalizes structure (normalizing)
c. Softens structure for machining (annealing)
d. Eliminates residual stress and strain to eliminate deformation and breakage at machining (annealing)
e. Hardens surface (high-frequency induction hardening, carburizing, nitriding)

Normalizing and annealing are widely adopted as standard heat treatments with less costly

facilities, and these can be applied to simple heat treatment processes of standard types of steel. On the other hand, high-frequency induction hardening and nitriding can be applied to partial surface hardening, but require high levels of technology to design coil electrodes.

Quenching is usually applied to special metal for dies and parts made of special steel, and investment costs for its facilities would be relatively large. In addition, strict control in heat history and temperature is required, and the operation of quenching heat treatment is not feasible unless a large scale of treatment is done.

6.1.1 Surface Treatment

Plating technology is one of the major surface treatment technologies. There are more than 300 factories in the proximity of Jakarta, and most of them employ the dip plating method for decorations and fences. Even though some companies employ the chrome plating method, it is known that their plating quality is not reliable.

There are several specialized companies with an industrial production scale, 3 companies affiliated with Japanese capital and 7 local companies, in the fields of the automotive, and electrical and electronic industries. In this field survey, two companies were selected for a factory survey and interviewed to obtain necessary information.

6.1.2 Heat Treatment

A simple heat treatment facility is installed in the working process in factories. This study focuses only on heat treatment for special steel used for molds, steel tools, etc.

There are no local companies carrying out this kind of heat treatment. This type of heat treatment is conducted by a few foreign capital companies. They are specialized companies or steel dealers.

During this field survey, the Study Team visited special steel heat treatment companies

affiliated with Japanese companies to interview them on their activities and their views on future prospects of this industry. The Study Team visited some local companies to study their in-house production situation.

6.2 EVALUATION OF MANAGEMENT AND PRODUCTION

Based on the results of the factory visits, the technical level of heat treatment in Indonesia, such as metal-surface treatment, electro-plating and galvanizing and strengthening of metal surface, can be summarized as follows:

6.2.1 Surface Treatment

In Indonesia, third class electroplating is generally adopted, which consists of zinc electro-plating, focusing on the anticorrosive feature. There are almost no companies in the fields of first and second class electroplating such as Ni-Cr and Cu-Ni-Cr, which are used for the plating of ornamental products and require complicated technology. In addition, few companies carry out hard chrome electro-plating, which is adopted to add certain functional characteristics to products.

Indonesian domestic companies in this field have difficulty in introducing the production technology of high class plating methods such as chrome plating because such plating methods require complicated temperature control and solution control. In addition, production facilities of high class plating methods are expensive and their automated operation needs high levels of skill. The difficulty in obtaining advanced technology and know-how on automated operations further prevents domestic companies from the introduction of such plating methods.

The Study Team visited two plating companies. Both companies are Indonesian domestic companies, and are engaged in zinc electro-plating and chromizing. The Study Team observed a big difference in technology between these companies. One company is well equipped with an automated electro-plating production system, and the company operates effectively, from solution control to the inspection of finished products. As a result, they receive orders from Japanese affiliated automotive manufacturers and motorcycle manufacturers. The other company is equipped with obsolete production facilities, and its operation is based on manual work. This company does not even have waste water

treatment equipment.

6.2.2 Heat Treatment

The Study Team visited two Japanese affiliated companies and several domestic companies. The present situation of quenching and tempering have been studied in this survey because these two methods are closely related to die and mold making. Other heat treatment methods such as annealing and normalizing have not surveyed although they can not be totally ignored.

The two Japanese affiliated companies are specializing in heat treatment. Both are equipped with the latest production facilities. For instance, flow high tempering furnaces, gas hardening furnaces, and salt bath furnaces, which are all fully controlled according to programming, are installed. In addition, high level auxiliary equipment such as temper oil tanks and alkaline hot water jet cleaners is installed.

On the other hand, domestic companies are equipped with low level facilities, including simple electric furnaces, manual sliding resistance boxes for temperature control, and simple oil tanks for quenching. Electric household fans are even used at factories for tempering.

6.3 IMPROVEMENT TARGETS

6.3.1 Surface Treatment

As already mentioned, the Study Team observed a big technological gap between two domestic companies. This gap is considered to derive from their different attitudes towards the introduction of advanced technology. One company has employed a Japanese expert for the past 3 years, and actively tries to improve its technology level, while the other company does not take any measures to improve its technology, but rather simply follows its former ways of factory operation. Even the former company occasionally runs into some problems such as the mixture of different materials in the same production line.

Although surface treatment is mostly automated in Japan, workers and operators are, in general, well aware of the content of the technology employed as well as the details of their work, and they rarely make careless mistakes.

Currently, both production technology and control technology of plating methods such as dip plating, galvanizing and anode oxidization are still underdeveloped in Indonesia. Indonesian companies first have to obtain quality improvement technology and mass-production technology. For this purpose, the introduction of foreign experts is considered to be very effective so that the improvement of quality, cost and delivery can be achieved. Also, it could increase the competitiveness of domestic companies so that they can compete well with foreign affiliated companies.

6.3.2 Heat Treatment

Both annealing and normalizing are widely carried out in Indonesia. These heat treatment methods do not require strict temperature control, and thus the overall level of Indonesian domestic companies is evaluated as being acceptable. On the other hand, quenching and tempering need strict temperature control, and only a few foreign affiliated companies are engaged in this type of work. In addition to regular steel, steel tools such as SKS, SKD,

SKT, and SKH are heat treated by these companies. They are regarded as having enough capability to heat treat dies and molds.

Heat treatment methods which require a very high level of technology, such as PVD (physical vapor deposition) and CVD (chemical vapor deposition), are yet to be introduced into Indonesia. It is envisaged that high class heat treatment methods in this country would be handled by foreign affiliated companies for the time being.

7. OVERALL EVALUATION OF MANAGEMENT AND PRODUCTION

7.1 EVALUATION OF MANAGEMENT AND DIRECTION OF IMPROVEMENT

Managerial issues which supporting industries in Indonesia face vary widely depending on the type of companies, size of companies, and fields in which companies exist. Especially, substantial gaps are observed between foreign affiliated companies and large scale companies, and medium and small scale companies. Foreign affiliated companies have few managerial problems because they regularly receive a wide range of managerial support from their overseas parent companies. The most critical management issue for them may be the recruitment of capable engineers and the development of middle level managers. This issue may stem from the recent rapid increase of investments into Indonesia from overseas countries, which has tightened the engineer market, and the limited educational opportunities in the country. Foreign affiliated companies are requested by the government to accelerate technology transfers and increase the number of local managers, and intend to develop comprehensive technologies including those of management administration. However, the problem of insufficient labor force hampers the smooth transfer of technologies.

Among domestic companies, large scale companies mainly introduce a modern management system, and as a result they face few critical management problems except for the insufficient supply of labor. On the other hand, medium and small scale companies lag behind in the development of managerial skills. In addition, the high turn-over ratio of employees and the rapid increase in labor costs have become critical issues for them.

One of the most important external factors which are considered to affect the management of supporting industries is the limited and fluctuating demand for subcontracting services, which stems from the limited production of assemblers. This makes it difficult for supporting industries to secure sufficient production volume which would justify new investments.

Major managerial problems which domestic medium and small scale supporting industries

face, and the directions of improvement are discussed below.

7.1.1 Modern Managerial Skills

Modern managerial skills shall cover the whole of managerial activities, which include management planning, marketing, sales, production, procurement, human resources, financing, and research and development. Companies belonging to major industrial groups and foreign affiliated companies receive various kinds of managerial support from their sister/parent companies, and accordingly they have few managerial problems except for human resource problems such as the lack of engineers and skilled workers, and the rapid increase of wages.

On the other hand, most medium and small scale companies lack managerial skills. Most of these companies are so-called family owned companies, and are considered to be reluctant to introduce modern managerial skills. As a result, they have various managerial problems, and are unable to make management plans or maintain management control.

Managerial problems are basically to be solved by the effort of an individual company. However, it is suggested that industrial associations and governmental organizations work to solve the problems through activities such as the holding of management skills seminars and the invitation of experts from overseas countries to make factory visits and give advice to companies.

Table 7-7-1 summarizes the results of the questionnaire survey on assistance to the supporting industries from customers and assemblers in the fields of supplies (materials, dies, molds, etc.), financial support, technical support, managerial assistance, and education and training. More than one third of PMA companies receive some of these kinds of assistance while 27.5% of PMDN companies and 24% of non-PMA/PMDN companies receive some of them.

Table 7-7-1 Assistance from Customers and Assemblers

Company Status	Receiving	Not receiving	Not receiving, but wish to receive	Effective answers
PMDN	11 (27.5%)	19.4 (48.5%)	9.8 (24.5%)	40
PMA	13.4 (34.4%)	19.6 (50.3%)	5.6 (14.4%)	39
Non-PMDN/PMA	32.4 (24.0%)	65.6 (48.6%)	36.6 (27.1%)	135

Note: Average number of companies who corresponded to the five questions.
Source: Questionnaire survey, JICA Study Team

7.1.2 Skilled Work Force

Skilled workers, mostly skilled specialists, are lacking, especially in the fields of plating, casting, and mold and die making. There are several reasons for this. Firstly, most graduates from high schools, politekniks, academies, colleges, and universities do not wish to work for medium and small scale companies in the supporting industries but wish to work for large scale assemblers and foreign affiliated companies. In addition, the high turn-over ratio, which is often observed in the supporting industries, prevents them from accumulating the necessary technology and skills. This problem may be solved by each company through the improvement of work force management such as the expansion of full-time employees, the reduction of work hours, the improvement of work environment, the increase of welfare, and the strengthening of work ethics. In addition, it is imperative to improve the image of the supporting industries through these activities.

Secondly, it is suggested that educational and training facilities for the development of skilled workers are lacking in the country. In Indonesia, universities and politekniks mainly fill the role of technical education, but their curriculums are concentrated in theory, and the education of technical skills are neglected to some extent except for some politekniks. In addition, most companies in the supporting industries do not well utilize the functions of existing educational and training institutions. Education in the technical skills is necessary not only for students at schools but those who have graduated from schools and presently work for companies so that their technical skills can be improved. Those curriculums that meet the needs of the supporting industries should be developed.

The JICA Study Team observed that many engineers are lacking in the basic knowledge of technology. It is suggested that universities, politekniks and high schools strengthen basic science education. The development of technical training schools where theory and practice are taught is considered to be necessary, and governmental research and development institutions as well as industrial associations may contribute to the establishment of such schools.

Major problems concerning human resource management, which were revealed through the questionnaire survey, are shown in Table 7-7-2. "Frequent job-hopping" is the second ranked critical problem having been selected by 43% of all respondents , and "Difficulty in recruiting highly educated personnel," ranks fourth with 23.3%. In addition, because of their essential technologies, the casting industry and the forging industry have difficulty in recruiting highly educated personnel,. The parts assemblers, the forging industry, the presswork industry, the heat treatment industry and the plastic molding industry have difficulty with frequent job-hopping.

Table 7-7-2 Major Problems Concerning Human Resource Management

Essential technology	Difficulty in recruiting highly educated personnel	Difficulty in training and educating in-house	Lack of discipline and morale among workers	Frequent job-hopping	Labor disputes or strikes	Increase in salaries and wages	Others	Effective answers
Parts assembling	36	55	71	61	1	32	5	137
Casting	25	29	47	26	0	11	2	74
Forging	7	6	13	9	0	5	1	22
Machining	32	56	71	48	1	25	5	125
Presswork	19	43	69	56	2	26	2	113
Plating and Surface treatment	6	16	25	15	1	10	2	39
Heat treatment	10	12	23	18	1	12	1	40
Plastic molding	4	12	16	14	0	3	1	30
Others	45	78	111	90	2	35	5	201
Total	63 (23.3%)	99 (36.7%)	145 (53.7%)	116 (43%)	2 (0.7%)	46 (17%)	7 (2.6%)	270

Note: Total numbers do not necessarily meet the sum because of multiple answers.
Source: Questionnaire survey, JICA Study Team

7.1.3 Information Sources

Information may contribute to the reduction of production costs and the improvement of product quality. It is therefore very important for the supporting industries to be exposed regularly to useful information.

Medium and small scale companies in the supporting industry obtain information mainly from their customers, the suppliers of production facilities, their own experiences, technical magazines and publications, and seminars held by industrial associations. Most information, however, is not comprehensive but is limited to specific topics. In addition, the majority of information does not concern management but technical matters only.

Although the supporting industries are interested in the latest technology and managerial skills, the sources of such information are limited. Most information that is necessary for the supporting industries is not always the latest information but that which has been prevalent among assemblers, parts/components manufacturers and governmental

organizations. Thus, the establishment of information sources and professional assistance to medium and small scale companies about how to access such information sources is important. Especially, it is regarded as being very useful for the government to set up a system where both technical and managerial information is transferred from assemblers and parts/components manufacturers to the supporting industries. Industry associations may be most appropriate to gather a wide range of information to be rendered to the supporting industries. However, many industrial associations in Indonesia are underdeveloped, and therefore support from governmental organizations as well as foreign organizations is strongly required.

Table 7-7-3 below shows the results of the questionnaire survey on the necessity for new technology information. Forty-three percent of effective answers or 125 companies recognize the importance of information. Especially, industries such as casting, presswork, heat treatment, and machining have a high level need for information. The development of appropriate sources of information by the government is highly requested.

Table 7-7-3 Necessity for Information on New Technologies

Essential Technology	Necessary	Effective answers
Parts assembling	61 (41.5%)	147
Casting	39 (48.1%)	81
Forging	10 (40%)	25
Machining	56 (42.1%)	133
Presswork	54 (45.8%)	118
Plating and Surface treatment	14 (35.9%)	39
Heat treatment	19 (44.2%)	43
Plastic molding	9 (31.0%)	29
Others	89 (41.6%)	214
Total	125 (43%)	291

Note: Total numbers do not necessarily meet the sum because of multiple answers.
Source: Questionnaire survey, JICA Study Team

7.1.4 Support from Assemblers

A very limited number of assemblers, for instance National Gobel, give education and

training not only to their employees but also to those who are engaged in the electric and electronic industry. This kind of case is, however, very rare. Support from assemblers to the supporting industries generally deals with technical matters such as quality assurance and specific technical problems in production processes. In most cases, systematic and regular support is not provided. In addition, support for the supporting industries in management and financial aspects is rarely given. Most companies usually receive support from assemblers only when a quality problem occurs.

Some assemblers, especially Japanese affiliated companies, intend to strengthen vendor support by organizing cooperative associations among their vendors, which is prevalent among large scale assemblers in Japan. However, there are few cases in Indonesia that such cooperative associations have been established. Under the circumstances, systematic and comprehensive support from large scale assemblers to small and medium scale companies in the supporting industries is urgently required. It would be worthwhile to make a feasibility study on the establishment of an industrial estate where assemblers, parts/components manufacturers, and the supporting industries in specific fields are concentrated so that a stronger linkage among them can be achieved.

Tables 7-7-4 and 7-7-5 show the results of the questionnaire survey on customers' assistance to the supporting industries in the fields of management and technology. A big gap is observed between large-scale companies and small-scale companies in both fields. Out of companies with less than 50 employees, 22 companies or 18.6% receive managerial assistance, and 37 companies or 29.8% receive technical assistance from their customers. In the case of companies with 200 and more employees, 17 companies or 26.2% receive managerial assistance, while 36 companies or 51.4% receive technical assistance from their customers.

On the other hand, only 20.8% of companies receive managerial assistance from their customers while 36.9% of companies receive technical assistance. This seems to indicate that the majority of assistance provided by customers and assemblers to the supporting industries is related to technical matters.

Table 7-7-4 Assistance from Customers and Assemblers (Managerial Assistance)

Number of employees	Receiving	Not receiving	Not receiving, but wish to receive	Effective answers
less than 50	22 (18.6%)	66 (55.9%)	30 (25.4%)	118 (100%)
50 to 199	9 (18.8%)	26 (54.2%)	13 (27.1%)	48 (100%)
More than 199	17 (26.2%)	34 (52.3%)	14 (21.5%)	65 (100%)
Total	48 (20.8%)	126 (54.5%)	57 (24.7%)	231 (100%)

Source: Questionnaire survey, JICA Study Team

Table 7-7-5 Assistance from Customers and Assemblers (Technical Support)

Number of employees	Receiving	Not receiving	Not receiving, but wish to receive	Effective answers
less than 50	37 (29.8%)	54 (43.5%)	33 (26.6%)	124 (100%)
50 to 199	17 (34%)	20 (40%)	13 (26%)	50 (100%)
More than 199	36 (51.4%)	21 (30%)	13 (18.6%)	70 (100%)
Total	90 (36.9%)	95 (38.9%)	59 (24.2%)	244 (100%)

Source: Questionnaire survey, JICA Study Team

7.1.5 Support from Governmental Organizations & Industrial Associations

Some governmental and semi-governmental organizations, politekniks, universities, and industrial associations have recently started to provide support to the supporting industries, which includes short-term training programs and seminars. However, these support activities are not active except for those carried out by a handful of politekniks because of the lack of experts, insufficient funds, and various other reasons. In addition, they mainly deal with technical matters, and are often regarded as being not practical due to the insufficient volume of information. It is suggested that strong assistance from third parties including both Indonesian and overseas governmental organizations, and public institutions is necessary to expand support to the supporting industries. Taking the importance of competitiveness into consideration, it is significant for industrial associations to study how the outcome of AFTA will affect the supporting industries in 2003.

It was revealed through company visits by the JICA Study Team that few companies use governmental institutions such as MIDC. It is suggested that the Indonesian government make a plan as to how the supporting industries can utilize governmental institutions effectively.

Table 7-7-6 summarizes the problems involved in public institutions from the results of the questionnaire survey. "Lack of information on the institutions" was considered to be the most critical problem followed by "Location far from the company." This result may indicate that the increase of customer awareness is imperative for public institutions.

Table 7-7-6 Problems in Receiving Technical Supports from Public Institutions

Problem	Number of Companies
Lack of information on these institutions	33 (41.3%)
Location far from the company	27 (33.8%)
Obsolete equipment and technologies	23 (28.8%)
Expensive service charges	17 (21.3%)
Slow response/service	11 (13.8%)
Complicated procedures for application	12 (15.0%)
Others	3 (3.8%)
Total	80

Note: Total numbers do not necessarily meet the sum because of multiple answers.
Source: Questionnaire survey, JICA Study Team

7.1.6 Entrepreneurship

Most activities of the supporting industries are subcontracting production, but some parts and components such as molds and dies, switches, speakers, tools, and parts and components for the after sales service market can be sold in the market through their marketing efforts. However, the majority of small and medium scale companies seem to give up the possibility of the expansion of their companies as they tend to limit their work to subcontracting jobs from their customers. If they hesitate to develop the market at their own risk, it may be very difficult for them to survive when foreign affiliated companies with modern managerial skills actively enter into the same market. For that reason, it is very

important for the supporting industries to develop entrepreneurship.

Some of the possible scenarios for developing entrepreneurship include, a) dissemination of market information and technology trends through the information activities of industrial associations, b) organization of visits to excellent companies with the cooperation of industrial associations, c) assistance to an individual company by experts through governmental organizations and/or industrial associations, and d) explanation and notification of various governmental laws and regulations to medium and small scale companies.

According to the results of the questionnaire survey, approximately 60% of companies deal with less than 11 customer companies. In addition, about 40% of companies deal with a limited number of customers, one to five. In order for supporting industries to increase their business through the expansion of their customers, more active development of customers is regarded as being very important.

Table 7-7-7 Number of Customers

Number of Customers	Number of Companies
1 to 5 companies	93 (39.2%)
6 to 10 companies	50 (21.1%)
11 to 20 companies	37 (15.6%)
21 to 50 companies	26 (11.0%)
more than 50 companies	31 (13.1%)
Effective Answers	237 (100%)

Source: Questionnaire survey, JICA Study Team

7.1.7 Financing

From the macroeconomic point of view, the Indonesian economy is steadily expanding, and many companies are planing to build new factories and expand production facilities. Subsequently, since most of them do not have sufficient funds to make investments by themselves, they are concerned about the financing of new investment costs, and the

recruitment and education of workers. A great demand for capital exists, but most small and medium scale companies have difficulty in borrowing funds from banks. In addition, the present interest rate, which varies between 20 to 25%, is too high to make a sound investment or management plan.

On the other hand, the present governmental loan schemes to the supporting industries are considered to have some impediments, and do not necessarily satisfy the financing demand for the industries. Under the present schemes, the maximum loan amount is relatively low, and the target industries for the loans are limited. It is therefore imperative to develop systematic governmental loan schemes to meet the actual financing needs of the supporting industries. In addition, it is regarded as being very useful for governmental financial institutions to send financial and accountant consultants to small and medium scale companies so that they can receive professional advice about various managerial problems.

Based on the results of the questionnaire survey, major problems of the supporting industries in financing are shown in Table 7-7-8. More than 60% of companies pointed out high interest rates to be the most critical problem. After that, 75 companies or 36% of the companies corresponding regard severe loan eligibility as being the second most critical problem.

Table 7-7-8 Major Problems in Financing

Problem	Number of Companies
High interest rates	127 (61.4%)
Severe loan eligibility	75 (36.2%)
Insufficient mortgage	54 (26.1%)
Limited loan amount	52 (25.1%)
Troublesome formalities of borrowing procedure	50 (24.2%)
Financial institutions take too much time for loan screening	46 (22.2%)
Financial institutions require guarantee of a guarantee company	35 (16.9%)
Financial institutions passive attitude to finance SMIs	28 (13.5%)
Exposure to exchange market in Indonesia	12 (5.8%)
Lack of financing know-how in the company	5 (2.4%)
Lack of access to the international financial market	4 (1.9%)
Underdeveloped stock exchange market in Indonesia	3 (1.4%)
Others	7 (3.4%)
Effective Answers	209

Note: Total numbers do not necessarily meet the sum because of multiple answers.
Source: Questionnaire survey, JICA Study Team

7.2 EVALUATION OF FACTORY MANAGEMENT AND DIRECTION OF IMPROVEMENT

In order to identify the problems associated with supporting industries (subcontractors of assembling firms) of the Republic of Indonesia, an interview survey was implemented through visits to assembling firms and as a result a "Mutual Diagnosis Table for the Confirmation of the Present Status of Plant Management (Appendix 3)" was prepared to evaluate factory management.

7.2.1 Problems of Subcontractors of Assembling Firms

The major three problems of these subcontractors may be described as follows;

i) Defects
ii) Delay in delivery
iii) Low cost competitiveness

Low cost competitiveness, in particular, is indicated by many car assemblers. It seems that cost competitiveness is an essential factor for the industry to serve as a manufacturing center for the Asian market.

7.2.2 Evaluation by "Mutual Diagnosis Table for the Confirmation of the Present Status of Plant Management

(1) Type of Subcontractor

The surveyed subcontractors are categorized as follows;

i) Primary subcontractors (working directly with assemblers) or secondary subcontractors (not working directly with assemblers)
ii) Companies technically associated or not associated with foreign firms.

iii) Companies employing, or employed by foreign consultants and those neither employing , nor employed by foreign consultants.

(2) Survey Items

The evaluation of plant management has been carried out based on the 7 criteria from the Mutual Diagnosis Table for the Confirmation of the Present Status of Plant Management, as follows.

i) Arrangement and putting into order (5S)
ii) Materials Handling Control
iii) Production Management
iv) Quality Control
v) Expediting Control
vi) Acceptance Inspection/Subcontracting Purchasing Control
vii) Equipment/Jig & Tool Management

(3) Result of Evaluation

The Evaluation has been figured on a 5 point scale as listed below;

· good in all parts	5 points
· generally good	4 points
· partially good	3 points
· good in a few points	2 points
· insufficient	1 point

a. Comprehensive Evaluation for Each Type of Company

Table 7-7-9 Comprehensive Evaluation for Each Type of Company

1) Joint venture with foreign company	: 3.7	Local company	: 2.2
2) Primary subcontractor	: 3.2	Secondary subcontractor	: 2.0
3) Technically associated with foreign company	: 3.6	No technical association with foreign company	: 2.5
4) Employing foreign consultants	: 3.2	Not employing consultants	: 2.7

Source: JICA Study Team

The biggest difference is observed in 1) with 1.5, followed by 2) with 1.2 and 3) with 1.1. Regarding plant management level, joint ventures and primary subcontractors received high evaluation points.

b. Evaluation of Joint Venture and Local Companies

Table 7-7-10 Evaluation of Joint Venture and Local Companies

	Joint Venture	Local Company
1) Arrangement and putting into order	4.3	2.8
2) Materials Handling Control	4.2	2.5
3) Production Management	3.6	2.0
4) Quality Control	3.4	2.2
5) Expediting Control	3.5	2.2
6) Acceptance Inspection/ Subcontracting Purchasing Control	3.9	2.1
7) Equipment/ Jig & Tool Management	3.1	1.9

Source: JICA Study Team

- Between joint venture and local companies large differences are observed in 6) Acceptance Inspection/Subcontracting Purchasing Control, 2) Materials Handling Control, and 3) Production Management (Process Control).

- Joint venture companies received relatively low points in 4)Quality Control, 5) Expediting Control, and especially in 7) Equipment/Jig & Tool Management

- Local companies received generally low points, especially in 3) Production Management (Process Control) and 7) Equipment/Jig & Tool Management.

c. Evaluation of primary subcontractors and secondary subcontractors

Table 7-7-11 Evaluation of Primary Subcontractors and Secondary Subcontractors

	Primary Subcontractor	Secondary Subcontractor
1) Arrangement and putting into order	3.5	2.5
2) Materials Handling Control	3.4	2.0
3) Production Management	2.9	1.6
4) Quality Control	2.9	1.9
5) Expediting Control	3.0	1.7
6) Acceptance Inspection/ Subcontracting Purchasing Control	3.1	1.6
7) Equipment/ Jig & Tool Management	2.7	1.7

Source: JICA Study Team

d. Evaluation of Companies with and without Foreign Technical Association.

Table 7-7-12 Evaluation of Companies with and without Foreign Technical Collaboration

	With	Without
1) Arrangement and putting into order	4.2	2.9
2) Materials Handling Control	4.0	2.7
3) Production Management	3.5	2.3
4) Quality Control	3.5	2.4
5) Expediting Control	3.5	2.4
6) Acceptance Inspection/ Subcontracting Purchasing Control	3.0	2.4
7) Equipment/ Jig & Tool Management	3.0	2.2

Source: JICA Study Team

- Companies with "foreign technical assistance" show relative weakness in 6) Acceptance Inspection/Subcontracting Purchasing Control, and 7) Equipment Management.

- Between companies with and without "foreign technical collaboration", large differences are observed in 6) Acceptance Inspection/Subcontracting Purchasing Control and 1) Arrangement and putting into order.

- Companies without "Technical Assistance" have problems in 7) Equipment Management and 3) Production Management (Process Control).

e. Breakdown of the evaluation points for companies employing and those not employing foreign consultants.

Table 7-7-13 Breakdown of the Evaluation Points for Companies Employing and Those not Employing Foreign Consultants

	Employing	Not Employing
1) Arrangement and putting into order	3.4	3.0
2) Materials Handling Control	3.4	3.0
3) Production Management	3.0	2.5
4) Quality Control	2.9	2.7
5) Expediting Control	3.1	2.6
6) Acceptance Inspection/ Subcontracting Purchasing Control	3.5	2.6
7) Equipment/ Jig & Tool Management	2.8	2.3

Source: JICA Study Team

- There are no significant differences between companies in these categories except in 6) Acceptance Inspection/Subcontracting Purchasing Control.

f. Evaluation by different industry type

Industry Types are classified as below;

- Raw Materials: molding, casting, die casting
- Machinery: press (include heat and surface treatment)
- Electric/electronics
- Plastic molding (includes rubber)

Table 7-7-14 Evaluation by Different Industry Type

	Raw materials	machine /press	electric/ electronics	plastic
1) Arrangement and putting into order	2.5	3.5	3.5	3.3
2) Materials Handling Control	2.2	3.3	3.5	2.9
3) Production Management	2.4	2.7	3.1	2.4
4) Quality Control	2.5	2.7	3.5	2.7
5) Expediting Control	3.0	2.7	3.3	2.3
6) Acceptance Inspection / Subcontracting Purchasing Control	3.5	3.1	3.3	2.5
7) Equipment/Jig & Tool Management	2.9	2.6	2.8	1.7
Total evaluation	2.7	2.9	3.3	2.5

Source: JICA Study Team

- On the overall evaluation, the electric/electronics industry is the most lightly evaluated followed by machine/press, and plastic/rubber industries.

- Raw material industries have a problem in "Material Handling", and "Arrangement and putting into order. "Equipment Management" is a common problem for all industry types.

7.2.3 Comprehensive Evaluation for Plant Management System

In the course of the evaluation study, the supporting industry was categorized into: primary subcontractor (80% have foreign joint venture and/or technical association with foreign firms) and secondary subcontractor. Consequently, the comprehensive evaluation for plant management shall adopt the two categories as well.

(1) Quality Control System

a. Primary subcontractors

Companies of this category keep records of defect ratios using Quality Control Flowcharts, In-process check sheets, and Intermediate check sheets to provide a countermeasure system to eliminate defects. There are, however, problems in the DO-CHECK-ACTION process. Because of problems in selecting inspection machinery and systems, the defect ratio becomes considerably large. In the ACTION process, the problems are due to the low technical level in a particular field, and the insufficiency of the countermeasure systems for temporary repair and recurrence (e.g , in machine processing; areas to be considered are the blade shape of cutting tools and the sharpening process and the basic improvement technique for setting original face of jig and installation point).

b. Secondary subcontractors

There are considerable differences compared to primary subcontractors. First, the final inspection method (inspection equipment and method) should be improved. Secondly, the quality control systems need to be reorganized.

(2) Delivery Control System

a. Primary subcontractors

Schedules are implemented by a Production Control Board for comprehensive plant management and a Control Board providing detailed schedules for the production sites. Companies under this category have finished inventory and hardly any delays in meeting assemblers' delivery requests. Delays occasionally happens due to late delivery from secondary subcontractors.

b. Secondary subcontractors

These companies have problems in both delivery control in plant management and schedule control at the production site. The ability to estimate production capacity which is necessary for schedule planning is not sufficient and results in imprecise planning. Therefore, the output of the production is only recorded but not checked with the production plan and countermeasures to eliminate delivery delays are not provided.

Insufficient delivery amount due to defects is the major reason for delivery delays. Thus the improvement of delivery control and quality control systems are the urgent tasks to be implemented.

(3) Cost Control System

Even in companies with well organized plant management system, cost control is relatively insufficient compared to quality control and delivery control. In cost control the basic notion of "Sales price - profit = total cost" should be understood, and the establishment of a cost control planning system which sets components and parts as cost targets and breaks them down into items should be prepared.

The items of expenditure comprise production cost are material cost (direct/indirect), processing cost (labor, outside order, depreciation, facilities), and factory expenses. To become cost competitive, both technology and management have to be improved. With respect to plant management, it is important to reduce the defect ratio, surplus inventory, and materials cost, and to improve work efficiency and operation ratio.

(4) Equipment, Jig and Tool Management

In varying degrees, primary subcontracting companies have programmed inspection systems for daily and periodic inspection of production equipment and renovations of jigs

and tools. They also have inspection criteria for measurement equipment to maintain accuracy. Some systems, however, do not maintain inspection records, or the inspection records that are maintained have no numerical indicators and are inaccurate. These implementation stage problems have to be addressed.

In mass production, processing facilities should be automated to maintain product quality. The more facilities are automated, the greater the need becomes for total facility efficiency management dealing with product defect ratio, process efficiency, and inefficient operation arising from facility problems.

Compared to primary subcontractor companies, the management systems of secondary subcontractor companies are less developed. Especially, insufficient maintenance systems of the accuracy of the measurement tools for final inspection and inconsistent implementation of inspections increase the defect ratio of processed products. Thus, training for accuracy control of inspection equipment, and instruction on the use of inspection and measurement equipment should be carried out.

(5) Environmental Management

Among secondary subcontractor companies, small companies in particular should take the treatment of solid waste and factory waste into account.

7.2.4 Upgrading Plan for Plant Management

(1) Quality Control and Delivery Control

Japanese style cooperation grouping is recommended between assemblers and primary subcontractors. Some primary sub-constructors have a well developed management system. This management system should be transferred to group companies to enhance their management skill. Also, primary subcontractors should instruct secondary subcontractors to improve their management system in cooperation with assemblers.

(2) Cost Management

It is recommended that primary subcontractors employ the cost management system of foreign joint ventures and/or technically associated foreign companies so that they can share a common cost management system as the primary subcontractor group. Specialists from assemblers, foreign bodies, and training may also be utilized to enhance the cost management level. It is then recommended that the cost management system be transferred to secondary subcontractors.

(3) Equipment/Jig and Tool Management

Equipment/jig and tool management has a significant influence on quality and delivery of products and thus it may utilize the improvement plan mentioned above for "Quality Control and Delivery Control." However, regarding management system (TPM: Total Productive Maintenance) by using total equipment efficiency, instruction from foreign experts (from Japan, for example) may be needed.

(4) Environment Management

Environmental specialists from foreign joint ventures should carry out diagnostic surveys of secondary and lower level subcontractors. Either that, or the use of foreign aid or public investment should be considered to implement necessary improvements in the area of environmental concerns.

CHAPTER VIII. INTERNATIONAL COMPETITIVENESS OF INDONESIAN PRODUCTS IN THE ASIAN REGION

1. MAJOR FACTORS FOR INTERNATIONAL COMPETITION IN THE ASIAN REGION

In the Asian region, which is considered a leading growth center in the world, countries which have shown rapid growth are China and ASEAN countries, and recently Vietnam and India. These countries hold great growth potential both in terms of industrialization and market size. Market integration and globalization in this region will continue to advance at a rapid pace with the establishment of regional cooperation systems under APEC and AFTA.

Major environmental factors of the markets in the Asian region are:

i. Progress of liberalization
   - Liberalization of trade and investments through APEC and WTO will progress. At APEC, member countries have agreed that they will abolish tariff barriers and non-tariff barriers by the year 2020.
   - ASEAN countries have agreed, with AFTA, that they will reduce import duties among member counties to less than 5%, and reduce import duties for trade with non-member countries to less than 20% by the year 2003.

ii. Expansion of market sizes

Major Asian countries such as ASEAN countries, China, Vietnam, and India will continue to grow although there may be some occasional setbacks. The purchasing power of the emerging middle-income consumers will continue to grow and demand is expected to expand favorably.

Table 8-1-1 Economic Indicator of Major Asian Countries

	Indonesia	Thailand	Malaysia	Philippines	Singapore	China
GDP (Mil. US$, 1994)	174,636	143,205	70,626	65,875	68,949	508,197
Per Capita GDP (US$, 1994)	909	2,411	3,594	953	23,532	424
Exports (Mil. US$, FOB,1995)	45,479	56,435	73,864	17,519	148,770	148,770
Imports (Mil. US$, CIF,1995)	39,769	70,859	77,597	28,388	124,392	132,080
Population(1,000, 1994)	192.22	59.40	3,290	67.04	2.93	1,208.8
Exchange Rate (US$) (End of Dec. 1995)	2,308	25.190	2.5420	26.214	1.4143	8.3174

Source: *International Financial Statistics*, IMF, *World Tables*, World Bank, *Asia Economic Review*, Japan Research Institute

Responding to changes in the business climate, assemblers and parts and components manufacturers, especially multinational enterprises, in the automobile, electrical and electronic, and machinery industries in the ASEAN region are taking the following measures:

i. New and additional investments in the Asian region
   - Increase in investments into ASEAN countries
   - More severe competition in the Asian region among Japanese, US, Europe, Korean, Taiwanese manufacturers

ii. Progress of business operations which deal with the ASEAN as one country
   - Increase in local procurement within the ASEAN
   - Progress in mutual complementation within the ASEAN

iii. Expansion of exports to outside the ASEAN

iv. Expansion of R&D activities in the ASEAN

The competition among multinational manufacturers in the ASEAN closely affects the country-to-country competition at the individual industry level among ASEAN countries.

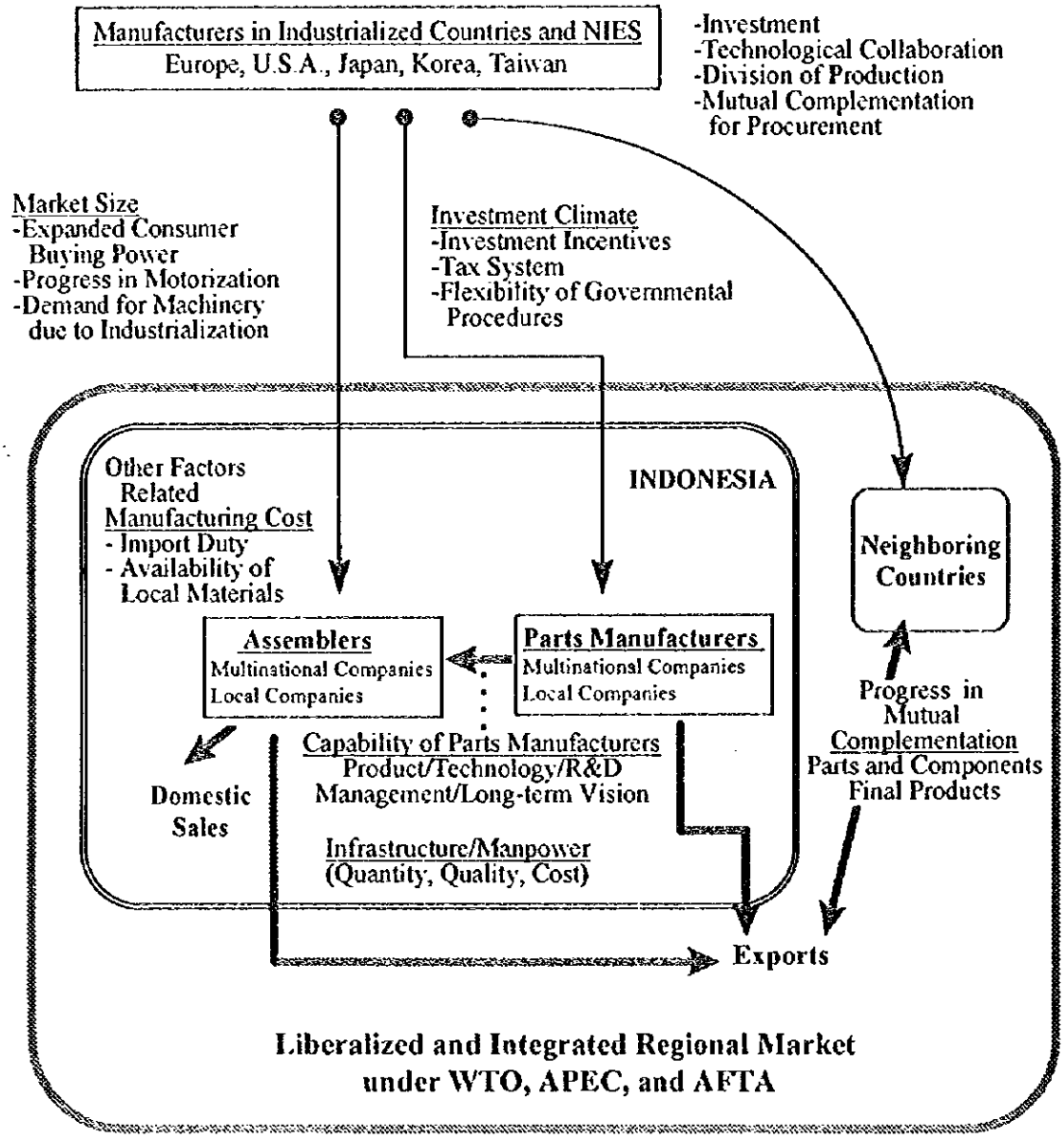
As for the Indonesian automotive, electrical and electronic, and machinery industries, the building-up of international competitiveness and establishing positions in international competition are necessary in order to achieve the expected further development. Key factors in the country-level competition among the Asian countries are as follows:

i. Reinforcement of industrial foundation
ii. Expansion and opening of domestic markets
iii. Expansion of cooperation and linkage with multinational enterprises in the USA, Europe, Japan, and NIES
iv. Establishment of driver industries
v. Establishment of Indonesia's unique advantages and clear differentiation from other neighboring countries

The situation of international competition and Indonesia's international competitiveness should be evaluated in order to identify the future growth trends of the subject industries and to clarify the approaches to be taken by Indonesia's individual industries. The key factors for this evaluation are as follows:

i. Production, exports/imports, and market sizes of the subject industries in the major Asian countries, especially the neighboring ASEAN countries.
ii. Industrial policies in these countries
iii. Investment promotion policies in these countries
iv. Trend of international division of production and investments of multinational enterprises
v. Metal processing industries in these countries
vi. Production cost, such as labor cost, in these countries

Fig. 8-1-1 Major Factors for International Competition in the Asian Region



2. AUTOMOTIVE, ELECTRICAL/ELECTRONIC, AND MACHINERY INDUSTRIES IN THE ASEAN

2.1 THE AUTOMOTIVE INDUSTRY IN THE ASEAN

2.1.1 Automobile and Auto Parts Industries in Thailand

(1) Production Trend

Currently there are 12 automobile assembly companies in Thailand. One-ton pickup trucks and other small commercial vehicles purchased by farmers, which comprise 70% of the country's population, account for the major share of automobile demand in Thailand. A significant reason for this is that duty rates on imports of commercial vehicle CKD kits are lower than those on passenger cars.

Thailand has the largest automobile market of all ASEAN economies, and in 1994 the number of automobiles sold grew by 6.4% to 485,700 units. Of these, one-ton pickup trucks accounted for 258,100 units, a 53% share of all automobiles sold. In contrast, passenger cars accounted for just 32%. While passenger car sales declined by 11% versus the previous year, sales of pickup trucks posted a 15% increase. Incidentally, 1995 automobile sales are estimated to have posted a 17% yearly increase, to 570,000 units.

As of 1994, Toyota claimed the top share of Thailand's automobile market, at 26%. Isuzu, which boasts the top share in terms of truck sales, was second at 20%. Japanese-affiliated manufacturers together account for an 87% share of the market, with Germany's Mercedes Benz and BMW holding shares of just 2.3% and 1.5%, respectively, and Korea's Hyundai Motors a mere 1.5% share.

In April of 1996, Toyota Motor announced production plans for a new 1500cc subcompact passenger car as an "Asia car." The company plans to produce about 36,000 of the cars annually, beginning in early 1997. In addition, Honda Motor, which holds

the number two position in the passenger car market (21% share), has announced that it will launch production of its own "Asia car" during the spring of 1996, at a pace of about 20,000 cars per year. Automobile production in Thailand is expected to continue growing rapidly for many years to come, and the combined production plans of the various auto makers puts total automobile production volume at over one million units in 1998.

Table 8-2-1 Automobile Production in Thailand

(Unit: No. of vehicles)

	1992	1993	1994
Passenger cars	100,276	144,449	109,822
Commercial vehicles	223,685	275,412	323,504
Motorcycles	863,185	1,117,735	1,349,037

Source: *Trade Statistics and Economic Indicators of Thailand 1994*, Ministry of Commerce, Thailand

Table 8-2-2 Automobile Sales in Thailand

(Unit: No. of vehicles)

	1992	1993	1994
Passenger cars	121,745	174,169	155,670
Pickup trucks (1-ton)	182,958	224,388	258,091
Other commercial vehicles	58,284	57,911	71,917
Total	362,987	456,468	485,678

Source: *Thailand in Figures 1995-1996*, Alpha Research Co.

(2) Export/Import Trends

Total automobile exports for 1994, including automobile parts and components, increased 33% yearly to Bt20 billion. Likewise, imports also jumped 30% to Bt107.3 billion. Assembly for the domestic market accounts for the major share of automobile production in Thailand, which means that imports naturally exceed exports. However, recently Toyota has begun exporting some automobile components from Thailand to Japan, and exports of parts to neighboring ASEAN countries, while still small in volume, are increasing.

Table 8-2-3 Imports/Exports of Automobiles and Automobile Parts of Thailand

(Unit: Baht Million)

	Exports	Imports
1992	5,392	66,945
1993	13,421	92,580
1994	20,027	107,283

Source: *Thailand in Figures 1995-1996*, Alpha Research Co.

2.1.2 Automobile and Auto Parts Industries in Malaysia

(1) Production Trend

In 1994, a total of 211,000 automobiles were produced in Malaysia. Of those, passenger cars with engine displacements under 1600cc accounted for 62%, and the production share of all passenger cars, including large cars, was 82%. This means that Malaysia is the only ASEAN economy in which passenger cars make up the largest share of automobile production. Although automobile production reached 230,000 units in 1991, that same year the government, out of inflationary concerns, implemented auto loan restrictions, and these restrictions led to a decline in demand. While this also resulted in a temporary decline in production volume, the restrictions were lifted in 1993, and production volume recovered the following year.

The focus of production volume is the "Proton Saga", which accounted for 72% of all cars produced in Malaysia in 1992. Furthermore, in June of 1993, Proton launched production of the luxury car "Proton Wira" at a pace of 10,000 cars per month. In July of 1994, the company concluded a technology transfer agreement with France's Citroen, and plans to launch production of a 1100cc-class passenger car in the near future.

The primary feature of the automobile market in Malaysia has been an overwhelming market share of PROTON, the first national car project. However, PROTON's share, in spite of its sales growth, has been dropping since the summer of 1994, when Produa, a joint ventrue with a Japanese automobile manufacturer, Daihatsu Motor Co., Ltd., started to sell the second national car, Kancil (660 cc) and gained a favorable market response. These two brands occupy most part of the market. Among the passenger ve-

hicle sales during the first half of 1995, PROTON's share decreased from 74.5% during the same period in the previous year to 57.5%, while Kancil captured 17.1%. There is another national car, PROTON Satria, with a 3.5% market share. Japanese brand passenger vehicles occupy 16.2% of the market.

In March, 1996, Produa marketed Rusa, a small one-box type car (1,300 cc) and the first multi-purpose national car, at a price range of MR30,365 - 39,365. This model is based on Daihatsu's model for the Indonesian market, Zebra. This model purchases 25% of its parts and components locally, 55% from Japan, and 20% from Indonesia.

In April, 1996, PROTON started to sell a small passenger car, PROTON Tiara (1,100 cc), which was developed with the collaboration of Citroen, France. They plan to introduce a diesel engine mode of 1,500 cc in 1996. PROTON is constructing its second plant, which will be completed by 1998, and PROTON will reach a total production capacity of 500,000 units per year.

Table 8-2-4 Automobile Production in Malaysia

(Unit: No. of vehicles)

	1992	1993	1994
Passenger cars(under1,600cc)	119,320	116,369	131,245
Passenger cars(over1,600cc)	17,631	28,701	42,057
Commercial vehicles	34,711	34,711	37,749
(Totals for 4-wheel vehicles)	171,662	179,781	211,051
Motorcycles	235,239	241,615	270,006

Source: *Yearbook of Statistics 1994*, Department of Statistics, Malaysia

(2) Export/Import Trend

Automobile exports totaled RM1 billion in 1994. In contrast, the import total, at RM4.6 billion, was 4.6-times as large. Motorcycles account for a 35% share of automobile exports, exceeding the share of passenger cars (31%). Automobile parts exports posted growth of 41% in 1994, but imports of parts also exceed exports by about 3.6 times. According to the "Yearbook of Statistics Malaysia 1994", imports of CKD automobiles jumped 29% to 180,000 units in 1994, resulting in a 44% jump, to RM1.9

billion, in monetary terms.

In 1995, PROTON exported approximately 20,000 units among its total production of 150,000 units.

Table 8-2-5 Malaysian Imports/Exports of Automobiles and Automobile Parts

(Unit: RM Million)

SITC No.	Product	1992		1993		1994	
		Exports	Imports	Exports	Imports	Exports	Imports
78	Automobiles	681	2,947	982	3,448	1,005	4,639
781	Passenger cars	333	1,656	406	1,987	315	2,823
782	Commercial vehicles	21	462	32	455	19	658
783	Others	2	116	1	94	2	91
784	Automobile parts	62	318	118	443	167	604
785	Motorcycles	229	335	337	423	347	392

Source: *External Trade Statistics of Malaysia 1994 Volume II*, Department of Statistics, Malaysia

2.1.3 Automobile and Auto Parts Industries in the Philippines

(1) Production Trend

Following the 1990 announcement of the national car program, Honda, Daihatsu, and Mazda jumped into the automobile CKD production market, which up until that time had been controlled by Toyota Motor, Nissan Motor, and Mitsubishi Motors. Honda and Daihatsu launched production of passenger cars in 1992, and Mazda followed in 1993. Further, with the lifting of restrictions on the domestic assembly of 2800cc and larger automobiles, in 1991 Germany's Mercedes Benz and BMW, Sweden's Volvo, and Korea's Daewoo Motors and Hyundai Motors all applied to begin domestic assembly operations, and in 1993 the joint venture company of the U.S.'s Chrysler Corp. was granted approval. Finally, in 1994 Malaysia's Proton Co. also announced plans to produce passenger cars in the Philippines.

By 1978, automobile production in the Philippines had already reached 70,000 units per year, but continued political instability coupled with the second oil crisis led to a declining trend in production volume until around 1985. Automobile demand recovered along with the birth of the Aquino administration in 1986, and in 1988 production volume increased to 17,000 units. Production grew steadily after that, reaching 46,000 units in 1991, 55,000 units in 1992, and 66,000 units in 1993. Since 1992, in particular, the political stability of the Ramos administration has contributed to a gradual economic recovery and subsequent increase in automobile demand, and production is estimated to have been around 100,000 units in 1994.

Table 8-2-6 Automobile Production in the Philippines

(Unit: No. of vehicles)

	1993	1994
Passenger cars	51,583	57,818
Commercial vehicles	29,337	42,280
Total	80,920	100,098

Source: *World Automobile Statistics 1995*, Japan Automobile Manufacturers Association, Inc.

(2) Export/Import Trend

Exports of automobiles and automobile parts climbed 65% in 1994 to $180 million, while imports posted a 20% increase to $1,097 million. As these figures show, imports of automobile-related products overwhelmingly exceed exports. In dollar terms, 92% of exports are of parts and components, and exports of these products alone posted a sharp 73% increase for the year. On the other hand, passenger cars account for 49% of automobile imports. While it is likely to be some time before automobiles become a real export industry in the Philippines, Mitsubishi Motors is planning to make the country one of the manufacturing hubs for its Asia car. The dramatic increase in automobile parts exports is one area where the future looks very bright.

Table 8-2-7 Imports/Exports of Automobiles and Automobile Parts of the Philippines

(Unit: US$ Millions)

SITC No.	Product	1993		1994	
		Exports	Imports	Exports	Imports
78	Automobiles	109.1	911.4	180.2	1,097.0
781	Passenger cars	2.5	402.9	0.3	541.0
782	Commercial vehicles	0.4	191.1	0.5	193.7
783	Others	1.2	31.9	0.7	37.7
784	Automobile parts	96.2	187.3	165.7	202.9
785	Motorcycles	8.5	89.6	12.7	112.6

Source: *External Trade Statistics of the Philippines 1994*

2.2 THE ELECTRICAL AND ELECTRONIC INDUSTRY IN THE ASEAN

2.2.1 Overview

The production of the electrical and electronic industry in ASEAN countries on a value basis can be compared according to the "Yearbook of World Electronics Data 1995". The production figures for 1995 are estimates at constant 1993 prices based on trends until 1993. They show that among the four ASEAN countries other than Singapore, Malaysia is by far the largest producer of electronics equipment (including parts and components), with production valued at $22.8 billion. Thailand is next with $10 billion, less than half the level of Malaysia. Indonesia and the Philippines follow with $3.9 billion and $3.5 billion, respectively.

While Malaysian production is still less than the $27.651 million of Singapore, ASEAN's only industrialized economy, in terms of production of electronics components only, Malaysia's production level of $9.43 billion has already surpassed that of Singapore, which is just $8.341 million. Furthermore, with regard to the production of consumer electronics equipment also, Malaysia's $6.164 million of production is nearly three times Singapore's $2.291 million.

These figures indicate that Singapore's electronics industry has already reached its saturation point as a manufacturing base. The government of Singapore has shifted its emphasis to the development of high-tech industries such as personal computers, and the private companies, faced with a chronic labor shortage and rising wage levels, are themselves shifting production of audio equipment and other consumer electronics products to off-shore locations like Malaysia's Johor Baharu region and Indonesia's Batam Island. Consequently, Singapore is currently playing the role of a global trade center for electronics equipment.

Looking at other Asian economies, Japan is the region's (also the world's) largest electronics producer, with output of $218.0 billion. As for Asian NIES, South Korea is second at $36.2 billion, and Taiwan and Hong Kong produce $22.6 billion and $9.2 billion, respectively. As these numbers show, Malaysia has already surpassed both Taiwan and Hong

Kong in terms of production volume. A major reason for this is that Asian NIES, like Japan, are shifting production to overseas locations in order to combat rising wages and the increased value of their currencies versus the dollar. Taiwan's electronics industry has been shifting its production bases primarily to ASEAN countries, while Hong Kong has been moving production primarily to mainland China.

Table 8-2-8 Electronics Industry Production in ASEAN Countries (1995) *

(Unit: US$ Million)

Product	Indonesia	Malaysia	Thailand	Philippines
Computer equipment	507	4,744	3,502	473
Office equipment	62	141	341	16
Measuring and control devices	85	222	167	45
Electronic medical devices	101	108	69	28
Communications/ military equipment	272	950	438	397
Remote communications equipment	317	1,103	508	150
Consumer electronics equipment	1,898	6,164	2,006	236
Parts and components	640	9,430	2,965	2,151
Totals	3,883	22,862	9,996	3,495

Note: * Figures are estimates based on data through 1993. Amounts are in 1993 prices.
Source: *Yearbook of World Electronics 1995*, Elsvier Advanced Technology

2.2.2 Electrical and Electronic Industry in Thailand

(1) Production Trend

Thailand's electrical/electronics industry has been growing at a rapid pace in recent years, thanks primarily to the government's deregulation of foreign capital investment and the resulting influx of companies from Japan, Taiwan, and elsewhere. After 1985 in particular, electronics companies from Japan, South Korea, Taiwan, etc., faced with the appreciation of their home currencies versus the dollar, increasingly targeted Thailand for investment as an export production base. Although foreign investment in Thailand peaked in 1988 and then declined for a short time, it began to increase once again in 1993. The number of foreign investment projects approved by Thailand's Board of In-

vestment (BOI) rose by 34% in 1994 to 507 cases, and projects in the electrical/electronics sector, led by investment from Japan and Taiwan, accounted for the largest share at 126 cases. The value of these investment projects increased even more dramatically, jumping 93% to Bt32.6 billion and accounting for a 22% share of total investment.

Production by product type, according to the "Yearbook of World Electronics Data 1995", is presented in Table 8-2-9. According to actual data for 1993, combined production of all electronics equipment totaled $7,227 million, with computer-related equipment (EDP) accounting for $2,648 million, or 37% of the total. Parts and components accounted for the next largest share, with $1,981 million (27%). Production of computer-related components was prominent within the parts category as well, with semiconductors accounting for $949 million and printed circuit boards $277 million. Production of consumer electronics appliances totaled $1,438 million, accounting for a 20% share. Color television sets accounted for the largest share among these products, with total production of $988 million.

Table 8-2-9 Electronic Industry Production in Thailand *

(Unit: US$ Million)

Product	1992	1993	1994	1995
Computer equipment	2,313	2,648	3,045	3,502
Office equipment	153	281	310	341
Measuring and control devices	87	107	133	167
Electronic medical devices	45	51	59	67
Communications/military equipment	239	281	351	438
Remote communications equipment	429	440	462	508
Consumer electronics equipment	1,448	1,438	1,697	2,006
Color TV	890	988	1,200	1,455
Parts and components	1,471	1,981	2,476	2,965
Active Ones	918	1,269	1,586	1,824
(Printed circuit boards)	236	277	356	471
Passive Ones	359	458	572	744
Totals	6,183	7,227	8,533	9,996

Note: * Figures for 1992 and 1993 are actual. 1994 and 1995 figures are estimates based on 1993 prices.

Source: *Yearbook of World Electronics 1995*, Elsvier Advanced Technology

(2) Export/Import Trend

According to Ministry of Commerce trade statistics, exports of electrical equipment increased 42% in 1994 to Bt125.9 billion, and exports of electronic equipment increased 36% to Bt185.2 billion. Both of these areas posted much higher rates of growth than overall exports, which grew just 21%. Exports of electrical and electronics equipment already account for nearly 30% of overall exports. Exports of computers and integrated circuits are particularly prominent.

Although statistical categories for imports differ somewhat from export categories, imports of electrical machinery increased 24% in 1994 to Bt136.8 billion, imports of computers jumped 36% to Bt53.0 billion, and imports of integrated circuits totaled Bt67.8 billion. As these figures demonstrate Thailand exports much more computer-related equipment than it imports.

At the present time, Japanese electronic equipment manufacturers are taking steps to boost in-house production of parts and components. This is because, in contrast to Singapore and Malaysia, there are still relatively few Japanese-affiliated parts manufacturers in Thailand, and the pace of development of local companies is slow. The focus of in-house production is on structural parts rather than circuit components, and they are also taking steps to reinforce basic technologies such as fabrication and molding. Circuit components are primarily imported from Singapore and Malaysia.

Table 8-2-10 Exports of Major Electrical/Electronic Equipment of Thailand

(Unit: Baht Million)

Product	1993	1994
Total exports	940,863	1,137,602
Electrical equipment	88,327	125,915
VCRs, components	14,486	22,728
Radios, televisions	22,206	28,032
Air conditioners, components	8,325	13,491
Electronic equipment	136,272	185,245
Computers, components	65,271	94,590
Integrated circuits	35,550	45,311
Printed circuit boards	5,902	10,106

Source: *Trade Statistics and Economic Indicators of Thailand 1994*, Ministry of Commerce, Thailand

Table 8-2-11 Imports of Major Electrical/Electronic Equipment of Thailand

(Unit: Baht Million)

Product	1993	1994
Total Thai imports	1,170,846	1,369,260
Electrical equipment, components	110,314	136,765
Motors, generators	24,491	18,897
Wireless equipment transmissions	6,508	12,327
Electrical switches, etc.	17,781	24,144
Computers, components	38,968	52,984
Integrated circuits	48,729	67,821

Source: *Trade Statistics and Economic Indicators of Thailand 1994*, Ministry of Commerce, Thailand

2.2.3 Electrical and Electronic Industry in Malaysia

(1) Production Trend

Malaysia's electrical/electronics industry, which had its beginning somewhat later than Singapore and Thailand, was born in 1965 when Matsushita Electric Industrial began manufacturing batteries. However, following the 1971 enactment of the "investment stimulation law" and "free trade zone law", Japanese consumer electronics manufacturers and U.S. semiconductor and other electronic components manufacturers moved into Malaysia at a brisk pace. Due to the sharp appreciation of the Yen after 1985, Japanese

companies became particularly interested in Malaysia as a production base from which to export electrical and electronics equipment to other Asian markets. This, together with the Malaysian government's export industry development policies and foreign capital deregulation measures, led to rapid investment by assembly plants and component manufacturers, and production and export volume quickly expanded.

The electrical machinery industry in Malaysia has grown dramatically since the beginning of the 1990s. While the industry numbered just 530 companies in 1992, a mere 7% share of the manufacturing sector overall, it accounted for RM7,263 million in value-added production, a 26% share of the total, and 286,500 workers, a 28% share. In addition, the industry also accounted for 28% of total wages and 18% of total asset value, making it one of Malaysia's leading manufacturing industries.

Table 8-2-12 Outline of Malaysia's Electrical and Electronic Industry

	1990	1991	1992
No. of companies	422	492	530
Value-added production(RM millions)	5,262	7,263	9,161
No. of workers (year end)	217,537	261,909	286,505
Total wages (RM millions)	1,631	2,238	2,737
Total assets (RM millions)	5,947	8,538	10,130

Source: *Yearbook of Statistics, 1994*, Department of Statistics, Malaysia

Table 8-2-13 Production of Major Electrical/Electronic Products in Malaysia

	1992	1993	1994
Household refrigerators(thousands)	288	250	266
Indoor air conditioning units (thousands)	2,519	2,388	3,017
Television sets (thousands)	5,553	6,629	7,702
Radios (thousands)	31,360	34,537	36,310
Semiconductors (millions)	3,121	3,491	3,355
Transistors (millions)	7,228	7,533	7,868
Integrated circuits (millions)	6,730	8,047	9,134

Source: *Yearbook of Statistics, 1994*, Department of Statistics, Malaysia

(2) Export/Import Trend

Trade in electrical/electronics equipment has been growing solidly since the beginning of the 1990s. In 1994, combined exports of office equipment, communications equipment, and electrical equipment totaled RM70,664 million, an amount equivalent to 46% of Malaysia's total export volume. Exports of parts and components are particularly prominent, accounting for 67% of office equipment, 31% of communications equipment, and over 80% of electrical equipment exports. Semiconductors comprise the vast majority of electrical equipment components.

Imports have also increased steadily, and in 1994 imports of electrical/electronics equipment accounted for 36% of Malaysia's total import volume. In the case of imports as well, components for assembly production comprise the largest share. Next to Singapore, Malaysia is quickly becoming Asia's second most important trade center for electrical/electronic components. Japanese-affiliated companies in Indonesia and the Philippines import many of their electrical/electronic parts and components from Malaysia.

Table 8-2-14 Exports/Imports of Electrical/Electronic Equipment and Components of Malaysia

(Unit: RM Million)

SITC #	Product	1992		1993		1994	
		Exports	Imports	Exports	Imports	Exports	Imports
	Totals of Trade	103,657	101,441	121,238	117,405	153,921	155,921
75	Office equipment, devices	6,032	3,082	8,531	3,540	13,191	5,028
751	Office equipment	363	155	537	161	568	228
752	Computers, peripherals	730	595	1,154	803	3,819	1,083
759	Parts and components	4,938	2,332	6,840	2,577	8,804	3,717
76	Communication equipment, devices	13,624	4,910	18,298	6,392	26,269	8,473
761	Televisions	2,162	48	3,180	85	4,547	99
762	Radios	4,431	242	5,377	227	7,436	262
763	VCRs, tape recorders	2,633	185	4,050	204	6,023	382
764	Communications devices, parts	4,399	4,436	5,691	5,876	8,263	7,731
77	Electric machinery, parts	18,329	21,570	23,833	28,373	31,205	42,816
771	Power machinery, parts	929	856	1,170	1,222	1,281	1,816
772	Circuit devices	1,453	3,742	1,984	4,550	2,321	6,717
773	Wiring devices	507	923	544	1,153	711	1,377
775	Household electric appliances	317	226	435	301	509	399
776	Semiconductors, etc.	14,341	13,643	18,751	18,318	24,847	28,251
778	Others (incl. electric devices)	774	2,094	943	2,740	1,531	4,162

Source: Malaysia customs statistics for each year

2.2.4 Electrical and Electronic Industry in the Philippines

(1) Production Trend

Semiconductor manufacturing comprises the largest element of the electronics industry in the Philippines. According to the "Yearbook of World Electronics Data 1995", in 1993 total production of electronics equipment in the Philippines was valued at $2.6 billion. Semiconductors accounted for 59% of that, or $1.5 billion. U.S. companies Stanford Inc. and Carter Semiconductor launched semiconductor manufacturing operations in the Philippines in 1969, and soon other U.S. companies, such as GE, 3M, Intel, and other semiconductor manufacturers, were setting up operations in the country. This is because there was a need for labor-intensive work, including assembly using im-

ported parts, packaging processes, and so on. Later, there was increased investment by electrical/electronics manufacturers from Japan, Taiwan, and other Asian NIES, and these companies began producing computer equipment, color televisions, and so on.

According to the Philippine Economic Zone Agency (PEZA), in 1995 foreign investment in export processing zones (EPZ) totaled P41.4 billion, 4.7 times more than the previous year. Investment in the electrical/electronics sector accounted for 80% of this amount, or P33.2 billion. Investment by Japanese electrical/electronic equipment manufacturers makes up a large share of this, and production of computer-related equipment, such as integrated/compound passive components, mini printers, hard disk drives, etc., is expected to increase.

(2) Export/Import Trend

In 1994, exports of electrical/electronic equipment (office equipment, communications equipment, electrical equipment) jumped 36% to $2,643.3 million. This represents nearly double the rate of increase of overall exports from the Philippines. The main component of these exports is semiconductors, which account for roughly 65% of electrical/electronics exports. Other important export products include communications equipment (excluding televisions, radios, and VCRs) and related parts ($500 million), and wiring devices ($450 million).

As is the case with exports, semiconductors and communications equipment components account for a large share of the country's imports as well. This is because it is still necessary to import assembly components for export products. Imports of semiconductors and communications equipment components totaled $900 million and $800 million, respectively.

Table 8-2-15 Exports/Imports of Electrical/Electronic Equipment and Components of the Philippines

(Unit: $ Million)

SITC #	Product	1993		1994	
		Exports	Imports	Exports	Imports
	Totals of Trade	11,374.8	17,597.4	13,482.9	21,332.6
75	Office equipment, devices	214.6	208.6	232.9	341.9
751	Office equipment	0.1	34.4	0.0	40.6
752	Computers, peripherals	187.8	96.9	179.2	115.0
759	Parts and components	26.7	149.3	53.7	186.3
76	Communication equipment, devices	506.0	613.1	681.2	895.3
761	Televisions	17.6	17.5	35.6	31.6
762	Radios	69.3	6.5	120.9	16.6
763	VCRs, tape recorders	25.6	16.3	24.8	24.5
764	Communications devices, parts	393.5	572.8	499.9	824.6
77	Electric machinery, parts	1,229.6	1,419.3	1,792.2	1,805.3
771	Power machinery, parts	22.6	100.5	31.9	100.4
772	Circuit devices	56.8	278.0	94.0	303.5
773	Wiring devices	310.0	179.5	450.8	245.8
775	Household electric appliances	23.3	21.4	32.3	27.2
776	Semiconductors, etc.	786.0	671.0	1,072.9	922.1
778	Others (incl. electric devices)	30.8	159.9	0.1	187.2

Source: Philippines customs statistics for each year

2.3 THE INDUSTRIAL MACHINERY INDUSTRY IN THE ASEAN

2.3.1 Outline of the Industrial Machinery Industry in Three Major ASEAN Countries

Comparing the industrial machinery industries in these three ASEAN economies, Thailand, Malaysia, and the Philippines, using UNIDO's international industrial statistics, we find that, although the figures are for 1989-1991, these industries account for an extremely small weighting in the respective manufacturing sectors in each country, with the exception of Thailand's agricultural machinery industry. As the following table shows, in Malaysia the combined number of companies in four industrial machinery sectors is just 72, a mere 1% of all manufacturing companies. In the Philippines there are also 72 companies, accounting for 0.7% of the total, and in Thailand, an agricultural nation, there are 189 companies, accounting for a relatively high 1.4% of all manufacturing companies.

In Malaysia these four sectors account for 0.4% of all employees in the manufacturing industries, in the Philippines 0.2%, and in Thailand 0.4%. The share of total product shipments is 0.2% in Malaysia, 0.1% in the Philippines, and 2.2% in Thailand. While these shares are largest in Thailand, it is clear that it is still a very small industry even there.

Table 8-2-16 The Industrial Machinery Industry in Thailand (1991)

(Unit: Baht Million)

ISIC #	Sector	No. of companies	No. of employees	Total wages	Shipments	Value-added amount
3821	Engines, turbines	15	200	4.3	45	10
3822	Agricultural machinery, equipment	102	4,700	530.6	14,042	3,884
3823	Metal and wood processing machinery	19	n.a.	52.4	44,186	10,115
3824	Other industrial machinery	53	1,700	98.3	676	182
	Totals for all manufacturing industries	13,926	1,607,900	118,348.0	2,681,362	1,669,136

Source: *International Yearbook of Industrial Statistics 1995*, UNIDO

Table 8-2-17 Malaysia's Industrial Machinery Industry (1991)

(Unit: RM Million)

ISIC #	Sector	No. of companies	No. of employees	Total wages	Shipments	Value-added amount
3821	Engines, turbines	0	1,200	3.1	67.8	27.5
3822	Agricultural machinery, equipment	(*)	(*)	(*)	(*)	(*)
3823	Metal and wood processing machinery	16	500	4.8	24.1	10.0
3824	Other industrial machinery	36	2,300	25.7	182.4	60.2
	Totals for all manufacturing industries	7,301	965,200	8,411.0	120,298.0	31,140.0

Note: * Agricultural machinery statistics are included in statistics for engines and turbines.
Source: *International Yearbook of Industrial Statistics 1995*, UNIDO

Table 8-2-18 The Industrial Machinery Industry in the Philippines (1989)

(Unit: Peso Million)

ISIC #	Sector	No. of companies	No. of employees	Total wages	Shipments	Value-added amount
3821	Engines, turbines	39	1,000	26	145	68
3822	Agricultural machinery, equipment	(*)	(*)	(*)	(*)	(*)
3823	Metal and wood processing machinery	16	600	17	109	60
3824	Other industrial machinery	17	500	23	134	64
	Totals for all manufacturing industries	10,154	940,300	38,831	463,055	145,550

Note: * Agricultural machinery statistics are included in statistics for engines and turbines.
Source: *International Yearbook of Industrial Statistics 1995*, UNIDO

2.3.2 Export/Import of Industrial Machinery of Three Major ASEAN Countries

Factors which all three of these countries have in common with regard to the industrial machinery industry are that the industry scale is still small, and there is little capacity for exports, as domestic shipments account for nearly all of production volume. This is true even for agricultural machinery produced in Thailand. In fact, a large volume of imports are re-

quired simply to cover domestic demand alone. Nevertheless, although the amount is still quite small, in each country there are a few products which are showing some growth in export volume. These include engines, engine parts, and air pumps in Malaysia, engines, engine parts, and plastic processing machines in Thailand, and metal processing machines and air pumps in the Philippines.

Table 8-2-19 Thailand's Exports of Industrial Machinery, Equipment, and Components

(Unit: Baht Million)

Product	1993	1994
Engines, components	1,019	1,261
Plastic processing equipment	576	688
Molds	573	540

Source: *Trade Statistics and Economic Indicators of Thailand 1994*, Department of Business Economic, Thailand

Table 8-2-20 Thailand's Imports of Industrial Machinery and Components

(Unit: Baht Millions)

Product	1993	1994
(Industrial equipment totals)	168,607	193,272
Engines, components	18,033	20,853
Textile machinery	13,650	12,841
Construction machinery	23,482	33,360
Air/liquid pumps	14,195	18,188

Source: *Trade Statistics and Economic Indicators of Thailand 1994*, Department of Business Economics, Thailand

Table 8-2-21 Malaysia's Exports/Imports of Engines, etc.

(Unit: RM Million)

SITC #	Product	1992		1993		1994	
		Exports	Imports	Exports	Imports	Exports	Imports
71	Power generating machinery	973	2,810	1,220	3,098	1,435	4,704
713	Engines, components	466	1,219	412	988	457	1,150
73	Metal processing machinery	81	1,984	124	1,861	176	2,567
737	Metal processing equipment, components	31	667	28	466	59	668
74	Industrial machinery	1,931	5,936	2,448	7,085	3,316	8,187
742	Liquid pumps	34	387	34	382	40	349
743	Air pumps	276	1,115	315	1,360	507	1,368
749	Molds	78	688	125	821	199	1,013

Source: *External Trade Statistics of Malaysia 1994*, Department of Statistics, Malaysia

Table 8-2-22 Philippine's Exports/Imports of Engines, etc.

(Unit: $ Million)

SITC #	Product	1993		1994	
		Exports	Imports	Exports	Imports
71	Power generating machinery	3.3	815.5	6.4	886.4
713	Engines, components	0.4	195.7	0.2	293.3
73	Metal processing machinery	2.8	105.8	5.0	93.4
737	Metal processing equipment, components	0.7	28.9	0.8	24.5
74	Industrial machinery	22.0	605.2	28.2	727.0
742	Liquid pumps	0.1	60.5	0.6	66.8
743	Air pumps	4.0	99.7	6.7	127.4
749	Molds	3.3	38.5	3.3	42.3

Source: *External Trade Statistics of Philippines 1994*, Department of Statistics, Philippines