III. OVERVIEW OF THE ESSENTIAL TECHNOLOGY INDUSTRIES IN INDONESIA

1. CASTING INDUSTRY

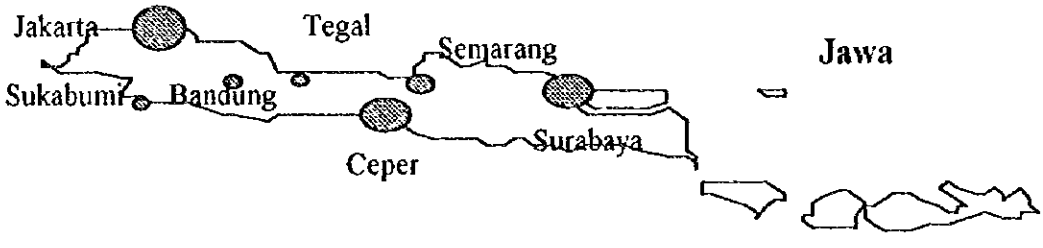
(1) Outline of the Industry

In the late 19th century, sugar refining machines for sugar cane, mining machines for tin ore and oil rigs were introduced from Europe. These machines needed casting spare parts, which were first produced by traditional methods such as in Ceper.

After Indonesia gained independence, the Dutch-owned casting factories were requisitioned and nationalized, and cast production of industrial machinery for ship building, railways, vehicles, mining, etc., began. Since 1970 the Indonesian government has encouraged industrialization and especially the domestic manufacture of auto parts. Also the number of new casting enterprises has risen since 1971. Since the early 1990's modern casting factories have increasingly been built, mostly by joint enterprises funded with foreign capital.

Fig 3-1 shows the area distribution of casting enterprises. Most A and B Class enterprises, which are rather modernized, are located in Jakarta. In addition, three to five companies each are in Surabaya, Bandung and Semarang.

Fig. 3-1 Number of Casting Enterprises in Each Area



(Number of Casting Enterprises in Each Area)

Area	Jakarta	Bandung	Sukabumi	Tegal	Semarang	Ceper	Surabaya	Others	Total
Production Capacity (tons/year)	65,000	5,000	4,000	4,000	10,000	30,000	30,000	2,000	150,000
No. of Enterprises									
A,B Classes	24	4	1	0	3	3	5	0	40
C,D Classes	30	0	40	30	5	320	5	20	450

Note : The class criteria are as follows:

(i) Class A : Level of advanced nations (Can supply to Japanese assemblers).
(ii) Class B : Level which can advance to A in 2-3 years after small improvements
(iii) Class C : Level which can advance to A in the future by proper guidance.
(iv) Class D : Level which will have difficulties in becoming casting companies for machinery parts in the future

Many small companies and local industries of C and D classes are located in Ceper, Sukabumi, Tegal, etc., which are suburbs of Yogjakarta in central Java.

The import ad export status of casting products is shown in Table 3-l and Table 3-2, respectively. 1995 imports totaled about 220,000 tons, mainly from Japan, Australia, China, Taiwan, the U.S.A. and Germany. Exports, on the other hand, totaled 13,700 tons, mainly to the U.S.A., Australia, Malaysia and Taiwan. Export values to Malaysia and Thailand are large because they involve the relatively expensive large aluminum die casting parts for automobiles.

Table 3-1 Import Status of Casting Products (1995)

Countries	Import volume		Import in dollars	
(Unit)	tons	%	US$1million	%
Japan	104,246	47.2	1,048.8	70.0
Australia	35,580	16.1	34	2.3
China	30,304	13.7	33	2.3
Taiwan	11,558	5.2	56	3.8
USA	6,547	3.0	86	5.7
Germany	5,275	2.4	51	3.5
Others	27,556	13.4	191	12.4
Total	221,066	100.0	1,503.6	100.0

Source : Central Bureau of Statistics

Table 3-2 Export Status of Casting Products (1995)

Countries	Export volume		Export in dollars	
Unit	tons	%	US$1million	%
USA	3,733	27.2	19,710	35.4
Japan	2,858	20.9	10,110	18.2
Thailand	490	3.6	3,961	7.1
Australia	1,380	10.1	3,569	6.4
Malaysia	1,314	9.6	4,967	8.9
Taiwan	1,167	8.5	1,849	3.3
Singapore	949	6.9	2,690	4.8
Others	1,831	13.2	8,791	15.9
Total	13,722	100.0	55,647	100.0

Source : Central Bureau of Statistics

Table 3-3 shows material changes in casting production from 1990 to 1995.

Table 3-3 Changes in Casting Production (tons/year)

		1990	1991	1992	1993	1994	1995
Cast Iron	Gray iron casting	47,400	53,489	57,834	65,396	74,022	85,526
	Ductile iron	3,050	3,725	4,693	2,748	3,274	3,798
	Malleable cast iron	5,580	5,914	6,328	7,984	8,753	9,456
	Subtotal	56,030	63,128	59,474	78,506	89,149	102,649
Cast steel	Carbon steel	1,318	1,440	1,627	1,716	1,900	2,190
	Alloy steel	510	571	625	635	699	779
	Stainless steel	36	38	40	86	99	126
	Subtotal	1,864	2,049	2,292	2,437	2,698	3,095
Aluminum alloy casting		7,689	8,765	10,342	11,593	13,229	15,405
Steel alloy casting		2,366	2,675	2,982	2,846	3,235	3,612
Zinc alloy casting		86	93	97	93	95	105
Total		68,035t	76,710t	85,187t	96,237t	108,406t	124,866t
Index		1.00	1.13	1.25	1.41	1.59	1.89
Annual growth rate		-	12.75%	11.05%	12.97%	12.64%	15.18%

Source : CIC

Table 3-4 indicates the status of automobile casting production. The casting production per automobile (kg/automobile) was calculated by simply dividing the automobile casting production by the number of automobiles produced. The casting production per automobile in Japan, Malaysia, and Taiwan is 300 kg/automobile. That of Indonesia is a low 190 kg/automobile, due to the high import ratio of castings for automobiles.

Table 3-4 Status of Automobile Casting Production

	(A) Number of automobiles produced 10,000 cars/year 1994	(B) Casting production for automobiles 1,000t/year 1993	(C) Total casting production 100t/year	(B)/(A) Casting production per automobile kg/car	(B)/(C) Ratio of casting products per automobile %
1. Japan	1,050	3,300	6,682	314	49.4
2. Taiwan	44	150	1,450	330	10.3
3. South Korea	217	700	1,305	536 *	53.4
4. China	145	800	12,000	667 *	6.7
5. Thailand	43	80	350	186 **	22.9
6. Malaysia	7	20	64	286	31.3
7. Philippines	7	10	140	143 **	7.1
8. Indonesia	32	60	150	188 **	40.0

Source : Prepared by JICA Study Team according to statistics of each country

(2) Results of Management and Technology Level Diagnosis

1) Administrative Operation

a. Management

Japanese-Indonesian joint enterprises have business management policies, mid- and long term business targets, and so on. Factory management is conducted like that of Japan in terms of monthly production schedules, daily schedules, purchasing schedules for raw and

side materials, etc. Productivity, production costs, and defect rates are controlled by establishing goals. Safety management and technical training of workers are carried out as vigorously as in Japan. Business and factory management thus appear to be sound, and the difference in quality of management is small. Also, a few high class local companies are endeavoring to adopt the advanced management system by hiring a foreign advisor. Thus, as far as the first tier sub-contracting companies are concerned, their management level is high.

b. Personnel Training

This training should be carried out by separating personnel into the following three groups:

(i) Group 1 : Casting training of technicians with high school and college degrees;
(ii) Group 2 : Training and fostering of factory foremen and supervisors; and
(iii) Group 3 : Technical training of factory workers.

Joint enterprises with foreign capital send personnel in Groups 2 and 3 to their parent companies, and have successfully trained them largely by OJT. On the other hand, small and medium size enterprises send workers to factories of large enterprises to train personnel of Groups 2 and 3 by OJT. At some companies, instructors sent by foreign public organizations teach very basic casting technology. Thus personnel training is conducted with enthusiasm, but technical experts are still in short supply.

c. Financial Management

Interest rates are high in Indonesia. As a result the modernization of many factory facilities is not financed by bank loans but is rather self-financed. Investment timing is important in this case. Repeated small scale investment is considered to have induced irrational facility layouts and ultimately led to low productivity.

2) Production System and Process

Each casting part has its own optimum casting process. The molding process must be selected with due consideration of production lot size including that of similar products. In Indonesia it is necessary to improve the casting processes of casting plan, core molding, injection check, etc., and to increase the number of workers trained to be technical experts and to accumulate technical know-how.

3) Production Facility

a. Melting Facilities

Many of the Class A and B enterprises are equipped with high or low frequency furnaces. Not many enterprises have cupolas. This is because the cupola requires a strong and even-grained ash of a quality not readily obtained, and also because the cupola's operation takes time to master. The capacity of many low frequency furnaces is only 1-2 tons, and of cupolas 1-2 tons, which is unfavorable to heat efficiency and furnace stability.

Many traditional small enterprises in Ceper use Tonkin. This furnace is unsuitable for thin casting products such as machinery parts requiring practical strength, since the blower is turned off at tapping, which prevents the tapping temperature from rising.

b. Molding Facilities

At many small enterprises in Sukabumi and Ceper, ground floor molding is applied for molding. The system accumulates flour elements such as dead clay, and ventilation is restricted, resulting in the occurrence of such gas defects as pinholes and blowholes. It should therefore be replaced by the molding jolt squeeze machine system without delay.

4) Raw Materials, Wood Mold, and Metal Mold

a. Raw Materials

With the exception of quality silica sand for casting and copper scrap for casting, produced

in Banka Island, pig iron, alloy iron, shell resin, furan resin, bentonite, and refractory brick are almost entirely imported and as such are generally expensive.

b. Production Technology of Wood and Metal Mold

Large Japanese-affiliated casting enterprises produce and repair wood, resin and metal molds and reinforce facilities for them. But since self-sufficient production is difficult for small and medium enterprises, companies specializing in pattern production to which those enterprises can consign work should be invited from abroad. At the same time, the pattern producing technology level of national enterprises should be raised. Demand for cores will henceforth rapidly increase for thin, complex domestic auto parts. Raising the technology level requires, in addition to improvement of workers' pattern making skills, the introduction of specialized measuring devices (three dimensional layout machines) to the pattern production division. These machines measure the three dimensional size of pattern and casting products to acquire data of contraction and transformation, which improves pattern precision and reduces pattern producing time.

5) Quality Control and Safety Management

a. Quality Control System of Local Enterprises

Many medium enterprises already have pre-furnace testing facilities and sand testing facilities. Nevertheless the rate of defects is still high. Improved quality control and defect measures are urgently needed for each product.

b. Reduction of Defect Ratio

Many local casting enterprises have a casting defect rate of 10% at casting release, and 10% at casting process. To solve this problem, the entire casting industry must promote reduction, and public testing organizations must give full support.

In particular, casting defects not found during the casting process eradicate the consumers'

trust, making it difficult to obtain new orders. It is worth noting that the high defect rate at casting release is the main reason for significant delivery delays. Since these issues have become grave problems in full scale mass production of auto parts, which is a different matter from small production, immediate improvements are essential.

The following measures must be taken to reduce the high defect rate:

- Quality testing and improvement of casting and side materials
- Quality testing and improvement of melt and system sand
- Application of SEM to discern causes of casting defects
- Preparing a collection of casting method improvement cases.

c. Improvements in Testing Laboratory Measuring Equipment, and the Maintenance Systems of Advanced Processing Facilities

There are many cases of early deterioration of advanced measuring equipment and metal mold processing facilities from abroad (e.g., spectroscopic analyzers, electroerosion machines) at public laboratories and casting factories, due to malfunction and insufficient maintenance. Technical experts to maintain such advanced equipment should be trained, and expert organizations with a small staff like the Maintenance Technology Center should be established as systems for problem prevention and early equipment maintenance, so that these expensive imported facilities may be efficiently used.

d. Upgrading Safety Awareness and Safety Management in Local Enterprises

There is a low level of safety awareness and safety management at local enterprises. Some workers pour melted iron or work on core finishing while barefoot or in sandals. Improvements are urgently needed to prevent labor accidents in the future when more machinery is installed.

6) Technical Development

The public technical support organizations in Indonesia do not always work in close cooperation with one another. Each organization's role must be clarified so that they can operate efficiently.

Some of the suggestions for the reinforcement measures of the technical development organizations and testing related to practical material technology are as follows:

a. Sample Cases of Technical Development Promoted by the Government

i. Technical development apropos of production technology of aluminum alloy casting for automobiles.

Major parts such as transmission gear cases are selected for use in casting experiments to determine optimum casting conditions by die cast, low pressure casting, gravity casting, etc. Technical expertise gained from the experiments is then shared with private enterprises. In addition, technical guidance is given based on technical expertise accumulated in laboratories for the technical upgrading of small and medium scale casting operations in particular.

ii. Technical development apropos of production technology for strong cast iron casting

Major parts such as camshafts or crankshafts are selected for experiments to build up the basic technology for efficient casting of products made of low-alloy cast iron, pearlite ductile iron, Benite cast iron, etc. The acquired technical expertise is then shared with private enterprises to upgrade technical levels of local enterprises.

iii. Technical development apropos of heat treatment technology for gears, shafts, etc.

Mass production technology largely focuses on heat treatment technology to harden the surfaces of gears and shafts widely used as parts for automobiles, motorcycles, general-purpose engines, and pumps. The acquired technical expertise of quenching, gas carbonizing, ion nitriding, etc., is to be shared with private enterprises to advance heat treatment technology. As an outcome, heat treatment technology for metal molds is expected to improve dramatically.

b. Basic Testing for Quality Control of Casting and Forging Products

Technical guidance and assistance for private enterprises is promoted by establishing a technology of testing and examination for quality control regarding the following important matters of technical development and consigned testing:

i. Examination of casting products for internal defects by electron microscope, X ray micro analyzer, transmission X-ray apparatus, etc., and using testing technology to determine the cause of defects.

ii. Quality testing technology for mold materials used in casting and forging, and examination of various coking materials for casting by atomic absorption analysis, differential heat analysis, differential thermal analysis, etc.

iii. Testing technology to evaluate the quality of sand mold for casting (Testing technology to evaluate basic normality of mold and casting sand, particularly high heat properties of mold and ramming properties of casting sand).

7) Cost Analysis

Survey results on cost components of casting products are shown in Table 3-5. In the case of factory A which uses a low pressure casting of aluminum alloy, the cost of aluminum ground metal accounts for a high 45%, and labor cost is a low 5%. On the other hand, the labor cost

for cylinder blocks of cast iron produced in Japan is a high 30%. This demonstrates that the cost differs greatly with the size of casting products and casting conditions.

Table 3-5 Survey Results on Cost Elements of Casting Products.

Survey subjects			Cost elements				
			Material cost	Labor cost	Consign-ment cost	Facility cost	Misc. production costs
Indonesia	Factory A	Aluminum alloy casting Car wheels Low pressure casting	45%	5%	-	25%	25%
	Factory B	Aluminum alloy casting Tire molds Gypsum casting	18%	26%	-	19%	37%
	Factory C	Cast iron casting	35%	18%	-	22%	25%
	Factory D	Cast iron casting	30%	16%	-	25%	29%
Japan	Factory A	Cast iron casting Diesel engines Cylinder block heads	13.6%	28.6%	10.7%	11.9%	35.2% (Electoricity 11.4%)
	Factory B	Cast iron casting Transmission gear cases	25.4%	22.5%	20.7%	9.1%	22.3% (Electoricity 12.6%)

Note : 1. Facility cost includes facility depreciation, maintenance cost, and cost of repair tools.
2 Consignment cost includes cost of core and finishing.
Source : JICA Study Team

8) Marketing

In Ceper, 167 companies are members of the Cooperative Association of Casting Producers. Working in cooperation, they have succeeded in obtaining orders for such casting products as the brake shoes of trains. UPIs of Ceper and Sukabumi provide a place to display local

products, and those in Ceper are working together to make a product catalogue. Marketing needs the cooperation of all small and medium enterprises, and nationwide exhibitions of products sponsored by the Association of Technology are much anticipated.

9) Technical Level Evaluation

For the 37 enterprises visited, their technical levels were evaluated for the following four evaluation headings:

i. Completeness of production facility
ii. Level of production technology and skill
iii. Completeness of testing and examination equipment
iv. Management and product quality control level

The evaluation results are summarized in Table 3-6. Because the evaluation target companies were selected mainly from the first tier sub-contracting companies, their technical levels were evaluated generally high. In the levels of testing and examination equipment, however, their levels were inferior.

Table 3-6 Technical Level Evaluation Results of Indonesian Casting Factories

(Unit : No. of factories)

	Casting facility	Casting technology	Testing equipment	Quality control
Excellent	16	20	5	16
Good	18	16	23	13
Minor Problems	3	1	9	7
Major Problems	0	0	0	0
Total Number	37	37	37	36

Note : Quality control level was not evaluated for one factory which had not started operation.

Source : JICA Study Team

Priorities for major casting parts for domestic production were screened from parts of automobiles and pumps. Then, the elementary technologies for the production of these high priority casting parts were identified, the results of which are summarized in Table 3-7.

Table 3-7 Elementary Technology for Production of High Priority Casting Parts

Details of elementary technology of priority	Specifications of high priority casting parts
1. Production technology for casting products requiring complex slope cores.	* For small general-purpose engines Cylinder block, Cylinder head, Transmission case * Pump case, Intake cover
2. Production technology for casting products of high-strength cast iron	* For automobiles Cam shaft, Crank shaft, Cylinder head, Exhaust manifold
3. Production technology for low pressure casting, metal frame and die cast, which requires high quality internal soundness	* For motorcycles Cylinder head, Cylinder block * For automobiles Flywheel housing
4. Quality control technology for mass production of mid-size casting products	* General casting products for automobiles * General casting products for all-purpose pumps

Source: JICA Study Team

(3) Improvement Targets

The following three improvement goals are proposed for the casting industry:

a. Increase the rate of domestic forging parts for automobile parts : From 30%(1995) to 70%(2005)
b. Reduce the rate of imported forging products for automobiles : From 271,000 tons. (1995) to 74,000 tons. (2005).
c. Increase the rate of exported forging products : From 13,700 tons (1995) to 41,000 tons (2005).

As the governmental measures to assist in achieving the above goals, the following are proposed :

a. Establishment of a system to promote joint development of simple facilities for modernizing casting facilities.
b. Establishment of a system to send instructors in highly specialized technology to each factory site.
c. Support for the consigned training system to train casting factory supervisors at advanced casting factories
d. Establishment of a public support system for the promotion of technical surveys and research

2. FORGING INDUSTRY

(1) Outline of the Industry

Generally it may be said that Indonesia's forging industry has undergone almost the same historical development process as that of the casting industry. At the age of Dutch control, forging factories were constructed by Dutch engineers, and forging production of machinery parts for sugar refineries, oil rigs and ships, etc. began.

After Indonesian independence, these factories were requisitioned and resumed production as national enterprises. A five year plan implemented in 1970 promoted an industrialization policy for domestic production of machinery parts and automobiles. As a result, demand from various industries for forging machinery parts rapidly increased.

Since neither industrial nor technical associations have been organized in Indonesia, it is difficult to fully grasp the nature of the industry. It is known, however, that there are an estimated 25-30 enterprises capable of producing forging machinery parts. Annual production, determined by the volume of consumed materials, is approximately 24,000 tons. The Indonesian forging industry is thus undeveloped compared with its Japanese counterpart (approx. 600 forging enterprises; annual production, 2.3 million tons). Many large companies are joint ventures and have foreign capital. Some enterprises operate without foreign capital, however these have endeavored to upgrade forging technology by technical tie-ups.

Projected production for 1998 and 2000 is shown in Table 3-8. This is calculated by assuming unit production of forging automobile parts (kg /automobile); rate of domestic production; rate of forging automobile parts in the overall forging production, etc.; based on automobile production records and current official production forecasts. The figures indicate that Indonesia's annual production in the year 2000 should be about 70,000 tons, an amount 2.5 - 3.0 times greater than the present production.

Table 3-8 Projected Demand for Forging Products

		1995	1998	2000
Annual automobile production automobile/year*1		379,000	470,000	550,000
Automobile-related forging production	Demand tons/year *2	37,900	47,000	55,000
	Rate of domestic production %	20	40	60
	Production tons/year	7,580	18,800	33,000
Total forging production	Rate of automobile forging production	30%	40%	50%
	Production tons/year	25,300	47,000	66,000
	Rate of increase	1.00	1.86	2.61

Note : 1. Automobile production : 4 wheeled vehicles (commercial vehicles and sedans)
2. Calculated demand assuming unit production of automobiles (100 kg /automobile)
Source: "Shin Sokeizai", The Materials Process Technology Center, May, 1996.

The calculated forging production per capita in major East Asian countries is shown in Table 3-9. These results should be considered with the awareness that there may be certain inaccuracies in the basic data. Nevertheless the figures indicate the need for the promotion of the forging industry in the industrialization of Indonesia.

Table 3-9 Relation of Population and Forging Production

	Population 10,000 people	Forging production 1,000 t /year	Per capita production kg /year
1. Japan	12,471	2,269	18.19
2. South Korea	4,461	130	2.91
3. Taiwan	2,109	14	0.67
4. Indonesia	19,723	24	0.12
5. China	117,758	830	0.07

Note: Data is as of 1990 for each country and is in some cases estimated
Source : Prepared by JICA according to data for the countries

Few forging enterprises currently use the hydraulic press, which is precise in measurement and not restrictive of product shape. Cold forging technology for efficient, high quality forging production, and forging technology for aluminum alloy used increasingly for automobile parts, must also be actively adopted.

(2) Results of Management and Technological Level Diagnosis

1) Operating Ratio

Some forging factories surveyed had extremely low operating rates. At company A, the low rate was a result of new metal frame processing and metal frame surface treatment machines being installed, since the aging forging facility was unsuitable for the production of automobile parts. At company B it was due to delays in obtaining new orders by slow sample making from the inadequate metal frame processing equipment. Company C had a low rate because mass production had only recently been implemented. Regardless of reasons, the operation rate must be improved immediately since it is basic to factory management.

2) Production and Cost Control

Few factories visited in this survey were in full, stable operation. Henceforth an important consideration is the establishment of a suitable production rate and cost management for each factory.

3) Production Processes

The forging process varies according to such factors as shape, size, materials, production lot size and technical skill. The production process likewise varies. Selecting and planning the forging process, and designing the metal frame requires experience and specialized techniques. Joint ventures with specialized enterprises of advanced countries, or technical supervision by experts cannot be dispensed with. In some cases, company management led to failure by engaging in wage work, not using specialized machines, and not researching the market sufficiently.

4) Raw Materials

The raw materials of forging products are steel and aluminum alloy. In Indonesia, carbon steel is domestically produced, but high carbon steel and abrasion resistant alloy steel are imported

and supply is limited. Post-forging surface hardening technology must also be considered in the future.

5) Technological Development

In advanced countries such as Japan, the following have for the last ten years been actively studied: i) applied technology of non-heat treatment, ii) no-flash forging technology (closed forging), iii) technology of direct quenching forging, and iv) technology of carbonating treatment and nitriding of forging products. Nevertheless, basic forging technology for various machine parts should be pursued step by step as an immediate goal.

An effective way of achieving this goal is to organize a technology association, and to form a technical committee for a joint study with the participation of academy and industry members.

6) Cost Analysis

Material costs account for 50% of the casting production cost. It is important to increase material yield by pre-molding, such as by roll molding, and to more accurately regulate the casting temperature, to reduce defect rates. The break-even point for enterprises planning to export automobile parts to Japan is believed to be 30% of the production cost in Japan, which requires considerable effort. In a few cases, the depreciation cost of facilities not needed for export production raises the production cost.

7) Technical Level Evaluation Results

Table 3-10 shows the technical evaluation results of the surveyed forging factories. Analysis of causes of casting defects, and accumulation of technical expertise to prevent defects are the subjects of improvement.

Table 3-10 Technical Level Evaluation Results of Indonesian Forging Factories

(Unit : No. of factories)

	Forging facility	Forging technology	Testing equipment	Quality control
Excellent	1	1	2	1
Good	3	5	3	4
Minor Problems	2	0	1	1
Major Problems	0	0	0	0
Total Number	6	6	6	6

Source : JICA Study Team

(3) Improvement Targets

The above evaluation results show that technical forging expertise for major parts in great demand should be acquired to develop the forging industry. Proposed target figures are provided in Table 3-11.

Table 3-11 Development Target Figures for Forging Industry

	Estimated figure	Target figure	
	1995	1998	2000
Entire forging production	25,000 t	50,000 t	75,000 t
Production of forging automobile products	7,600 t	18,800 t	33,000 t
Domestic production rate of forging automobile products	30%	40%	50%

Source: JICA Study Team

3. PRESSWORK INDUSTRY

(1) Overview of the Industry

The demand for presswork products has existed in the area of household metal utensils for a long time. At the beginning stages, it is thought that such presswork was done on a cottage industry basis with manual hand presses and foot presses.

Since the middle 1970s, the production of presswork parts has dramatically increased as a result of the governmental policy to substitute import products with domestic products. However, the reality was that most press parts produced in the country were automotive replacement parts (REM parts) for the automotive industry, and easily pressed boxes for the electric/electronic industry. Exclusive presswork companies emerged in this period, and manual press machines have been gradually replaced with electric powered press machines.

The second wave of foreign investments into Indonesia, which began in the late 1980s, has increased the production of the industry sector on the whole, and as a result of subsequent change in the structure change of the sector, there have been calls for the presswork industry to be modernized. Especially, the automotive industry demands that the presswork industry shift its production items from REM parts to OEM parts. However, up to now, many domestic companies have not shifted from REM parts production.

Because presswork is one of the most basic kinds of metal processing work, most of the metal work related manufacturers undertake presswork together with other metal processing works. Even in those factories which mainly supply sub-contracted presswork service, other related services are also undertaken. From this nature of the industry, it is very difficult to find concrete figures of the number of companies or the total production volumes of the industry.

Location wise, most presswork companies, who produce parts and components for the automotive industry and the electric/electronic industry are located near their customer assemblers, such as in Jakarta, Surabaya, and their outskirts.

Presswork companies are roughly classified by the size of their products, where large parts mean those which are more than 500 mm square while medium parts are 300 to 500 mm square, small parts, 30 to 300 mm, and very small parts, less than 30 mm. For instance, automotive bodies and panels are large parts, some automotive parts and parts of consumer electric products are medium and small parts, and functional parts of electric/electronic products and precision instruments are very small parts. Among them, most large parts are produced by automotive assemblers within their factories because production facilities to make large parts are very expensive and large. On the other hand, facilities to produce very small parts are very precise with high speed operation for mass-production, and are generally tailor-made for specific presswork. Because it requires mass-production and a high level of technology, the production of very small parts has not been developed in Indonesia. The main stream of presswork in the country is medium and small parts production which are carried out by universal press machines.

(2) Management and Technological Level Evaluation

1) Management

Most presswork companies are small-scale companies. This is one of the reasons that the on-the-job training was the major means adopted for their personnel training. The lack of off-the-job training opportunity due to limited technology information on presswork is considered to be another reason. A lot production system is used, in response to their customer needs. Their production schedule are based on a short-term plan, which is supplied by their customers, and usually they do not have long-term plans or medium-term plans. Demand for presswork in the country is still small with a wide range of products, which hampers the replacement of obsolete machines and the improvement of technology. Further, safety and sanitation in factories, which are regarded as most necessary for employees, in addition to operation guidance and facility maintenance, are not properly carried out.

2) Production Management

Average presswork companies in Indonesia somehow produce dies within their factories. However, most dies are the simple, one-process type. Press machines are outdated crank press machines with sliding pin clutches. In addition, production processes are not organized in line, but each process is individually done. As a result, production efficiency is low, and the quality of products is not satisfactory.

3) Production Facility

As mentioned before, outdated crank press machines with sliding pin clutches are widely used. These machines do not bear clear specifications. Even among the latest friction clutch type press machines, only a few machines have specifications such as capacity and capacity limitation stated clearly. As a result, a basic plan for presswork can not be properly made.

Most machine tools, which are used for the production of dies, are universal in type, and die making work is usually done manually. In short, the die making process at average domestic companies is old.

Inspection equipment is important to determine the quality of products. However, domestic presswork companies lag far behind. They have basic measurement equipment only. Length between two points is measured, but the accuracy of a shape is not measured. Although the quality of dies is decided by the hardness of dies, few companies are equipped with hardness testers, which measure the hardness of dies.

4) Materials

The major material used for presswork is soft steel sheets. Soft steel sheets are further classified into cold rolled steel sheets and hot rolled steel sheets. In general, approximately 70% of steel sheets used in the automotive industry and the electric/electronic industry are cold rolled steel sheets, and those with high transformation ability are used. The majority of material for presswork is imported.

For the production of dies, special steel is widely used, and all special steel is imported.

Standard parts for dies are imported as finished products.

5) Quality Control

Because average domestic presswork companies receive information about the basic technology of quality control, i.e., quality assurance, from their customer companies, they have not developed quality control technology and measurement technology by themselves.

In quality control technology, total quality control (TQC) and statistical quality control (SQC) especially are not fully understood by them. Subsequently, the standardization of presswork has not been achieved by most of them. In measurement technology, most companies are not equipped with measuring instruments. Actually, they determine the quality of presswork by primitive measurement. In addition, the maintenance of production facilities is almost totally neglected.

6) Cost Analysis

Three constituent factors in presswork cost are material cost, labor cost, and other expenses represented by depreciation of production facilities. At average presswork companies in Indonesia, obsolete production facilities, which are not properly maintained, are used so as to lower the depreciation cost. With such obsolete facilities, high quality, high value-added press products can not be produced. Although production volume and the period of time of production are other factors which influence the production cost of press products, they are not at a satisfactory level at the moment. In order to produce quality, high value-added products at reasonable cost in the future, measures to change the present cost structure of presswork, where investment in facilities is restrained and instead cheap labor is heavily used, should be devised.

7) Technological Level Evaluation

On the evaluation of production technology, assessment items are first divided into production/process sections and quality assurance sections. Then, these two items are

subdivided into hardware sections and software sections, to create a matrix with four classifications as shown in Table 3-12.

Table 3-12 Production Technology Assessment Matrix

	A. Production/process section	B. Quality assurance section
1. Hardware section	A-1 Production equipment	B-1 Inspection equipment
2. Software section	A-2 Production technology	B-2 Quality assurance management

Items A-1, A-2, B-1, and B-2 are further classified into 5 to 10 sub items, and each sub item is evaluated on a 5 point scale. The assessment was done at the factory site visited.

For each sub item, full marks or 5 points are given in the technology level, if the level of the sub-item is considered to reach the average level of developed countries while the minimum mark or 1 point is given for a level comparable to that of cottage industry.

The points of each sub item are summed up by item, namely A-1, A-2, B-1 and B-2, and the average points for each item are calculated. Then, in the same way, the average points are determined for items, A and B. Finally, the average points of items A and B are calculated to make the overall evaluation points of factories.

The average points calculated here are classified into four grades, A, B, C, D, and each grade is interpreted as shown in Table 3-13.

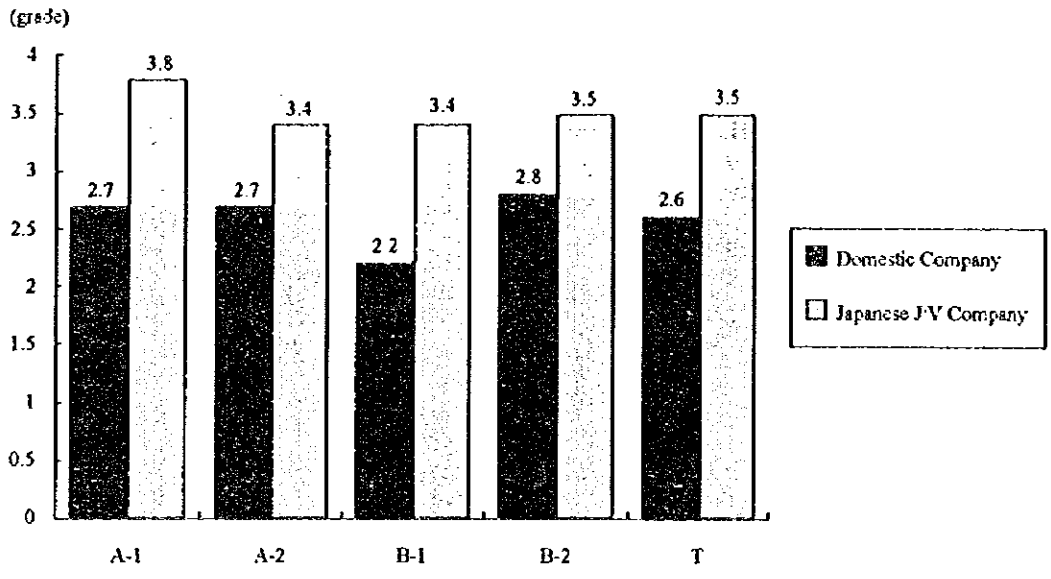
Table 3-13 Meaning of Assessment Grades

Grade	Point	Level	Quality of Possible Products
A	4.5 to 5.0	OEM International brand, International market	Beyond the average level of industrial countries. Products can be exported as OEM, either direct or indirect.
B	3.8 to 4.4	OEM International brand, Local market	Comparable to an upper level of the ASEAN countries. Products can be supplied to foreign affiliated companies in Indonesia. Final products can be sold within the country.

C	3.0 to 3.7	OEM Local brand, Local market	Equivalent to the middle class of the ASEAN countries. Products can be supplied to domestic companies as OEM. Final products can be sold within the country
D	less than 3.0	REM Local market	Products can be sold within the country as after sales service parts.

The results of the assessment of 12 local press companies and 3 Japanese and local joint venture companies are shown in Fig. 3-2. The technological levels of local companies on the whole were assessed rather low, falling in category D+, while those of joint venture companies fall between Categories B and C. Compared with the joint venture companies, the local companies are assessed low in both production facilities (A-1) and quality assurance equipment (B-1). The lack of these facilities and equipment have lowered the overall technological level of the local companies.

Figure 3-2 Comparison Between the Domestic Companies and the Japanese Joint Venture Companies



(3) Improvement Targets

A combination of three elements, that is, press machines, dies, and materials, determine the

basic conditions of presswork, i.e., production volume, quality, costs, and process time. Therefore, a good balance of the three elements, i.e., the type and specifications of press machines, the structure and function of dies, and the characteristics and form of materials, should be considered so that presswork can be carried out successfully. Among them, dies have the function of actually forming the material into the product, and are the element which most affects the quality of press products.

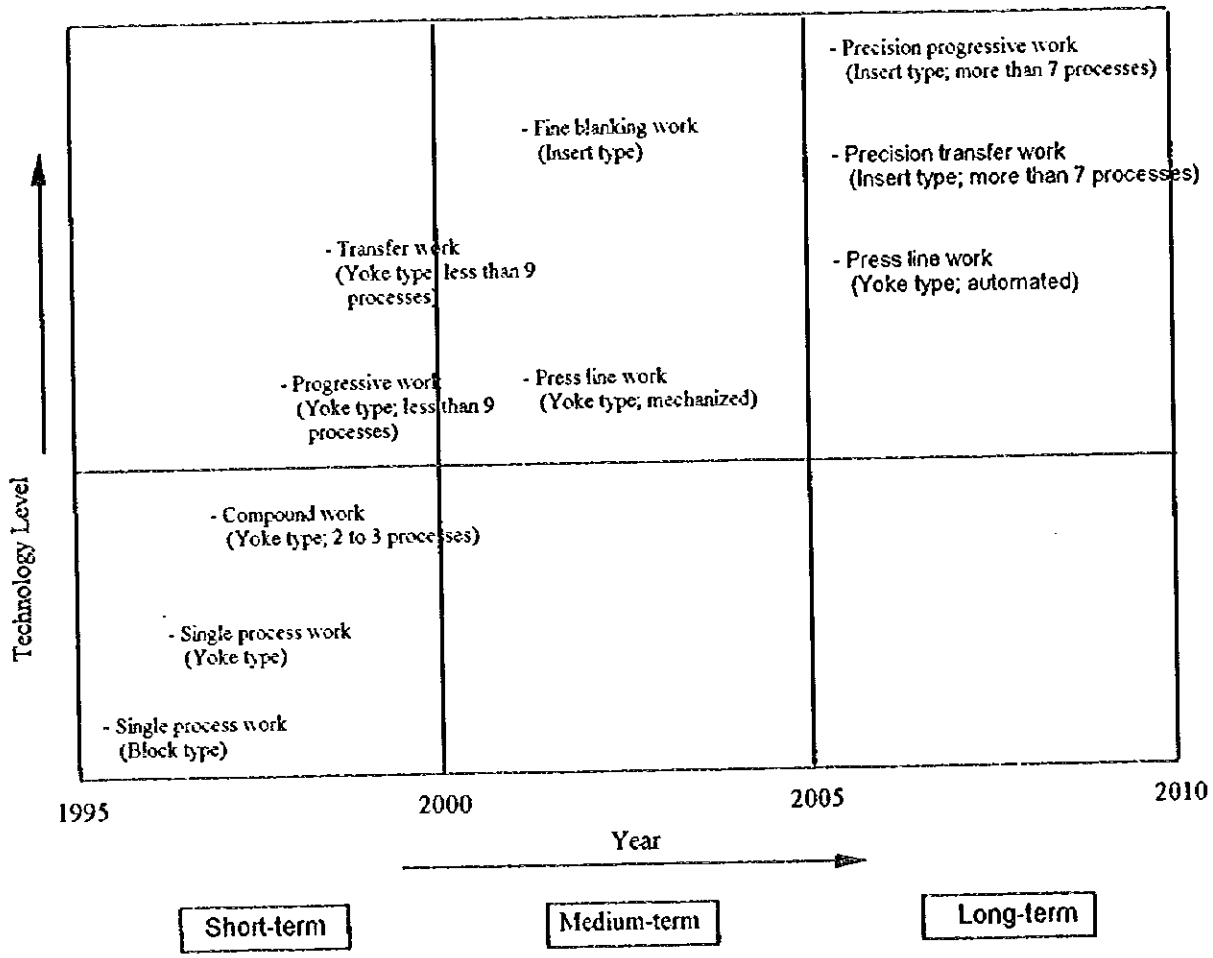
For the development of the presswork industry, first of all, the improvement of presswork technology and technical skills concerning die making is very important, for which the education and training of engineers and technicians will become a short-term improvement target. By this, the understanding of the basic conditions of presswork is achieved, and the presswork processes at production sites can be improved. It is suggested that an industrial organization of presswork be set up, and the education of engineers and the training of technicians be periodically carried out with support from foreign experts.

The second area for improvement is the poor production facilities and quality assurance equipment at local companies. Facilities and equipment should be gradually replaced with new ones in order of priority. In line with the introduction of new facilities and equipment, new technology also should be introduced. The government is requested to favor the replacement of facilities.

The third area for improvement would be the maintenance of presswork facilities. Maintenance is necessary to stabilize the quality of presswork and increase the safety of work. It is necessary to legislate for periodic maintenance of presswork facilities in order to develop sound presswork companies.

Further, the development target by type of technologies is summarized and shown in Fig. 3-3.

Fig. 3-3 Development Schedule of Presswork and Press Mold Technologies



4. PLASTIC MOLDING INDUSTRY

(1) Outline of the 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 electric products, has begun.

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.

As for molds, 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.

More companies of 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.

In order to identify the market size of plastic molding industry, the domestic consumption volume of plastic resins was investigated. The demand for plastic resins in Indonesia in 1995 reached 700 thousand tons as shown in Table 3-14.

Table 3-14 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

From the kind of plastic resins used, 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.

Because there are no nation-wide industrial associations in the plastic mold making industry, the exact production volume of plastic molds could not be obtained. Only seven leading companies in the industry participate in APINDO (Indonesia Plastic Manufacturing Association). According to the interview survey results with those companies, the demand for plastic molds in Indonesia is about to show a substantial increase. Further, 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.

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

(2) Management and Technology Level Diagnosis

1) Management

a. 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, often the relatives of owners take the positions as heads of technical divisions, and try to reduce the turnover in engineers.

b. 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.

A new program is currently planed by an industrial association. 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. One locations is planned in Jakarta and another in Surabaya.

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 highly evaluated to be practical. However, the number of students is limited because of the constraints of both long-term training period and location.

In addition, the lack of technical information documents or textbooks of plastic molding hampers the smooth human resource development in the industry.

c. 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. 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.

2) Production Management

In the production process of plastic injection molding in Indonesia, the following improvement would have to be achieved:

a. Because engineering plastic resins are totally imported, appropriate inventory control methods have to be adopted.
b. The stability of the quality of domestic resins has to be quantitatively measured. Data such as mixed foreign matter, coloring, and MI values are to be 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 has to be conducted.
d. Knowledge about how to decide the appropriate conditions of plastic molding is lacking. The training of such knowledge has to be carried out.
e. Most companies are not equipped with thermal regulators or surface thermometers to control the temperature of molds.
f. Measuring technology and measurement equipment such as slide calipers, micrometers, and stereoscopic microscopes has to be spread.
g. Problem solving capability on technical troubles has to be increased.

In the production process of plastic molds, the following problems have to be solved.

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.

3) Production Facilities

The plastic injection molding machines are mostly Japanese and Taiwanese machines. However, more than one half of all machines in the country are used ones. As for thermal regulators, their diffusion rate is low; 30 to 70% of the number of injection molding machines. Surface thermometers are rarely installed. Many machine tools such as lathes, milling machines or surface grinders are from China, Taiwanese and Japan. They are usually old, and only a limited number of companies use NC machines or machining centers. And only a few excellent companies have CAD/CAM systems.

4) Materials

As of 1996, general purpose plastic resins such as PP, PE, PVC, PS, and AS are produced in Indonesia. Besides the domestic resins, they are also imported from Japan and the USA Imported resins are often used by foreign affiliated assemblers, because of their long experience of using the same materials.

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

resins is Rp. 3,500/kg.

As for engineering plastic resins such as POM, PBT, PC, PA6, and PA66, they are totally imported as of 1996. 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.

Of thermosetting plastic resins, polyurethane resins and unsaturated polyester resins are domestically produced. Melamine resins wholly depend on import.

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.

As for mold bases, those made in Taiwan, Hong Kong, and Singapore are popular. Some Japanese affiliated automotive parts manufacturers import Japanese mold bases. Most of standard parts are also imported from Taiwan and Korea. Recently, Japanese standard parts have become to be introduced.

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.

6) R&D and Design

The R&D 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 R&D ability of plastic molds in Indonesia is regarded as being extremely low.

7) Cost Analysis

For plastic molding, there is some room to reduce material cost by switching from imported material to domestic material. As for the molding cost, Indonesia has an advantage over Singapore, Thailand or Malaysia due to lower direct labor cost. 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. After injection arrangement cost is related to work such as gate cutting and runner selection. These are simple jobs, which do not need special skills, and therefore Indonesian companies can take full advantage of cheap labor costs.

Secondary processing cost includes work such as painting and silk printing. Although cheap labor contributes to cost reduction, loss caused by defecting products offsets the reduction. As for the mold depreciation cost, it is very high in Indonesia because many molds are imported. Finally, the quality assurance cost in Indonesia tends to be high because the defect ratio of molding is generally high at domestic companies.

8) Marketing

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.

9) Technological Level Evaluation

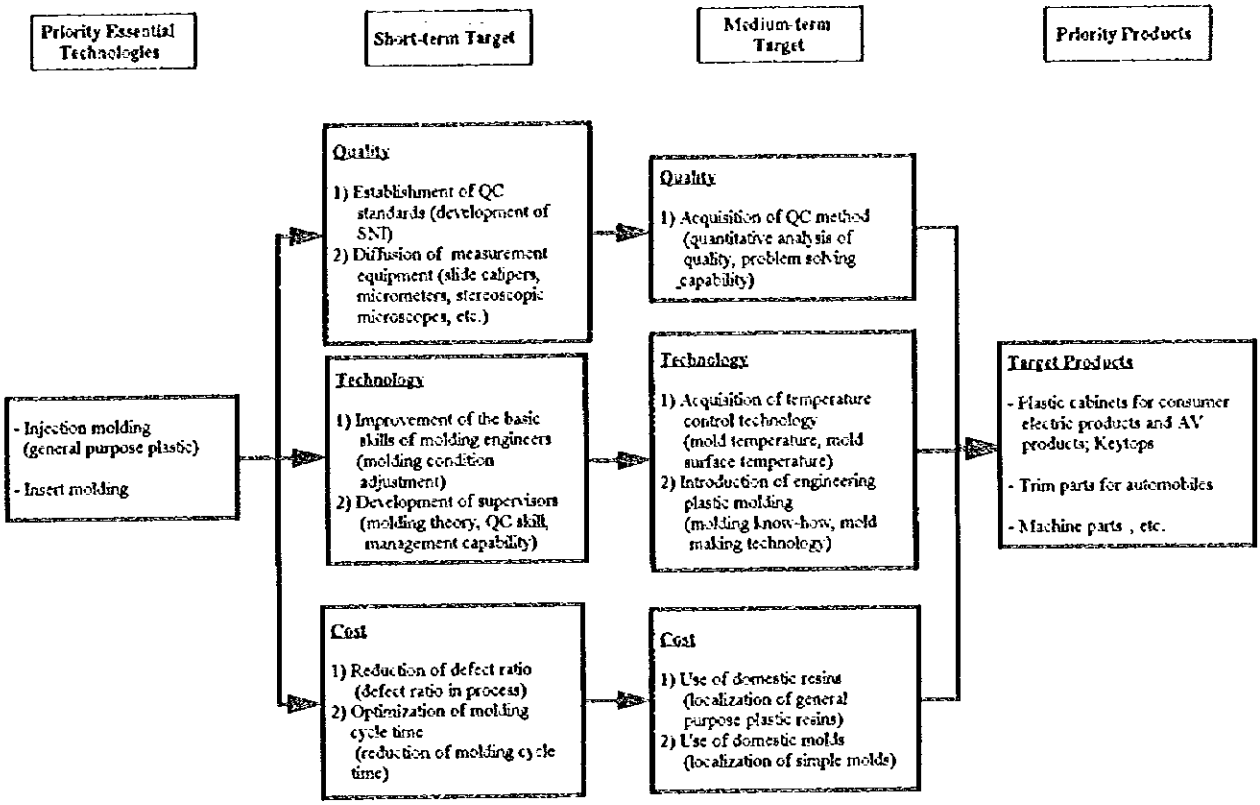
The evaluation results of Indonesian domestic companies are summarizes as follows :

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

(3) Improvement Targets

Based on the results of the Study, the improvement target is determined both for the plastic molding industry and the plastic mold making industry. It is suggested that the Indonesian government take measures to achieve the target so that the industries can develop.

Fig. 3-4 Improvement Target of Priority Essential Technologies (Plastic Molding)



5. MACHINING INDUSTRY

(1) Outline of the Industry

In Indonesia, the machining industry had been using universal equipment for a long time. However, in accordance with the emergence of mass production products such as cars and electric home 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.

Similarly with the presswork industry, there are no reliable data on the number of establishments of the total production values of the machining industry. As to the type of the industry, there are many owner businesses companies. In setting up small scale businesses, there are many cases of starting in the business by renting machining equipment from lease companies. However, in accordance with mass production industries being established in some metropolitan areas such as Jakarta and Surabaya, fairly large scale machining companies are also developing around those areas as related industries.

(2) Management and Technical Level Evaluation

In the machining industry, two companies were selected for intensive case study. The major objective of the study was placed on the identification of the causes of the following two problems, which are common to most of the small scale local manufacturers :

i) High defect ratio (Low product quality level) ; and
ii) Delay of product delivery

The results of the evaluation of Company A are briefly summarized as follows.

i) This company has sufficient technical capability. To further accelerate level 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.

ii) This company does not have big problems either in "defective products " or in "delay of delivery." The management capability of this company has reached a fairly high level. Thus, it was considered that the company could sufficiently comply with assemblers' needs, if a further slight improvement were made by both the introduction of better production technology and the development of appropriate jigs and tools.

The results of Company B were as follows.

i) One of the major causes of defective products was identified as defective welding. The defects are caused by the voltage drop which occurs when a number of welding devices are operated at the same time. In order to reduce the number of defective products, it was recommended that voltage stability should be kept by taking measures to avoid operating the welding devices at the same time.

ii) At the storage place of press molds, the anti-corrosive treatment was not completely done. It was also recommended to place a good sample produced at a previous production run so that the operation of workers becomes easier.

iii) Labor consciousness for achieving the targets shown by instruction sheets appeared to be low. It is recommended that regular education and training of the laborers be conducted through OJT.

iv) Many scratches were found on the metal surface. One of the reasons for these scratches is the defective metal plating and painting processed by the subcontractors. From the results of the study of three subcontractors, it was identified that these defects were caused both by the unsuitable packing and the poor road conditions.

v) Metal plating firms answered that the final treatment of the waste water produced had been operated by the firm itself. However, sludge disposal activities were not observed. It is considered that the waste water treatment in these firms is quite insufficient. Further, most of 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.

(3) Improvement Targets

The improvement targets suggested to the machining industry are summarized in Table 3-15.

Table 3-15 Improvement Targets of the Machining Industry

		Short-term	Medium-term	Long-term
Production Management and Technology	Small-scale	Upgrading of operation ratio and the reduction in the defect ratio		Improvement of management skill through the activities of industrial associations and the installment of common use facilities.
	Medium-scale	Upgrading of quality through upgrading of jigs and tools		Upgrading of productivity through the support of public R&D organizations
R&D Activities		Improvement of universal machine tools that are commonly used in Indonesia.	Design know-how development for introducing NC machine tools.	Upgrading of metal working technology for accuracy improvement and application of modern technologies to new product areas
Governmental Supports		Periodic technical guidance visits to factories by governmental support agencies	Promotion of joint businesses by organizing small scale manufacturers	Provision of upgraded industrial infrastructure such as the construction of specialized industrial estates

6. SURFACE TREATMENT AND HEAT TREATMENT

(1) Outline of the Industry

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.

A simple heat treatment facility is installed in many of the metal working factories. As for the heat treatment for special steel used for molds, steel tools, etc., there are no local companies carrying out this kind of service. This type of heat treatment is conducted by a few foreign capital companies. They are specialized companies or steel dealers.

(2) Management and Technical Level Evaluation

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 domestic Indonesian 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.

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, they also have high level auxiliary equipment such as temper oil tanks and alkaline hot water jet cleaners. 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.

(3) Improvement Targets

1) Surface Treatment

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.

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 raising the overall level of Indonesian domestic companies could be achieved just by the improvement of process control technologies. On the other hand, quenching and tempering need strict temperature control, and only a few foreign affiliated companies are currently engaging 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.

As for the heat treatment methods which require a very high level of technology, such as PVD (physical vapor deposition) and CVD (chemical vapor deposition), however, are yet to be introduced into Indonesia.

IV. INTERNATIONAL COMPETITION

1. MAJOR FACTORS FOR INTERNATIONAL COMPETITION

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. Further, 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 4-1 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)	908.5	2,411	3,290	953	23,532	424
Exports (Mil. US$, FOB)	40,053	45,129	58,564	13,252	96,456	121,040
Imports (Mil. US$, CIF)	31,984	54,402	59,414	22,584	102,394	115,690
Population(1,000, 1994)	192.22	59.40	3,290	67.04	2.93	1,198.5
Exchange Rate (US$) (Dec. 95)	2,308	25.160 (Nov. 95)	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
   - Further investments to meet the increasingly severe competition in the Asian region among Japanese, US, Europe, Korean and Taiwanese manufacturers

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

iii. Expansion of exports to outside ASEAN

iv. Expansion of R&D activities in ASEAN

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

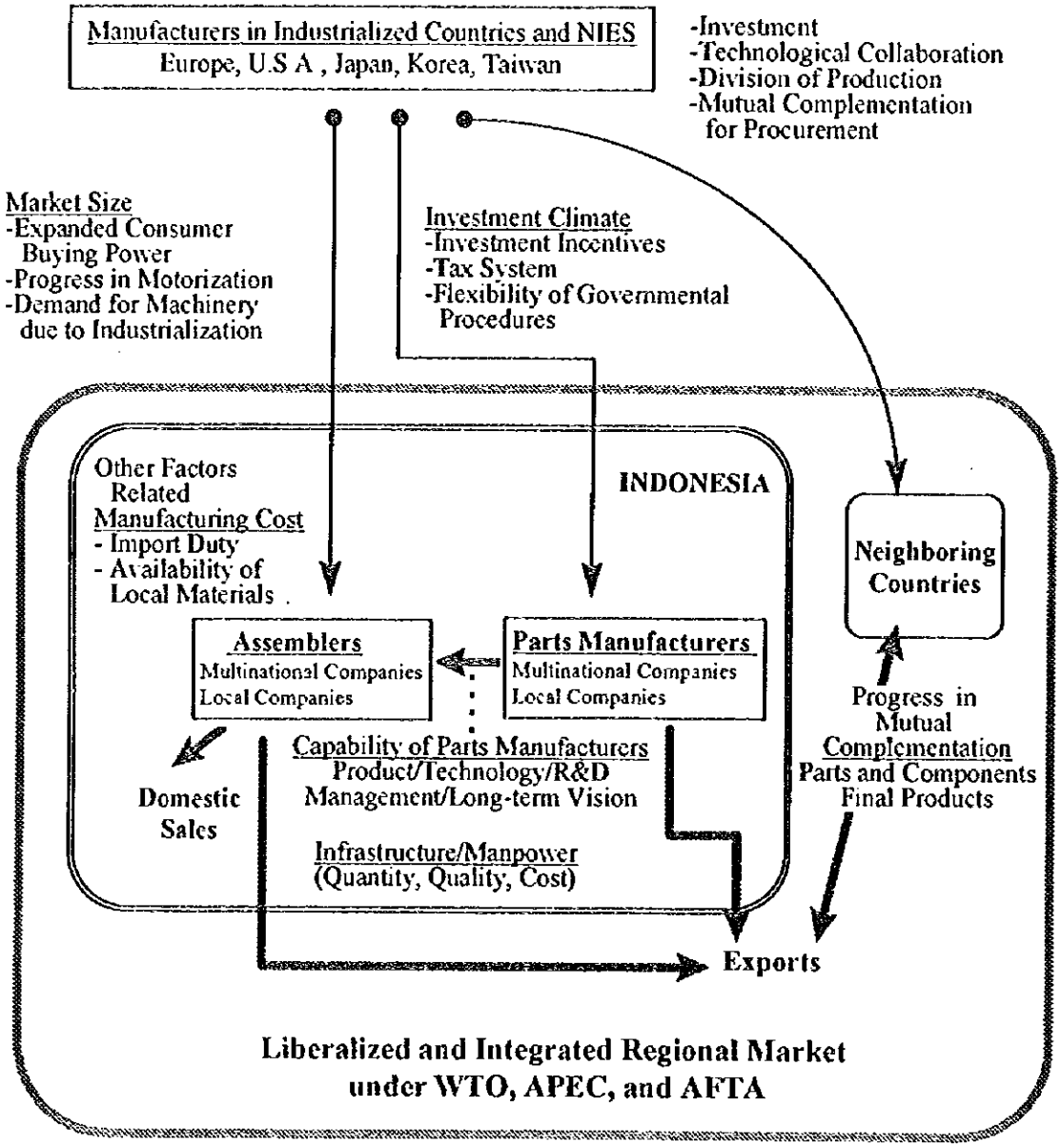
As for the Indonesian automotive, electrical and electronic, and machinery industries, building up international competitiveness and establishing positions in international competition are necessary in order to achieve the expected further development. Key factors in the country-level competition among 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. 4-1 Major Factors for International Competition in the Asian Region



2. EVALUATION OF INTERNATIONAL COMPETITIVENESS OF INDONESIAN PARTS

(1) Machinery Trade Between East Asian Countries and Advanced Nations

The machinery trade flows between the advanced nations and the 7 East Asian countries consisting of the four ASEAN nations plus Korea, Taiwan and China were examined by item (SITC 2 digits category) making use of OECD statistics.

Relative superiority is determined by comparing trade specialization coefficients, that is: [(OECD import value - OECD export value) divided by (OECD import value + OECD export value)] x 100.

1) Power Machinery and Parts

As of 1993, none of the developing countries were net exporters of power machinery and parts, but China achieved substantial growth in its exports starting in the 1980s. In 1993, the value of its exports in this category reached approximately US$ 500 million, making it the largest exporter of power machinery and parts among the seven nations. Exports by Thailand and Malaysia increased rapidly in the 1990s, but export values still remain low. Export capacities of Taiwan and Korea dropped, exhibiting negative growth in the 1990s. Exports by Indonesia and the Philippines have grown, but monetary sums are still low.

2) Industrial Machinery and Parts

As of 1993, the advanced nations had extensive export capabilities in this category but there were no net exporters among the developing nations. Exports by Taiwan accounted for an overwhelmingly large portion of total exports by the developing nations, but Taiwan's exporting capacity has been declining somewhat. (The value of its exports in 1993 was approximately 865 million dollars.) From 1985, Thailand's exports continued to grow at an average annual rate of over 60 percent, but the value of its exports has

remained low. Among the ASEAN nations, however, Thailand ranks first in terms of export value.

In this category, the growth in exports by China has been substantial, and in terms of export value, it ranks in third place after Korea, but of the seven nations, China ranks highest in terms of import value. There are almost no exports of industrial machinery and parts from Indonesia or the Philippines.

3) Metal Processing Machinery and Parts

In this category, the value of Taiwan's exports was large at 340 million dollars in 1993, but overall growth in such exports in the 1990s turned negative for Taiwan, as it did for Korea. Taiwan's imports of metal processing machinery and parts expanded so that the nation shifted from net exporter to net importer status. The growth in China's exports also stagnated in the 1990s while imports increased extensively. This is ascribed to expanded investments in plant and equipment in line with the advancements of foreign capital invested in China.

Since 1985, Thailand's exports have continued to expand at an average annual rate of well over 30 percent, making Thailand the leading exporter in this category among the ASEAN nations. Nevertheless, the value of Thailand's imports has reached over 17 times the value of its exports. The three nations of Indonesia, Thailand and the Philippines still have no export capacity in this category.

4) General Machinery and Parts

In this category, Taiwan's exports were the largest in 1993 at US$ 1,660 million, but the margin of growth in this export category has been shrinking. China's exports increased dramatically from the 1980s, reaching US$ 960 million in 1993, placing China ahead of Korea and just behind Taiwan in this category.

Among the ASEAN nations, Thailand's exports were the largest, but so were its imports.

Indonesia and the Philippines have almost no export capacity in this category.

5) Business Machines and Parts

As of 1993, all of the seven nations except Indonesia were net exporters of business machines and parts. Taiwan's export capacity was the greatest, reaching an export value of US$ 11, 060 million in 1993. Its share of the total OECD import value is also large at 8 percent.

Among the ASEAN nations, Malaysia and Thailand exhibit substantial export capacities. In the 1990s, Malaysia, in particular, showed an average annual growth rate of 96 percent. Indonesia's average annual growth in the 1990s has been about 360%. Accordingly, only a little more growth is needed for it to become a net exporter.

6) Communications Equipment and Parts

As of 1993, each of the seven nations, including Indonesia, was a net exporter of communications equipment and parts. In 1993, Malaysia became the largest exporter (export value of US$ 5,300 million), outstripping Korea, Taiwan and China. In the 1990s, growth in this category of exports by Korea and Taiwan turned negative. This trend is ascribed to more and more transfers of production bases to ASEAN nations.

Exports by China have continued to expand, reaching a value of US$ 4,700 million in 1993. Every year since 1985, Indonesia's exports in this category have continued to double or increase even more, swelling to US$ 780 million in 1993.

7) Electrical Machinery and Parts

Korea and Taiwan are the two leaders in this category, but Malaysia achieved a comparable scale in 1993. (Export values were: Korea: US$ 6,800 million; Taiwan: US$ 6,100 million; Malaysia: US$ 5,700 million). Exports from Korea are increasing but Taiwan has shifted from net exporter status in the 1980s to being a net importer in

the 90s.

Indonesian exports exhibited substantial growth at a yearly average of 72 percent in the 1990s, but export values are still low. The three net exporters in 1993 were China, Korea and Malaysia.

8) Automobiles and Parts

Except for Korea, all the countries under study were importers of automobiles and parts in 1993. Korea became an exporting nation in the 1980s because it had implemented import restrictions on automobiles in order to protect its own national industry. Exports of passenger cars, in particular, have been substantial. The value of exports from Taiwan reached US$ 2,300 million in 1993, surpassing the figure for Korea, but the export items were mostly parts. Nevertheless, the value of Taiwan's imports in this category has surpassed that of its exports.

(2) Electrical and Electronics Products Trade Between East Asian Countries and the Advanced Nations

Looking at the trade flows of electric and electronics products (excluding parts), the exports of which the ASEAN nations are expanding, the following distinctive features can be noted from a comparison by item, in view of the status of competition, using OECD trade statistics (SITC 3-digits category, REV. 3). Comparisons were made between OECD nations and a total of six nations, the four ASEAN nations plus Taiwan and Korea. China was not included.

1) Business Machines

In the 1980s, Taiwan and Korea had great capacities for exporting business machines, but in 1989, exports from Malaysia and Thailand increased substantially, and in the 1990s, there has been a reverse in the exporting capabilities of Malaysia and Thailand as op-

posed to Taiwan and Korea. Exports from Indonesia also increased in 1991 and 1992, and the country became a net exporter in 1993.

2) Computers and Peripheral Equipment

Taiwan and Korea were the first to become net exporters of computers and peripheral equipment, but in the 1990s, the ASEAN countries, except for Indonesia, also became exporters. Indonesia increased its exports in 1992 and 1993, establishing itself as a net exporter in 1993.

3) Radios and Televisions

In the case of radio, all the ASEAN nations, including Indonesia and Thailand, had been importers, but they became net exporters in 1989. Taiwan and Korea were early in becoming exporters, but in the 1990s, Taiwan began losing its exporting capacity.

With televisions, Taiwan's loss of exporting capacity is even more evident. It switched to being a net importer in 1993. This is seen as the result of Taiwanese companies shifting their production bases to ASEAN nations.

Indonesia has a high capacity for exporting not only radios but also televisions. It became a top-class exporter in 1993.

4) Tape Recorders and Videos

Taiwan and Korea were the first to achieve growth in exports of tape recorders and videos. Among the ASEAN countries, Malaysia was the first to become an exporter, in 1988. In this field also, Taiwan's exporting capacity has been dropping during the 1990s.

Thailand became an exporter in 1989; the Philippines in 1991, and Indonesia in 1992. Foreign capital investments accounted in large measure for exports from each of these

nations. The time periods mentioned above reflect the different periods when foreign investments were made in each nation.

5) Communications Equipment

Taiwan was earliest in achieving growth in exports of communications equipment but Korea expanded its exports in this category to the point that it overtook Taiwan. Nevertheless, Korea's export capacity in communications equipment is small in comparison to other AV equipment. Among ASEAN nations, Malaysia and the Philippines were the first to expand exports of communications equipment, becoming net exporters in 1989, but now imports and exports are balanced. Thailand's exports swelled dramatically from 1989 to 1991. Indonesia increased its exports in the 1990s, but its export capacity is still weak and the country is still a net importer.

6) Home Electrical Appliances

Korea and Taiwan were earliest in expanding exports of home electrical appliances, but in the 1990s, their export capacities have been trending downward. Among ASEAN nations, Malaysia was the first to boost exports, but thereafter its export capacity dropped, while Thailand's exports increased rapidly from 1988 to 1989. Indonesia has been the latest to export such appliances, and in 1993, its exports and imports became balanced.

(3) Machine Parts Trade of ASEAN Countries to the Advanced Nations

Generally speaking, the developing countries import parts from the advanced nations, assemble them, then export them as finished products. Exports of parts to the advanced nations, therefore, are not very extensive. Usually, the bulk of parts exports by developing nations are directed at other developing nations. Once into the 1990s, however, there have been cases in which parts are imported from developing nations and assembled in advanced nations, so that parts exports have slowly started to climb. Multinational corporations have

invested in developing countries in order to have parts, such as semi-conductors, assembled in these countries, and then exported. The nature of their investments, therefore, has varied with particular parts.

In regards to the major machinery parts, the features of exports by the ASEAN countries to the advanced nations are summarized as follows.

1) Automotive Parts (Not Including Engines)

Taiwan, Korea and the Philippines were the first to achieve growth in exports of automotive parts, but imports in these countries are still greater than exports. The other countries are complete importers. In the wake of political instability in the Philippines, its exports dropped from the second half of the 1980s, but in the 1990s they have begun to exhibit steady recovery.

Indonesia is a net importer but its exports increased in 1992 and 1993. In Malaysia and Thailand as well, the percentage of imports is overwhelmingly large.

2) Electrical and Electronic Parts

a. Electrical parts (switches, printed boards, resistors, etc.)

Taiwan's imports and exports of electrical parts are even in volume. Korea also exports large volumes but its imports are still larger. The four ASEAN nations are all net importers of electrical parts, but large volumes are exported from Malaysia and Thailand, while exports from Indonesia and the Philippines are sparse. Indonesia is the largest importer but its exports increased in 1992 and 1993.

b. Electronic parts (cathode ray tubes, semiconductors, etc.)

As of 1993, Korea, Malaysia and the Philippines were exporters while Indonesia, Thailand and Taiwan were importers of electronic parts. Despite the breakdown

into importers and exporters, the margins of difference were not as great as with other parts. During the second half of the 1980s, Indonesia and Thailand shifted from exporter to importer status.

c. Business machines and computer parts and accessories

In this category, Taiwan's export capacity stands out from that of the other nations. Korea became an exporter in 1992 and 1993. Malaysia shifted from exporter to importer status in 1986, but then became a net exporter again in the 1990s. Thailand also became an exporter in the 1990s, but imports by both these countries are also extensive. In 1993, Indonesia and the Philippines were importers, but Indonesia's imports have been the greater of the two. Indonesia's exports increased from 1991 to 1993.

3) Machine Parts

a. Internal combustion engines

Taiwan and Korea are importers with little capacity to export internal combustion engines. All four ASEAN nations are also importers, but Thailand's export capacity is somewhat large.

b. Pumps and compressors

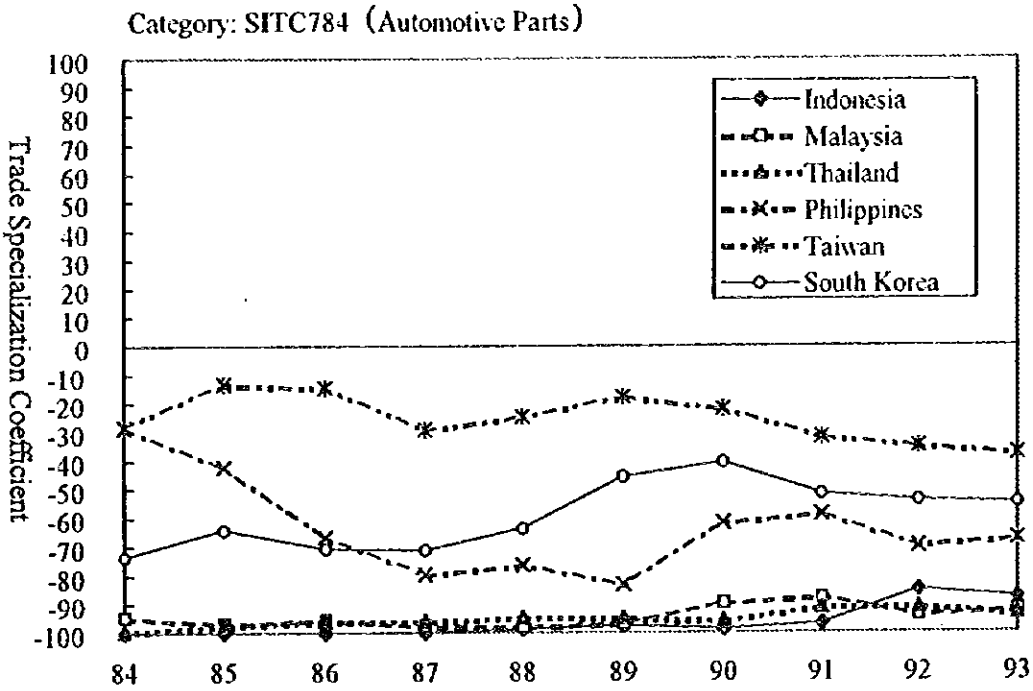
In 1989, Taiwan shifted from exporter to importer status in this category. Korea also has little or no export capacity. All the ASEAN nations are importers, too, but Thailand and Malaysia have some degree of export capacity. The Philippines and Indonesia are complete importers.

c. Non-electrical machine parts (cocks, valves, molds, etc.)

Taiwan and Korea are importers but Taiwan's export capacity in this category is large.

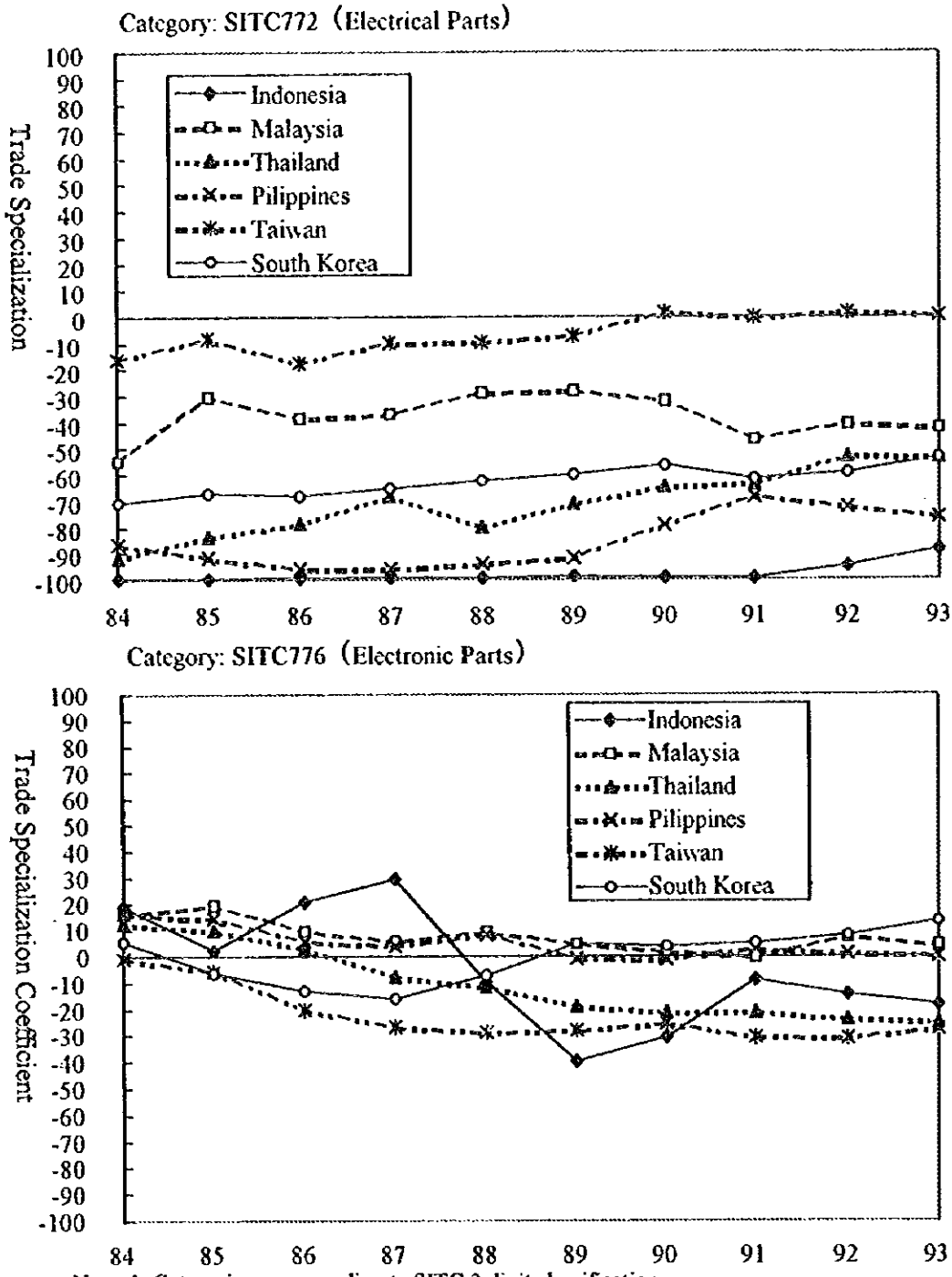
Among the ASEAN nations, Thailand's export capacity is large. The Philippines, Malaysia and Indonesia are complete importers.

Fig. 4-2 The Competitiveness of ASEAN Automotive Parts in the Advanced Market



Note: 1. Categories are according to SITC 3 digit classification.
2. Trade specialization coefficients are determined as
−Imports) ÷ (Imports+Exports)] x 100
Source: OECD Statistics and ITI (International Trade and Investment Research Center),

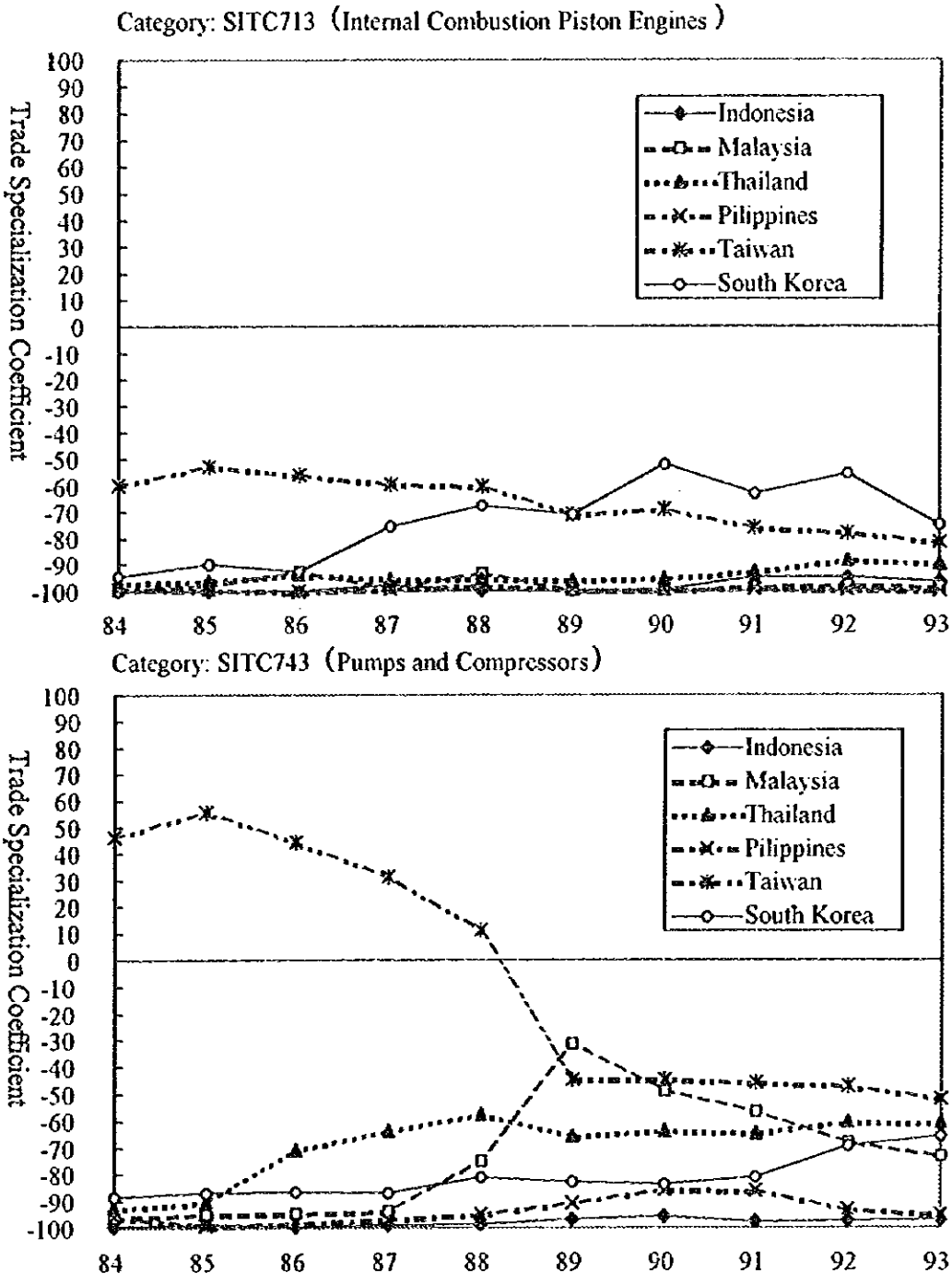
Fig. 4-3 The Competitiveness of ASEAN Electrical and Electronics Parts



Note: 1. Categories are according to SITC 3 digit classification.
2. Trade specialization coefficients are determined as
−Imports) ÷ (Imports+Exports)] x 100

Source: OECD Statistics and ITI (International Trade and Investment Research Center),

Fig. 4-4 The Competitiveness of ASEAN Machinery Parts in the Advanced Market



Note: 1. Categories are according to SITC 3 digit classification.
2. Trade specialization coefficients are determined as
(Imports) ÷ (Imports+ Exports)] x 100

Source: OECD Statistics and ITI (International Trade and Investment Research Center),

(4) Competitiveness of Indonesian Products by Item in the Export Market

Using trade statistics by country, the capacity of each ASEAN country to export machine parts is compared by item based on the coefficient of trade specialization. For item category, HS 6-digits (equivalent to SITC 5-digits category) was used. The time periods of comparison are 1990 and 1994, but for the Philippines alone, 1991 statistics (SITC RIV.3) were used. The reason is that the item categories in 1990 statistics, at SITC REV. 2, were somewhat varied.

Concerning automotive parts, electrical and electronic parts, and machine parts, product groups of export items and exportable items as of 1994 are listed by country. Export items are those with a coefficient of trade specialization ranging from zero to 100 (items of greater export value than import value). Exportable items are those with a trade specialization coefficient anywhere from zero to minus 50. The coefficient of trade specialization does not necessarily always indicate development of exports in stages, but as noted above, there are products that serve as development indices by item.

1) Automotive Parts (18 Target Items of Comparison)

Among the ASEAN nations, Thailand has the greatest export capacity in automotive parts. Indonesia recently has been increasing its exports of internal combustion engines, oil filters, wire harnesses and other items not included here.

Country	Export items	Exportable items
Indonesia	Wheels, radiators	Body-related parts
Malaysia	Bumpers, steering wheels	Body-related parts, radiators
Thailand	Safety belts, brake linings, brakes, non-driving axles, shock absorbers, radiators, exhaust pipes, clutches	Body-related parts, drive-axles, wheels, steering wheels
Philippines	Brakes, gear boxes, wheels, radiators, exhaust pipes	Passenger car bodies

2) Electrical and Electronic Parts (53 target items of comparison)

In electrical and electronic parts, Malaysia's export capacity has been large since the 1980s, but in the 1990s, Indonesia's exports have exhibited dramatic growth. Export capacity is also large in Thailand and the Philippines. Foreign capital has contributed greatly to exports of electrical and electronic parts, and the ASEAN nations are now establishing a worldwide export base.

Country	Export items	Exportable items
Indonesia	Word processor and printer parts, electronic calculating machine parts, computer parts, speakers, headphones/earphones, pickup cartridges, magnetic heads, potentiometers, resistor parts, piezoelectric crystals, transistor parts, monolithic ICs, other ICs.	Amplifiers, parts for amplifiers and speakers, TV and video parts, tantalum fixed capacitors, variable capacitors, fixed resistors, connectors
Malaysia	Word processor and printer parts, electronic calculating machine parts, microphones, speakers, amplifiers, CRTs for color TV, CRTs for black and white TV, transistors, thyristors, piezoelectric crystals, hybrid Ics, other ICs	Other parts for printers, etc., parts for telephones, etc., amplifier and speaker parts, TV and video parts, magnetic heads, fixed capacitors made of ceramic or plastic, fixed resistors, other variable resistors, printed boards, fuses, automatic circuit breakers, other breakers, connectors, other CRTs, monolithic ICs
Thailand	Other computer parts/accessories, speakers, headphones/earphones, amplifiers, magnetic heads, fixed capacitors, other variable capacitors, printed boards, other electrical switches, other electrical breakers, relays and thyristors, piezoelectric crystals, monolithic Ics	Parts for word processors/ printers, computer parts, microphones, TV and video parts, tantalum fixed capacitors, fixed capacitors made of ceramic or plastic, variable capacitors, electrical capacitor parts, electrical switches, CRTs for color TV, amplifier valves and tubes, transistors, other ICs
Philippines	Speakers, headphones/earphones, amplifiers, fixed resistors, CRTs for black and white TV, transistors, thyristors, other semiconductor devices, transistor parts, other ICs	Speaker and amplifier parts, TV and video parts, fixed capacitors made of ceramic or plastic, variable capacitors, printed board, piezoelectric crystals

3) Machine Parts (33 Target Items of Comparison)

In all the developing countries, capacity to export machine parts is low. This is ascribed to the fact that advancements by international corporations have not been widely noted. Among the machine tool makers in Japan, it is believed by some that the high yen can be offset with technological capacity, without advancing into developing countries. In general,

there is not much enthusiasm about investing in developing countries, and there has been little transfer of production to them. This is what distinguishes machine parts from electrical and electronic parts.

Country	Export items	Exportable items
Indonesia	Oil filters for internal combustion engines	Air filters for internal combustion engines, check valves
Malaysia	Compressors for refrigerators	Manual air pumps, mold patterns, other metal dies, ball bearings
Thailand	Marine engines, oil filters for internal combustion engines, ball bearings	Air filters for internal combustion engines, pressure reducing valves, valve and cock parts
Philippines	Oil filters for internal combustion engines	Drinking water purification filters, air filters for internal combustion engines, check valves

3. EVALUATION OF PRICE COMPETITIVENESS OF CASTING PARTS

The case study was conducted by selecting representative casting parts for automobiles as shown in Fig. 4-5 in order to evaluate the price competitiveness of Indonesian products.

(1) Evaluation Method

The evaluation of price competitiveness was carried out according to the following steps:

Step 1: To select products to be evaluated and set conditions for evaluation, such as production conditions.

Step 2: To calculate ex-factory prices in cases where they are produced in several countries.

Step 3: To compare the results and consider major reasons for differences.

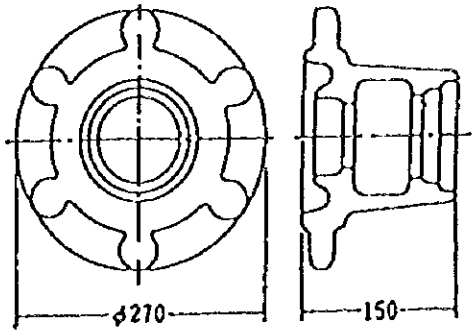
Ex-factory prices in several Asian countries are calculated by foundry specialists working in foundries in Japan, based on accumulated data concerning production in these countries.

(2) Conditions for the Evaluation

1) Selected Products for the Evaluation

- Name of parts: Hubs for automobiles
- Weight: 13kg
- Materials: FC250 and FCD450
- Shape and size: As shown in Fig. 8-6-10.

Fig. 4-5 Shape and Size of Selected Products



2) Production Conditions

- Production volume:	500 pieces per month
- No. of pieces per molding box:	2 pieces
- Yield:	85% for FC250 and 70% for FCD450
- Molding method:	Greensand mold for main mold and shell mold for core
- Machining of casting products:	Machining is not carried out.
- Expenses for patterns:	They are not included assuming that they are separately charged.

(3) Results of Evaluation

Ex-factory prices calculated for subject products in major Asian countries are shown in Table 4-2.

Table 4-2 Comparison of Ex-factory Prices of Selected Products

Producing Country	FC250			FCD450		
	Price per kg (¥/kg)	Price per Piece (¥/piece)	Comparison of Prices*	Price per kg (¥/kg)	Price per Piece (¥/piece)	Comparison of Prices*
Japan	165 (160～170)	2,145	100	185 (180～190)	2,405	100
Indonesia	120 (115～125)	1,560	73	135 (130～140)	1,755	73
Thailand	120 (115～125)	1,560	73	135 (130～140)	1,755	73
China	90 (85～95)	1,170	55	105 (100～110)	1,365	57

Note: * Japan = 100
Source: JICA Study Team

From the above results, the following are pointed out:

i. Products manufactured in Indonesia and Thailand are approximately 30% cheaper and products in China are more than 40% cheaper than those in Japan.

ii. The main reasons for Chinese casting products having the cheapest prices are as follows:

- Indonesia and Thailand import major raw materials such as iron and alloys, although they procure casting sands domestically. Their costs for raw materials are higher. However, raw materials are available in China and its costs are cheaper.
- Labor costs in China are low.
- Capital investments by Chinese foundries in local areas are small and their investment cost is small.

iii. Chinese foundries, in many cases, decide their prices flexibly responding to the market, and do not decide their prices based on the manufacturing costs of products. It is not clear how to include such expenses as depreciation expenses, sickness allowance for employees, allowances for infants, and pension allowances. Therefore, there is a

possibility of future rise in prices of Chinese casting products.

iv. The products evaluated are small sized products for mass production, and they are produced by hand molding. As for medium and large sized parts such as balance weights for forklifts and large specials tubes for water pipes, the cost advantages of Indonesian products against Japanese products are larger and the export potentials to the Japanese market are also larger.

v. Indonesian casting products will face more severe competition from other east Asian countries. It is necessary for the Indonesian foundry industry to make progress with the localization of major raw materials and production equipment and increase its price competitiveness.

vi. Transport costs to Japan from harbors in Asian countries are as shown in Table 4-3. When a Japanese buyer purchases Indonesian products, prices at the delivery to the buyer are ¥150 per kg (¥120 per kg + ¥30 kg) for FC250 products. If such a buyer is located far from a Japanese harbor, and therefore, the cost of inland freight increases, there is no cost advantage for imports of casting products from Indonesia and Thailand..

Table 4-3 Transport Expenses to Import to Japan

Items	Amount
- Freight	¥5 - 7/kg
- Import Duty	¥3/kg
- Inland Freight	¥8 - 13/kg
- Commission to Trader	¥9 - 12/kg (7 - 10%)
Total	¥25 - 35/kg (¥30/kg on average)

Source: JICA Study Team

V. DEVELOPMENT STRATEGIES BY INDUSTRY

1. DEVELOPMENT STRATEGIES FOR THE AUTOMOTIVE PARTS INDUSTRY

(1) Present Status and Characteristics of the Automotive Industry and Parts and Components Manufacturers in Indonesia

Characteristics and problem areas of the automotive industry and parts and components manufacturers in Indonesia are pointed out as follows.

(i) Though production and sales volume of cars has been increasing steadily, market size as a whole is still small. Because of this, not only automotive assemblers but also their subcontractors who manufacture parts and components find it difficult to secure production volume large enough to enjoy merits of scale.

(ii) Because domestic automotive parts and components production in Indonesia has been developed according to the localization program by the government, there exist many parts and components which do not have enough price and/or quality competitiveness in the international market. In addition, a relatively large number of parts and components have been localized by in-house production of assemblers themselves. As a result, the number of parts and components manufacturers is relatively small in comparison with the number of assemblers.

(iii) Because the technological levels of local metal processing related manufacturers which are expected to be secondary and tertiary subcontractors are very low, linkage between these manufacturers and the automotive industry is very small. As a result, the usual industrial multi-layer structure with assemblers at the top and the primary, secondary and tertiary subcontractors spreading widely as a broad foundation does not exist. This causes several problems such as dependence on the import of parts and components which should be procured locally or increase in costs as the result of in-house production of parts and components which should be processed by subcontractors.

(2) Basic Strategies for Development of the Automotive Parts and Components Industry

In consideration of the present characteristics and problem areas mentioned above, basic strategies for development of the automotive parts and components industry which Indonesia should adopt are focused on the following points.

1) Development Focusing on Priority Parts and Components which should be Localized in Indonesia
2) Improvement of Essential Technology Relating to Metal Processing
3) Development of domestic small scale metal processing companies as supporting industry

(3) Development Target Indices

Development target indices which roughly show the future status of the automotive parts and components industry were set up according to the following premises.

i) The growth rate of the manufacturing sector as a whole in the medium and long term is set as 10%.
ii) As for prediction of automotive production volume, an average annual growth rate of 7.5% from 1995 to 2002 is posited based on the GAIKINDO prediction until 2000. Further, the average annual growth rate from 2003 to 2007 is set at 5.0%.
iii) As for the prediction of motorcycle production volume, the average anuual growth rates of 10.0% from 1995 to 2002 and 3.0% from 2003 to 2007 are posited based on the survey with PASMI, etc.
iv) Domestic demand prediction is posited based on the growth rates of automotive and motorcycle production volume.
v) Prediction of production value for domestic demand of the total domestic production value is set based on the premises of local content ratio development of approximately 55% in 2002 and 70% in 2007 in addition to the growth of domestic demand.

vi) Prediction of the import value of parts and components is based on the premises of average import rates of approximately 45.0% in 2002 and 30% in 2007. (The average import rate in 1995 was 68.7%.)

vii) Average annual growth rates of export value are set as approximately 17% from 1995 to 2002 and 38.5% from 2003 to 2007.

Average annual growth rates of productivity per employee are set as 10% after 1995.

Table 5-1 Development Target Indices of the Automotive Parts and Components Industry

(Unit: Rp. billion, Unit)

	1995 (Actual)	2002(Predicted)		2007(Predicted)	
			Growth rate		Growth rate
Production value of manufacturing sector as a whole	186,367	363,177	10.0	584,899	10.0
Production volume of cars	387,541	643,000	7.5	821,000	5.0
Production volume of motorcycles	1,042,938	2,032,000	10.0	2,356,000	3.0
Automotive parts and components industry					
1) Domestic demand	8,588	14,718	8.0	18,606	4.8
2) Domestic production value	2,557	9,162	20.0	18,428	15.0
3) Import value	6,387	6,623	0.5	5,582	-3.0
4) Export value	356	1,067	17.0	5,404	38.5
5) Number of companies	362	666	9.1	831	4.5
6) Number of employees	47,177	86,761	9.1	108,336	4.5
7) Production value per employee (Million Rp.)	54.2	105.6	10.0	170.1	10.0

Note: Values are all in 1995 constant prices.
Source: The JICA Study Team

(4) Development Measures

1) Development Measures of Priority Parts and Components Groups

Based on the results of the study, priority parts and components groups which should be developed intensively are selected as follows.

(i) Group 1: Crucial parts and components which are recognized as priority parts and components for localization by assemblers and should be localized rapidly.

- Engine parts and components (4) : Alternators, Camshafts, Connecting Rods, Motor Starters
- Transmission parts and components (4) : Extension Housings, Gears, Input shafts/Main Shafts, Shift Forks/Speed Shaft Rails
- Drive axle parts and components (2) : Drive Shafts, Propeller Tubes
- Brake parts and components (1) : Backing Plates/Body Calipers

(ii) Group 2 (8 parts and components): Parts and components which have the potential to be competitive in the international market in the future and need to be more competitive by modernizing production technology and equipment.

- Engine parts and components (2) : Pistons & Piston Rings, Radiators
- Transmission parts and components (3) : Cases, Clutch Housings, Covers
- Suspension parts and components (1) : Shock Absorbers
- Universal parts and components (2) : Safety Glasses, Air Conditioners

(iii) Group 3 (9 parts and components): Parts and components which have already been exported but need to concentrate on further market expansion by intensifying competitiveness.

- Engine parts and components (3) : Air Filters, Fuel Filters, Oil Filters
- Clutch parts and components (1) : Facings
- Universal parts and components (5) : Batteries, Control Cables, Electric Parts, Tires, Wiring Harnesses

Invitation of investment by superior overseas parts and components manufacturers and promotion of capital and/or technological collaboration between such overseas manufacturers and domestic ones are effective for the development of Group 1. A series of active governmental supports for technological development and financing in addition to efforts to improve management and technology by each manufacturer are expected for the development of Group 2. Activities aiming at the development of the overseas market projected by Indonesian manufacturers in cooperation with the Indonesian government are necessary in line with improvement of competitiveness of parts and components

manufactured in Indonesia for the development of Group 3.

2) Development Measures of Essential Technology Level

Improvement of casting and forging technology is indispensable for the development of Group 1 and 2. The most important key technologies are forming and manufacturing technology of cores for casting parts and heat treatment for surface hardening and die repairing technology for forging parts. In addition, improvement of technology in manufacturers specializing in heat and surface treatment is also necessary. On the other hand, for the improvement of parts and components in Group 3 in the international market, improvement of automation technology for stable quality and design technology of jigs and fixtures for efficiency is necessary for the establishment of mass production technology. As for die manufacturing and factory control technology, strengthening of rationalization technology and methods which are suitable for repeated production such as quality control, cost control and reduction of lead time in addition to rationalization of production equipment and improvement of maintenance technology is necessary.

3) Development Measures of Domestic Small Scale Metal Processing Companies as Supporting Industry

Such fields as casting, forging, heat and surface treatment, presswork and machining are very important even in the case of the primary subcontractors. In the case of many parts and components or processes, procurement costs can be reduced by developing the domestic secondary and tertiary subcontractors. Development of domestic small scale metal processing companies which have not been developed as automotive parts and components suppliers and expansion of the supporting industry base should be promoted by the following governmental supports.

- Expansion of management skill training systems
- Financial supports for equipment modernizing and upgrading
- Strengthening of technical guidance visits by experts for establishment of mass production technology

- Expansion of common facilities
- Supply of market information
- Strengthening of managerial and/or technological supports through assemblers and primary subcontractors

2. DEVELOPMENT STRATEGIES FOR THE ELECTRICAL AND ELECTRONICS PARTS AND COMPONENTS INDUSTRY

(1) Present Status and Characteristics of the Electrical and Electronics Industry and Parts and Components Manufacturers in Indonesia

The present status and characteristics of the electrical and electronics industry and the electrical and electronics parts and components industry in Indonesia are summarized as follows.

a. In the early 1990s, corresponding to the governmental deregulation policy, the electrical and electronics industry in Indonesia changed its characteristics from the import substitution industry to the export oriented industry. The industry has grown to become one of the most important exporting industries in the country, which contributes to securing foreign currency. However, most electrical and electronics products are produced by joint venture companies between Indonesian domestic companies and foreign companies, and the development of the domestic electrical and electronics industry lags far behind In addition, the majority of companies which export electrical and electronics products are foreign affiliated. Domestic companies have not developed to the level where they can export products.

b. The assemblers of electrical and electronics products depend on import for many parts, because the electrical and electronics parts and components industry in the country is still underdeveloped. Especially, foreign affiliated companies import almost all the parts and components which are used for the assembling of finished products because the range of parts and components produced in the country is very limited. As a result, the growth of the electrical and electronics industry in Indonesia has rarely influenced other industries.

c. Domestic electrical and electronics parts manufacturers are lacking in technology, production facilities, and capital, and are not able to produce reliable parts and components except for simple plastic molding parts and simple metal press parts. Key parts and components such as functional devices and semiconductor related parts need

high level technologies, and are rarely produced locally. One of the reasons behind this is that foreign electrical and electronics parts manufacturers have long avoided a large amount of investments into Indonesia because the total demand for parts and components in the country has not been sufficient. However, as foreign electrical and electronic assemblers have accelerated investments into Indonesia since the beginning of the 1990s, foreign parts manufacturers are gradually increasing their investments in the country as well.

d. Various plastic molding parts and metal press parts are assembled into electrical and electronics parts and components. These plastic parts are produced locally using molds and dies, more than 90% of which are said to be imported. Because molds and dies represent the most important production technology, Indonesia is considered to be highly dependent on foreign countries in its technology. In addition to the mold and die making technology, what is necessary for the supporting industry of the electrical and electronic industry in Indonesia is production technology, mainly precise machining.

e. Compared with that in other ASEAN countries, the electrical and electronics industry in Indonesia is underdeveloped in terms of production value as well as in the ratio of production value over gross domestic production. In addition, as is different from the case of other ASEAN countries where the export of electrical and electronics products started after domestic demand was fulfilled, the industry in Indonesia has not fulfilled domestic demand.

(2) Basic Strategies for Development of the Electrical and Electronics Parts and Components Industry

Taking the present status and characteristics of the industry mentioned in 1.2.1 into consideration, basic strategies for the development of the electrical and electronics parts and components industry, which Indonesia should adopt, are determined as follows:

a. Invite foreign investments in the export oriented electrical and electronics parts and

components industry

b. Develop the electrical and electronic parts and components industry through strengthening the linkage between assemblers and the supporting industry.
c. Improve technology levels of essential technology in the metal process fields

(3) Development Indices

The development indices which show the outline of the future electrical and electronics parts and components industry are proposed based on the following assumptions.

(i) The annual growth of the whole manufacturing sector in the medium- and long-term is set at 10%.
(ii) The annual growth of the electrical and electronics industry is set at 20% between 1996 and 2002, and at 15% between 2002 and 2007. (Actual annual growth between 1989 and 1995 was 39.1%.)
(iii) In 1995, domestic demand for parts and components over the production of electrical and electronics finished products is estimated at 47%. This ratio is supposed to increase to 62% in 2002, and 70% in 2007.
(iv) Domestic production over domestic demand, i.e., localization ratio, which was 25% in 1995, shall be increased gradually so as to reach 40% in 2007.
(v) Average annual growth of export is set at 20% between 1996 and 2002, and at 15% between 2002 and 2007. (Actual annual growth between 1989 and 1995 was 65.5%.)
(vi) Import value is calculated based on the assumed localization ratio. ((Domestic demand x localization) - (Domestic production - Export value))
(vii) Productivity per worker is assumed to increase 10% every year after 1995.

Table 5-2 Development Indicators of the Electrical and Electronic Parts and Components Industry

(unit: billion Rp.)

	1995 (actual)	2000 (estimate)		2007 (estimate)	
			annual growth rate		annual growth rate
Production value of whole manufacturing sector	186,367	363,177	10.0	584,899	10.0
Production value of the electrical and electronics industry	10,686	38,289	20.0	77,012	15.0
Electrical and electronics parts and components industry					
1) Domestic demand	4,996,	23,739	24.9	53,909	17.8
2) Domestic production	3,244	15,173	24.7	35,999	18.9
3) Import	3,755	15,743	22.7	32,345	15.5
4) Export	2,003	7,177	20.0	14,436	15.0
5) Number of companies	207	497	13.3	733	8.1
6) Number of employees	72,169	173,406	13.3	255,493	8.1
7) Production value per employee (Rp. Million)	44.9	87.5	10.0	140.9	10.0

Note: Values are all in 1995 constant prices.

(4) Development Measures

Although the electrical and electronics industry has maintained rapid growth, the electrical and electronics parts and components industry which supports the former is substantially behind in progress. In order to develop the parts and components industry, it is imperative to have a development strategy that includes strong support from electrical and electronic assemblers. To expedite this, it is necessary to invite participation actively from foreign parts and components manufacturers as well as to strengthen relationships between assemblers and parts and components manufacturers. Specific development measures are as follows:

a. Strengthen relationships between assemblers and the supporting industries

Support from assemblers for 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, most companies receive support from assemblers only when a quality problem occurs.

Under the circumstances, systematic and comprehensive support from large scale assemblers given to small and medium scale parts and components manufacturers is urgently required. It is considered to be very useful for the government to give assistance to assemblers in organizing cooperative associations among their vendors, which is prevalent among large-scale assemblers in Japan, so that assemblers can give various kinds of support to the supporting industries effectively.

In addition, it would be worthwhile to make a feasibility study on the establishment of an electrical and electronics industrial estate where assemblers, parts/components manufacturers, and the second tier supporting industries in electrical and electronics fields are concentrated so that a stronger linkage among them can be achieved.

b. Promote foreign investments into the fields of priority products through the strengthening of investment incentives

Priority parts and components which are selected in Chapter IV of this report are reproduced below. Invitation of foreign investments into these product fields through the strengthening of investment incentives is required. Also, for priority parts and components which have been already produced in the country, it is effective for the government to set up incentives to expedite further technology transfer.

(i) Electrical parts and components

- PCB (one side, both sides, multi-layer)
- Induction motors
- DC motors
- Audio speakers
- Electric connectors
- Low voltage connectors
- Very low current connectors

(ii) Electronics parts and components

- Registers
- Condensers
- Semiconductors

In order to develop parts and components manufacturers of the above items, the development of essential technologies in metal processing such as presswork, die and mold making and heat treatment, and managerial skills are necessary. Measures mentioned below are considered to be effective.

c. Short-term training programs and seminars for parts and components manufacturers

It is suggested that strong assistance from third parties including both Indonesian and overseas government organizations, and public institutions is necessary to provide short-term training programs and seminars for the supporting industry. In reality, industrial associations such as GEI and governmental institutions such as MIDC are regarded as being appropriate organizations which fill the role of various supporting activities such as invitation of foreign experts, holding short-term training programs and seminars, and providing the supporting industries with technical advice on factory visits.

d. Develop technical training schools

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 such as MIDC as well as industrial associations such as GEI may contribute to the establishment of such schools.

On the other hand, it was revealed through the Study 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.

e. Establish information sources related to meal processing

The establishment of information sources in the field of metal processing 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 such as GEI 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.

f. Develop systematic governmental loan schemes

Under the present governmental financial 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 accounting consultants to small and medium scale companies so that they can receive professional advice about various managerial problems.

3. DEVELOPMENT STRATEGIES FOR THE MACHINERY PARTS INDUSTRY

(1) Present Status and Characteristics of the Machinery Industry and Machinery Parts and Components Industries in Indonesia

In Indonesia, the whole machinery industry is still very underdeveloped. By major product items, both the number of companies and the production values of each product of the machinery industry are very small, except for two items of construction machinery and combustion engines. Accordingly, the machinery parts industry in Indonesia is at the beginning stage of development, and most of their production items are various kinds of maintenance parts.

One reason for this delay of the development of the machinery industry is that the domestic demand for machinery is still small due to the low level of industrialization in Indonesia. Another reason is that a strategic development policy of the machinery industry of protecting the domestic market could not be taken, because it would decrease the total competitiveness of the Indonesian manufacturing industry. A third reason is the delay of the development of the metal processing industry which has such elemental technologies as castings. This means that the following vicious cycle has been formulated in Indonesia : immaturity of the machinery industry→ low demand for machinery parts → underdevelopment of the metal processing industry → immaturity of the machinery industry.

Not only in Indonesia but also in most of the other ASEAN nations, the development of the machinery industry is delayed compared with such industries as the electrical and electronics industry or the automotive industry. The largest reason for this is that the major machinery manufacturers in the developed countries such as Japan are not yet active in transferring their production bases to the Asian region. Thus, the majority of the high quality machinery used by investors in export product manufacturing is imported from Japan and other developed countries. As for the low-end machinery which is low grade but cheap, those products of such countries as Taiwan that succeeded in the early achievement of industrialization, or China that strategically developed its machinery industry, dominate the market.

Under the above circumstances, most ASEAN nations aim at developing the machinery industry as one of their core industries, following to the electric and electronics industry and the automotive industry.

(2) Basic Strategies for the Development of the Machinery Parts Industry

From the current status of the industry in Indonesia as mentioned above, the basic strategies for the development of the machinery parts industry would be summarized in the following.

(1) Development of the core machinery industry
(2) Improvement of Essential Technology Related to Metal Processing

(3) Development Target Indices

Based on the following broad assumptions, the development target indices, which could be used for assuming the general picture of the industry in the future, were set.

i) The annual average growth rate of whole manufacturing sector in the medium and long term is set at 10%.
ii) In 1994, the percentage share of the machinery industry was only 1.4%. From the experience of other nations, that share was assumed to increase to 2.0% in 2002, and 3.0% in 2007.
iii) The medium and long term average annual growth rate of the domestic demand for machinery parts was posited at 10%, which is equivalent to that of the whole manufacturing sector.
iv) The import ratio to the domestic demand in 1995 is estimated at 86%, which was assumed to decrease to 60% in 2002 and to 40% in 2007.
v) The same annual growth rate as that for total domestic production was assumed for exports.

Table 5-3 Development Target Indices of the Machinery Parts Industry

(Unit: Rp. billion)

	1994 (Actual)	1995 (Estimate)	2002 (Projection)		2007 (Projection)	
				Growth rate(%)		Growth rate(%)
Production of whole manufacturing sector	155,825	186,367	363,177	10.0	584,899	10.0
Production of machinery sector	2,203	2,135	7,264	16.6	17,547	19.3
Machinery parts industry						
1) Domestic demand	3,758	4,494	8,757	10.0	14,104	10.0
2) Domestic production	726	868	3,975	23.3	9,221	18.3
3) Imports	3,234	3,868	5,254	4.5	5,642	1.4
4) Exports	202	242	472	10.0	759	10.0
5) Number of companies	269	280	659	13.0	949	7.6
6) Number of employees	37,119	38,578	90,735	13.0	130,794	7.6
7) Production value per employee (Million Rp.)	19.6	22.5	43.8	10.0	70.5	10.0

Note: Values are all in 1995 constant prices.

(4) Development Measures

The development of the machinery parts industry has to be achieved together with that of the machinery assembly industry. For the development of the machinery industry in Indonesia, the following measures are recommended.

1) Invitation of overseas manufacturers' investments in Indonesia by expanding the investment incentives including income tax exemption or reduction

A package of strategic investment incentives should be applied to the companies which would start production of strategic machinery products such as those recommended in Chapter 4, Section 3.2. Selection of Priority Products and Essential Technologies (Group II to Group V).

- Air compressors
- Universal metal working machines
- Molds, jigs and fixtures
- Universal machine tools
- Bearings (rolling)
- Precision dies and molds
- High grade tools
- Oil hydraulic pressure devices
- Servo-mechanisms
- NC machine tools (2, 3 and 5 dimension)
- Industrial robots
- Precision metal working machines

2) Promotion of capital and technical tie-ups between local manufacturers and overseas manufacturers

Matching service activities should be promoted by setting up an organization that accumulates the information which would be useful for local companies trying to find overseas partner companies or the overseas manufacturers desiring to find suitable local partner companies.

Further, the technical levels of local metal processing industries such as casting, forging, press work or machining industries have to be improved by instituting the following measures.

1) The capability of public central R&D support organizations such as MIDC should be strengthened. They should establish the basic technologies of metal work and try to diffuse those technologies to local manufacturers.

2) The technical guidance capability to local small and medium scale manufacturers has to be strengthened by upgrading the facilities and technical levels of workers

of those technical service organizations which are established in the areas where many metal working industries are concentrated such as Ceper, Sukabumi or Tegal.

In addition, the following measures would also be considered effective for the development of the machine parts industry.

1) New investment by local and overseas manufacturers in the metal working areas should be promoted by offering them an industrial estate which features all of the necessary infrastructures such as power, upper and lower water supply, telecommunication, transportation network, waste disposal facilities or public technical service organizations as well as being an estate administration office which can having function as a one-stop service agency.

2) By establishing a soft loan scheme directed for capital investments of the supporting industry, the obsolete machines and equipment of the existing companies would be replaced and new investment for the capital intensive metal working industry would become easier.