3 Metalworking Industry Subsector

3.1 Metalworking Industry Subsector in Indonesia

The metalworking industry in Indonesia is said to have originated and developed under the patronage of the Yogyakarta royal family as a traditional craft industry to produce ornaments and furnishings used by the royal family. During the Dutch colonial period, the industry produced repair parts for sugar refining plants. Later, under Japanese occupation during Second World War, military goods, rolling stock, household goods such as pans, pots, and irons, and light weight pumps were manufactured, although most of enterprises remained in the form of home industry. The enactment of the Foreign Investment Act in 1967 and the Domestic Investment Act in 1968 has attracted overseas and domestic private investors at an accelerated rate. Foreign technologies were introduced vigorously and joint ventures established. Led by these joint ventures with foreign companies, the metalworking industry has modernized and expanded to today's status. Notably, the industry has been growing side by side with assembly industries, such as automotive, agricultural machinery, and electrical equipment industries, which it supports and serves.

The following sections describe 4 important subsectors of the metalworking industry that serve as the supporting industry for assembly manufacturers, namely casting, metal press working, forging, and pattern/die/mold making.

3.1.1 Casting subsector

3.1.1.1 General outline

Castings are roughly classified into 3 types according to their use: (1) ductile cast iron pipes, pipe joints, manhole covers, fire hydrants, brake shoes, anchors, and others that are used as final products; (2) components and parts for automobiles, agricultural machinery, machine tools, electrical equipment, and other manufactured goods, which are machined before use; and (3) dies for metal press working and other parts of production equipment for industrial products.

Large enterprises producing components for automobiles and agricultural machinery, die materials for metal press working, large ductile cast iron pipe fittings, anchors, and pipe joints are mainly found in industrial estates of Purogadung, Tangerang, and Bekasi in the suburbs of Jakarta, as well as regional cities in Java, including Semarang, Surabaya, Yogyakarta, and Pasuruan.

According to data furnished by APLINDO (Asosiasi Industri Pengecoran Logam

Indonesia : Association of Indonesian Metal Foundry), various products including castings for automotive parts and pipe joints are now exported to Japan and other countries, evidencing that the foundry industry has been steadfastly gaining international competitiveness.

However, the production of casting products that require high levels of precision and reliability, such as cylinder blocks/crank cases, and cylinder heads for engines of motor vehicles and agricultural machinery is quite limited. In the case of production of cylinder blocks for motor vehicles, only one company is in production, and it is an automaker jointly established with a leading Japanese company in Indonesia and produces the above products for captive consumption and specific models alone.

Some engine manufacturers have recently started pilot production of crank cases for single-cylinder horizontal diesel engines and cylinder blocks for 3-cylinder vertical diesel engines. Thus, foundry technology seems to have gradually risen.

Diecast parts as engine components are also manufactured by a large motor cycle maker which is a joint venture with a Japanese company producing for captive consumption.

A large number of foundries in small-and-medium enterprise or micro enterprise are located in Ceper, Tegal, Sukabumi districts, with some of them forming cooperatives. They produce a variety of castings including manhole covers, brake shoes, and fire hydrants. Recently, they have started to manufacture simple parts such as pulleys, and water hoppers for agricultural machinery, and pump casings.

3.1.1.2 Industry size

(1) Production

According to APLINDO's data, production capacities and volumes of castings by Indonesian enterprises in 1993 are shown below.

		Production Capacity (tons/y)	Production Quantity (tons/y)	Operation Rate (%)
Total in Indonesia:	Metal Casting	164,000	92,000	56
	Non Metal Casting	166,000	104,000	63
	Total	330,000	196,000	59
of which:				
APLINDO Membership Co.:	Metal Casting	109,000	64,000	59
	Non Metal Casting	106,000	73,000	67
	Total	215,000	137,000	65

Source: APLINDO

Annual production of all the castings in Indonesia reached 196,000 tons in 1993. However, the average capacity utilization rate remains at a relatively low level of 59%. Production of APLINDO member companies (33) amounts to 137,000 tons which account for approximately 70% of the total.

(2) Number of enterprises and employment

According to APLINDO's data, there are approximately 150 foundries of varying size operating in Indonesia, of which 33 large enterprises are members of APLINDO. It should be noted, however, that these figures do not include a large number of local foundries from medium to micro enterprise that operate through cooperatives in Ceper, Tegal, and Sukabumi. A source says that there are approximately 340 foundry shops including small or micro enterprises in Ceper. If they are added to the above figure, the foundry industry in Indonesia forms a sizable number of enterprises.

No official statistics showing employment in the foundry industry are available.

(3) Geographical distribution

Large foundry companies are mainly located in industrial estates of Purogadung, Tangerang, and Bekasi in the suburbs of Jakarta, as well as other major cities in Java, including Semarang, Surabaya, Yogyakarata, and Pasuruan. Outside Java, there seem to be large foundries in Medan, Sumatra. A large number of small-and-medium-sized enterprises as well as micro enterprises serving local demand are found in Ceper, Tegal, Sukabumi districts.

3.1.1.3 Domestic demand and supply situation

According to APLINDO's data, approximately 47% of annual production casting production in Indonesia (92,000 tons out of 196,000 tons) are ferrous castings, and 53% (104,000 tons) non-ferrous castings. The former include gray castings, ductile castings, malleable castings, and steel castings. The latter include aluminum castings, bronze castings, and brass castings. Of these projects, industrial products used for automotive and other parts, and pipe joints are exported to Japan and other countries.

Exports by APLINDO member companies in 1992 and 1993 are summarized as follows.

	1992		1993	
	Tons	Value (FOB US$ '000)	Tons	Value (FOB US$ '000)
Iron and Steel Casting	2,186.9	4,659.4	3,372.0	6,787.6
Black Lead	17,771.8	10,706.8	16,398.0	8,173.4
Non Ferrous Casting	1,898.9	1,110.8	1,149.0	525.8
Total	21,857.6	16,477.0	20,919.0	15,486.8

Large enterprises manufacture a wide range of castings for the following industries:

Automotive industry:	Including brake drums, disc brakes, pressure plates, flywheels, manifolds, hubs, differential cases, body calipers, rocker covers, and clutch covers.
Agricultural machinery industry:	Including flywheels, gear cases, pulleys, crank case covers, main bearing cases, gear case covers, water hoppers, flanges, cylinder liners, pistons, and piston rings.
Pump and valve industry:	Including pump casings, impellers, and valve casings.
Electrical equipment industry:	Including motor housings.
Other industries:	Including small steel cast components for construction machinery, ductile cast iron pipe fittings for waterworks, pipe joints, cast steel anchors for ships, chilled rolls and ingot moulds for steel plants, and dies for metal press work.

Furthermore, a foundry to produce castings for refrigerator compressors, another joint venture with a Japanese company, is under construction and will start commercial production in 1995.

Diecast parts for aluminum engine components are manufactured by a large motorcycle manufacturer, a joint venture with a Japanese company, for captive consumption.

Smaller foundries produce castings that do not require high levels of quality and dimensional accuracy, such as manhole covers, brake shoes, fire hydrants, hand pumps for wells, and legs for sewing machines. Recently, simple casting parts, such as pulleys and water hoppers for agricultural machinery and pump casings, have been added to their product lines.

3.1.1.4 Procurement of raw materials

Principal raw materials for castings, including pig iron, ferro-alloys such as Fe-Si, Fe-Mn, and Fe-Cr, and coke, are all imported. Pig iron imports in the recent 5 years are shown in Chart A1-3-1. In 1992 and 1993, more than 100,000 tons of foundry pig iron for castings were imported from various countries in a year. While pig iron is produced as a pilot project in LANPUNG, quality variation and quantity limitation result in the use of imported products by most companies.

Note that various raw materials including silica sand, resin-coated sand, and scraps are locally available.

3.1.1.5 Production structure

(1) Ownership

Enterprises in the foundry industry are classified in three types according to ownership as follows:

1) Joint ventures with Japanese companies
2) Large enterprises of local capital (state-owned or private enterprises having 200 or more employees)
3) Local small-and-medium-sized enterprises and micro enterprises (199-100 employees, 99-20 employees, and 19 employees, respectively)

Major characteristics of the above three types of enterprises are described as follows.

1) Joint ventures with Japanese companies

Four foundries are operated by assembly manufacturers of automobiles, pumps, and construction equipment as internal sources of casts for their own products. One foundry specializing in the production of industrial castings is on a contract basis. Their facilities and equipment are well arranged, supported by quality control and testing equipment resulting in good quality control practice. Melting is mostly done by using electrical induction furnaces, and molding, sand control, core making, cleaning and fettling are well mechanized.

2) Large enterprises of local capital

There are 40 large enterprises of local capital, which are divided into those receiving technical assistance from Japanese and foreign companies, and those having proprietary production technology.

The former type has a certain level of quality control. Melting is mostly done by

using electrical induction furnaces, molding, sand control, core making, cleaning and fettling, all of which are well mechanized. These enterprises produce castings for industrial components, such as engines for agricultural machinery, large water pipe fittings, anchors, and die materials for stamping.

The latter on the other hand, has expanded its buildings and equipment with increase in production, but are not arranged in an efficient way. With an insufficient stock of quality control equipment, many of them rely on empirical skills and judgment of workers. Cupolas are mostly used for melting, and due to the lack of mechanization, many facilities use a large number of workers.

Some produce castings for agricultural machinery engines and pumps, while many make malleable cast iron pipe joints and decorative castings for fences.

3) Local small-and-medium-sized enterprises and micro enterprises

These enterprises are abundantly located in Ceper and other districts as local industry. They mainly use old melting furnaces before cupolas and floor moulds. Most of them do not have sand mills. These foundries produce castings that do not require high levels of quality and dimensional accuracy, such as manhole covers, brake shoes, fire hydrants, hand pumps for wells, and sawing machine legs. Recently, these small-and-medium-sized foundries produce simple industrial parts such as pulleys and water hoppers for agricultural machinery, and pump casings, in which problems in terms of workmanship and quality are encountered, as measured by high fraction defects and repairing rate.

(2) Production technology

Joint ventures with Japanese companies and some of large indigenous enterprises are approaching technical levels emulating those available in other Asian countries. Major foundry techniques are summarized for each process.

1) Melting: Many foundries own more than two melting furnaces such as low-frequency induction furnaces, high-frequency induction furnaces, and cupolas, together with testing equipment at furnace front including CE meters and thermometers.
2) Molding: A variety of molds including green sand molds, furan resin molds, and cement bonded molds are made by molding machines or with manual labor.
3) Core making: Shell cores, furan resin cores, and hot box process cores are used.
4) Sand preparation: Sand mixers as well as sand recovery/reclamation systems are used according to different molding processes including, green sand molds and furan

resin molds. Sand quality is controlled by using sand testers.

5) Cleaning and fettling: Surface treatment of castings is carried out by shot blasting, grinding, chipping and other means.
6) Inspection: Material tests examining hardness, microstructure, tensile strength, and other quality requirements, and dimensional and appearance inspection are performed.

Furthermore, some foundries conduct nondestructive tests, such as magnetic particle and ultrasonic tests, as required. Most enterprises own hardness testers and metallurgical microscopes, while only a half of those visited have tensile testers. Foundries which do not have tensile testers commission necessary tests to group companies or outside testing laboratories.

7) Pattern & core box: Many large foundries have their own pattern shops where wood and metal molds are made or repaired.

In contrast, small foundries are far behind large ones in areas of both production equipment and technology. As for melting operation, small cupolas are used for cast iron, and crucible furnaces for nonferrous castings such as aluminum, brass, and bronze. Many foundries carry out melting operation once or twice per week. Floor molding is very common. Monitoring and control of molten metal and molding sand are mainly done by workers with experience, thus rarely using measuring instruments. Inspection is limited to appearance inspection of final products. Wood patterns and core boxes are made and used by some foundries, but many of these foundries use aluminum patterns which are moulded based on the castings obtained from other sources, and finished manually.

In Ceper, foundries form a cooperative which is engaged in joint order receiving, procurement of raw materials, and after treatment and machining of products.

3.1.1.6 Major issues facing the casting subsector

Joint ventures with Japanese companies and some of local large enterprises produce castings for a variety of industries including motor vehicles, agricultural machinery, and construction equipment. They are developing competitively against industries in other Asian countries in terms of technology and management. Nevertheless, they account for only a small portion of the industry, and the remaining numerous foundries have various problems in the areas of facility and equipment, technology, and quality.

For assembly industries such as motor vehicles, agricultural machinery, electrical machinery, and construction equipment to improve international competitiveness in the future, it is essential to improve technical capabilities of the metalworking industry that support them, the casting industry, in particular.

(1) Improvement of product quality

In Indonesia, the incidence of defects reaches around 10% among large corporations, and the incidence of repair such as filling sometimes exceeds 50% for products made by small-and-medium-sized enterprises.

A manufacturer of engines for agricultural machinery procures castings from Ceper in line with the policy of the Ministry of Industry to foster small-and-medium-sized enterprises. However, because of unreliable quality, the company inspects every product upon acceptance. Also, a pump manufacturer disposes nearly 25% of castings for pump casings procured from Ceper in the machining process due to blowholes.

It is therefore important to promote the improvement of production techniques including casting design, as well as strict quality control on casting sand, chemical composition and temperature of molten metal and other factors.

(2) Procurement of quality control equipment

To promote statistical quality control, instead of simply relying on empirical judgment by workers, various measuring instruments are required to monitor characteristic values of casting sand and molten metal, such as temperature and chemical compositions.

Clearly, many of small-and-medium-sized enterprises as well as micro enterprises seem to be unable to procure these equipment due to financial difficulty. At the same time, they are mostly concentrated in certain locations including Ceper, including one cooperative organized there. If the cooperative can serve as a conduit in promoting quality control practice among their member companies, it is expected to help in the improvement of product quality of the entire casting industry in the area. An idea is that for the cooperative to procure sand testing equipment in measuring moisture content, air permeability, strength, active clay content, and other properties, temperature measuring devices for molten metal, CE meters, and chemical analytical instruments, and; to hire or train lab technicians in providing visiting service for its member companies.

(3) Upgrading of technical capabilities

At present, castings requiring high levels of accuracy and reliability, such as cylinder blocks, crank cases, and cylinder heads of engines for motor vehicles and agricultural machinery, which are mostly imported, as cast or machined, from Japan, Germany, and neighboring countries in Asia. Only a few companies produce these castings, either on a pilot production or commercial basis. To improve international competitiveness of these assembly manufacturers, foundries and assembly manufacturers are expected to work together toward volume production of industrial castings with high levels of accuracy

and reliability.

One obstacle to this is a small production lot which discourages most foundries to introduce expensive and latest equipment required to produce high-grade castings. Some of them anticipate that local production is costlier than imported products. However, in light of the fact that local procurement of castings becomes increasingly difficult in Japan and other industrialized countries, and considering that foreign supply sources on a global scale have to be explored, it is important to focus on production activity conducive to the improvement of international competitiveness of Indonesian products in terms of quality, price, and delivery schedule, leading to the expansion of foreign as well as domestic markets.

3.1.2 Metal press work subsector

3.1.2.1 General outline

Metal press products, just like castings and forgings, are used as major components of automobiles, motorcycles, agricultural machinery, electrical and electronic equipment. In Indonesia, localization in the area has progressed smoothly under a production sharing arrangement between large and medium-sized enterprises. Users are mainly assembly manufacturers, mostly joint ventures with Japanese and other foreign companies. Large parts requiring high levels of accuracy, such as automotive bodies, chassis and frames, are largely produced by enterprises specializing in press working or stamping shops of Japanese-affiliated assembly makers. There are some specialized pressing makers who have a 4,000-ton hydraulic press - probably the largest in Southeast Asia - and produces automotive parts including chassis. On the other hand, there are medium-sized shops who perform punching and bending of small parts on a contract basis.

Dies for metal press working are locally made up of relatively large sizes. However, those for automotive parts requiring high levels of accuracy are imported from Japan and other countries.

3.1.2.2 Industry size

(1) Production volume

According to data published by GIAMM (Gobungan Industri Alat-Alat Mobil Dan Motor: Indonesian Automotive Parts and Components Industries Association), production of press automotive parts by GIAMM member companies amounted to 1,238,880 sets in 1992 and 74,375 sets in 1993. Statistical data covering metal press products as a whole are not available, and value of production is unknown. Nevertheless, production volumes of automobiles, motorcycles, agricultural machinery, and electrical

and electronic equipment, and other products using metal press parts, and their levels of localization suggest total production reaches an appreciable level.

(2) Number of enterprises and employment

No statistical data are available. Large and medium-sized enterprises are located in the suburbs of Jakarta.

(3) Geographical distribution

No statistical data are available. Judging from concentration of automobile and motorcycle assembly plants in the suburbs of Jakarta, press work makers are located near there.

3.1.2.3 Major markets and domestic supply and demand situation

There are some specialized press makers including those which have a 4,000-ton hydraulic press and a 2,000-ton mechanical press and producing chassis and other large automotive parts. Also, a stamping shop operating for a Japanese assembly maker produces parts for another Japanese automaker in addition to its parent company.

Automotive stamping parts, such as bodies, frames, chassis, cross members, fuel tanks, oil pans, rocker covers, mufflers, and exhaust pipes are produced.

Press parts for agricultural machinery including oil tanks, mufflers and radiators for diesel engines are all locally produced, and so are bonnets and others for hand tractors.

Press parts for electrical appliances, such as shells for refrigerator compressors, are produced by large makers for captive consumption. Electric panels and frames for computer are also produced by specialized pressing makers.

3.1.2.4 Procurement of raw materials

Steel plates, with some exemption, are mostly imported from Japan, Korea, and Taiwan. Some of cold-rolled steel plates (SPCC) are locally procured. However, local products are plagued by problems related to unstable quality including dimensions and constituents, causing cracks and creases in the shaping process.

Stamping dies are locally produced ranging to the relatively large sizes including those for aircraft components. However, those requiring high levels of accuracy for automotive parts, and those of complicated shape are mostly imported from parent companies in Japan and other countries.

Steel materials used for cutting dies for trimming and other purposes are imported from Japan.

3.1.2.5 Production structure

Local production of metal press parts has well progressed in comparison to other subsectors of the metalworking industry. Typically, large parts and those requiring high levels of precision are produced by large enterprises, and small parts and those with lesser accuracy level by smaller enterprises.

(1) Ownership

Enterprises in the press work subsector are classified according to ownership into the following three types:

1) Joint ventures with Japanese companies
2) Large enterprises of local capital (200 or more employees)
3) Local medium-sized enterprises (199-100 employees)

Major characteristics of the above three types of enterprises are described as follows.

1) Joint ventures with Japanese companies

The joint ventures were established stamping shops of parent companies providing stamping parts for automobiles and motorcycles. They own welding machines and weld stamped parts. Facilities and equipment are efficiently arranged. Necessary equipment are available and fully utilized for quality control and inspection purposes.

They also have their own die shop to repair dies used by the stamping shop and also manufacture some.

2) Large enterprises of local capital

These enterprises are specialized makers which produce press parts for automobiles, motorcycles, and agricultural machinery, electrical panels, computer housings, and refrigerator cases on a contract basis. Quality control is generally done very well. They have a design center and a die shop for in-house repairing and manufacturing. Some of them also produce dies of other companies on a contract basis.

3) Local medium-sized enterprises

There are manufacturers which, together with press work, perform machining, moulds and dies production, and plating operations. They stamp or bend small parts for automobiles and electrical equipment and are indispensable to support assembly industries.

(2) Production technology

Local companies, not to mention joint ventures with Japanese companies, have technical capabilities comparable to those of other Asian countries, e.g., some have large presses – probably the largest ones in Southeast Asia.

3.1.2.6 Major issues facing the metal press work subsector

As pointed out earlier, the localization rate in the industry has reached a relatively high level, with high levels of production technology.

Generally, the quality of metal press products depends primarily upon qualities of dies and steel materials used. While dies up to relatively a large size can be manufactured locally, those having complicated shape and those requiring high levels of accuracy are imported from Japanese parent companies or other sources. In the future, further improvement of die manufacturing technology and the mastering of die design technology are required.

To promote local availability of steel plates, the improvement and stability of quality of products of local steel manufacturers should be regarded of primary importance.

3.1.3 Forging subsector

3.1.3.1 General outline

According to data furnished by the Ministry of Industry, only four companies were registered comprising the forging industry as of 1993. Some estimate, however, that there are slightly more than ten forging shops, including the specialized ones as well as those also providing other metalworking services.

Within the metalworking industry which functions as the principal supporting industry, forging is a subsector that often emerges after the development of the casting and metal press work subsectors. The forging subsector in Indonesia is no exception to this, and has far lagged behind as measured by the number of enterprises and production capacity.

In fact, many of forging shops currently in operation have just started production activity very recently. Furthermore, several foreign affiliated companies, Japanese and Taiwanese, plan to establish their shops in the country.

Many forging shops have their own die shops with design, manufacture and repair capabilities, while some commission die-related work to affiliates in the same company group.

3.1.3.2 Industry size

According to the Ministry of Industry, the following four enterprises were registered

with the ministry as forging companies, as of 1993.

Company name	Location	Production capacity (tons/year)	Product type (registered)
PT. Medan Gerak Jaya	Bekasi	10,000	Machine parts
PT. Pindad	Bandung	3,000	Parts for sugar refinery
PT. Bukaka Forging Industries	Bekashi	9,000	Parts for production equipment
PT. Hokuriku United Forging Industries	Bekashi	4,000	Parts for heavy equipment

Among them, PT. Medan Gerak Jaya has changed its business to other subsector and does not manufacture forgings any more.

As there are enterprises which produce forgings together with other metalworking products, not in the above list, it is difficult to reveal the true picture of the forging industry as a whole. Based on reliable information obtained from several sources, there are estimated 12 enterprises which produce forgings at present, as shown in Chart A1-3-2.

Although statistical data including total production and employment are not available, industry sources estimate annual production at the order of 50,000 tons.

3.1.3.3 Domestic demand and supply situation

Major types of forgings currently produced in the country include industrial parts such as gear materials, teeth for cultivators, high pressure pipe joints and flanges, chains, track links, and cam shafts, and hand tools including spanners, screw drivers, wrenches, and jacks.

Also there is a factory established as a base for supplying forgings to Japan, which exports nearly 99% of its products. Another enterprise sent its samples to Japanese automakers for export and waits for test results. These companies are ramping up their production and started to supply forgings to domestic agricultural machinery manufacturers.

3.1.3.4 Procurement of raw materials

Steel materials for forging production are mostly imported from Japan and Australia, while small portions are procured locally. Steel materials for dies are all imported from Japan.

3.1.3.5 Production structure

Of the 12 companies shown in Chart A1-3-2, 5 are either joint ventures with Japanese companies or receive technical assistance and are specializing in forging. 2 companies are state-owned enterprises. The Japanese-affiliated joint ventures have started commercial operation in the past few years and most of them own die forging and open-die forging equipment.

3.1.3.6 Major issues facing the forging subsector

Enterprises in this subsector have a relatively short history of operation and are small in number compared to other metalworking subsectors. Their production is ramping up and their growth potential is very high if they vigorously explore automotive and other markets.

At present, the establishment of 3-4 companies is being contemplated, and some more enterprises will be added in the future with increased production capacity.

One major problem related to the subsector is the lack of steel materials for products and die materials within the country.

3.1.4 Pattern/die/mold subsector

3.1.4.1 General outline

As mentioned earlier, patterns and core boxes for casting, and dies for metal press working and forging are locally produced. Molds for plastic molding are also locally available.

Quality of products made by these industries are largely affected by quality of patterns and core boxes, dies, and molds used for production. In Indonesia, those requiring high levels of accuracy, complex shape or large size are not produced and hence, imported from Japan and other countries. There are few manufacturers specializing in die/mold/pattern making. As a result, foundries, stamping and forging shops of joint ventures with foreign companies (mostly Japanese) produce them as required. There are medium-sized manufacturers doing various metalworking operations who produce small sized molds and dies.

Special steel materials for dies and molds are not available and entirely depend upon imports from Japan.

3.1.4.2 Industry size

As pointed out earlier, there is no enterprise specializing in pattern, die and mold making. Production is mainly done by in-house shops of large enterprises or jobbing

machine shops, and small molds and dies are partly manufactured by medium-sized manufacturers doing various metalworking operations. Thus, there is no official statistics on the subsector including industry size.

3.1.4.3 Domestic demand and supply situation

(1) Patterns & core boxes

Many large casting enterprises have their own pattern making shops where metal and wood patterns and core boxes are produced and repaired. Small enterprises and micro enterprises make sand molds, when ordered in a small lot, by using casting samples furnished by their customers. For a large lot, some of them produce pattern materials of aluminum alloy by casting them based on customer-furnished samples, through manual finishing.

Metal moulds for die cast parts of motorcycles are mostly provided by Japanese parent companies. A manufacturer engaged in volume production of pistons for automobile and agricultural machinery engines has its own mould shop and produces a large number of metal moulds.

Note that design services such as casting plan are done within foundries.

(2) Metal press dies

Casted materials for stamping dies are produced by large foundries and machined at die making shops within stamping shops. Also, cutting steel dies such as punching are made by die making shops of large press shops. Small dies are also manufactured by medium-sized machine shops. Dies up to relatively a large size are locally made, but those requiring high levels of accuracy and those having complicated shape are imported from parent companies in Japan and other countries.

(3) Forging dies

Design, manufacture and repairing of dies are often performed by die making shops of manufacturers. Those without die making shops ask companies with die making shops in the company group. Special steel materials for forging dies rely on imports from Japan.

3.1.4.4 Procurement of raw materials

Pattern and core box for casting are made of aluminum or cast iron and are locally produced. Casted materials for stamping dies are produced by large foundries. Special steel materials for cutting press dies for punching and similar purposes, and forging dies are not locally available and depend upon imported products.

3.1.4.5 Ownership

In Indonesia, there are few specialized pattern/die/mold maker. Foundries, stamping shops, and forging shops of joint ventures with foreign companies (mainly Japanese) and large enterprises of local capital have their own pattern/die making shops that produce and repair them for home consumption or for other companies on a contract basis. There are medium-sized manufacturers doing various metalworking operations which produce small sized dies and molds.

3.1.4.6 Major issues facing the pattern/die/mold subsector

At present, unlike in Japan and Malaysia, there are few manufacturers specializing in die/mold/pattern making probably because industries using dies and molds have only developed quite recently, and they import these from parent companies or produce them at their own shops.

Quality of castings, forgings, and metal press products depends heavily upon the quality of patterns, core boxes and dies used. Some of patterns, core boxes, dies and molds used in various subsectors of the metalworking industry are locally produced. However, those requiring high levels of precision and those of complicated shape still have to be localized but meantime are imported from affiliates in Japan and other companies.

Future growth of the casting, stamping and forging subsectors will necessitate the number of manufacturers specializing in pattern/die/mold making for the subsectors to increase for timely service, while requiring higher accuracy. In the future, further improvement of pattern/die/mold design and making techniques will be called for. Note that in Japan and other industrialized countries, specialized pattern/die/mold manufacturers using CAD/CAM systems for pattern/die/mold design and manufacture are on the rise.

3.2 Need for Promotion of Standardization and Quality Control

3.2.1 Standards for the metalworking industry and proliferation in Indonesia

In Japan, the metalworking industry is associated with and relies on a large number of Japanese Industrial Standards (JIS) in a variety of fields, including 331 in Ferrous Materials and Metallurgy (G), 411 in Nonferrous Metals and Metallurgy (H), and 1,290 in Mechanical Engineering (B), by the end of FY1993. The recent notable moves related to JIS are Japan's active participation in international standardization activity and the increasing harmonization with ISO, and other international standards in view of boosting imports through the further opening of domestic markets.

In Indonesia, SNI related to the metalworking industry include 182 in Ferro and Steel Metal Industries, 66 in Non Ferro Metal Industries, 223 in Metal Working Machinery and Equipment, and 243 in Machine and Equipment Industries Except Electric Machine. SNI can be classified into 3 categories according to their nature and application: product standards such as galvanized sheet metal, extruded aluminum alloy, screwed pipe fitting made of black malleable cast iron, and hand water pump; method standards such as test method for metal bending, test method for silver solder, accuracy test for press die sets, performance test of centrifugal pump; and basic standards including welded symbols standards.

Regarding the most important and fundamental standard in the metalworking industry, "Permissible Deviations in Dimensions without Tolerance Indication for Iron Castings," JIS (B0407) and SNI (07-0359) are compared in Chart A1-3-3.

Major differences are summarized as follows:

(1) While JIS (B0407) specifies gray iron castings and spheroidal graphite iron castings separately, SNI (07-0359) do not classify them according to material and collectively specify them as castings.

(2) JIS classifies castings into two grades, Fine and Common, while SNI has 3 grades, Fine, Commercial 1, and Commercial 2.

(3) In terms of tolerance, JIS requires length of 120 mm or less on grey iron castings to be within +/-1 mm for fine grade and +/- 1.5 mm for common grade. SNI sets forth +/-1.5 mm for fine grade and +/-2.2 mm for commercial 1 grade, and +/-3.0 mm for commercial 2 grade per 100 mm or less. Under simple comparison, JIS is more strict than SNI in terms of dimensional accuracy of castings.

The first draft of a new SNI/SII standard is submitted to PUSTAN by research institutes, universities, industrial associations, and other organizations. APLINDO collects information on market needs and participates actively in the development of the first draft. For instance, many of first draft SNI/SII standards related to foundry technology, such as pipe fittings and brake drum castings for automobiles have been submitted by APLINDO.

Although the first draft was developed with reference to foreign standards such as JIS, DIN, and BS, it is often reduced to the minimum standards in order to make it acceptable to all the member companies. As a result, the established standard may not satisfy needs of some companies. Furthermore, many companies are using specifications that exceed requirements in applicable SNI/SII standards for their actual production, so that there is no incentive for them to rely on SNI/SII in the first place.

3.2.2 Use of standards by enterprises

Products supplied by the metalworking industry are roughly classified into 3 categories, (1) those used as parts and components of industrial products such as cylinder head, (2) those used as parts and components of machinery, equipment and tools such as metal press dies, and (3) those used as final products, such as cast iron pipes and manhole.

Looking at the subsectors under this study, most of stamping products belong to (1), and most of forgings are classified into (1), with some in (2) and (3). Castings are used for all of the purposes.

Products in (1) and (2) are produced, both internal and contract production, on the basis of standards and drawings specified by customers. Since there are many customers engaged in joint ventures with Japanese companies, JIS is widely used. Other foreign standards as well as international standards, such as BS, DIN, ASTM, and ISO, are also widely used. On the other hand, SNI/SII is rarely adopted by the above products. For products in 3), SNI/SII is sometimes used for those destined to domestic markets. For export products, standards in importing countries are usually used. It should be noted that the situation is not unique to Indonesia. Rather, it is generally seen in the metalworking industries in many countries including Japan. The difference lies in the lack of internal standards. What manufacturers require is to develop their own standards, e.g., instruction sheets, on the basis of customer-furnished drawings and specifications as well as technological resources at hand. Unfortunately however, very few companies in Indonesia have their own standards.

The similar situation is observed for standards used for procurement of raw materials.

SNI related to metalworking products in (3) includes cast iron drainage pipe and fittings, cast iron flanges, ductile iron pipes and accessories, screwed pipe fittings made of black malleable cast iron, gray cast iron soil pipes, ferro metal grinding balls, cast steel stock anchor, and cast iron brake shoes for railway train. These standards are used for products sold domestically.

3.2.3 Expectation for promotion of standardization, and major issues

Opinions and comments on standardization from GAMMA (Gabungan Asosiasi Perusahaan Penger Jaan Logam Dan Mesin Indonesia : Federation of Indonesian Metal Works & Machinery Industries) and companies are listed below:

(1) The shift from SII to SNI is confusing us, and we are not sure about which standard should apply.

(2) SNI/SII does not have standards indicating dimensions. As we follow ISO, JIS, and drawings, there is lack of uniformity in dimension as sometimes centimeters and

inchesare used.

(3) SNI/SII publications are not available at bookstores. GAMMA does not have any.

(4) JIS is very widely used, but Indonesian versions are not available. JIS publications in English are very expensive and cannot be understood by many people. The language problem is not limited to standards, but also largely to technical publications. There is are few publications in Indonesian, which is one obstacle to industrial development at the field level.

As pointed out earlier, JIS and other foreign standards as well as international standards are mostly used for industrial production, and few voiced out the need or expectation for SNI.

To develop and modify SNI that conforms to international trends and suitable for use in the country, the following improvements in the standardization process are recommended:

(1) In preparing the first draft, reference values specified in JIS and other foreign standards that form the basis of the draft standard should be adopted to a large extent, and reference should be made in explanatory notes attached thereto.

(2) At the same time, more lenient reference values may be adopted on the basis of overall consideration to technical capabilities of domestic industries and other relevant factors.

Take SNI 07-0359, for instance. It should be divided into 4 classes, Fine 1, Fine 2, Commercial 1, and Commercial 2. For length of 120mm or less, tolerance for Fine 1 may be +/-1.0mm, Fine 2 +/-1.5mm, Commercial 1 +/-2.2mm, and Commercial 2 +/-3.0mm, noting that the Fine classes are equivalent to that for gray iron castings under JIS B0407. This way, consistency with JIS can be maintained. At the same time, the establishment of the Commercial classes provides some leeway for companies unable to meet the Fine class requirements. This two-tier standards are expected to serve a dual purpose of maintaining integrity with international standards, and disseminating standards acceptable to domestic industries at all levels.

3.2.4 Current state of testing and inspection system

3.2.4.1 Internal testing and inspection system

Joint ventures with Japanese and other foreign companies and large local companies supplying their products to joint ventures maintain and operate relatively high levels of inspection systems in terms of both equipment and manpower. Foundries use a variety of equipment with varying ages depending on the operating years, these are: measuring

instruments for chemical composition and molten temperature in the melting process; sand testing equipment in the molding and sand preparation process; testing equipment for inspection of materials such as hardness meters, metallurgical microscopes, and dimensional measuring instruments. In addition, some companies use non-destructive testing equipment such as ultrasonic and magnetic particle testing equipment. Most of stamping and forgings shops belong to large companies or joint ventures with Japanese companies and have necessary measuring instruments.

The foundry industry has many small enterprises that do not have much measuring or testing equipment, nor technicians.

As for calibration and certification of these testing equipment and measuring instruments, joint ventures with Japanese companies ask periodical services among experts sent by Japanese manufacturers or from their service centers in Singapore. Some of them maintain in-house standards that are calibrated, and use them for periodical check of ordinarily used-testing equipment. Among local large companies, those supplying products to Japanese-affiliated manufacturers mostly use calibration organizations under JNK (Jaringan Nasional Kalibrasi: National Calibration Network), such as MIDC and KIM-LIPI for calibration and certification services. Other companies do not have much measuring instruments, which are rarely calibrated.

3.2.4.2 Outside testing and inspection organizations

Two research institutes under BPPI are closely related to the metalworking industry, MIDC and B4T. Their organizations, activities, testing and inspection capabilities, and other details are described in Annex 2. MIDC has training shops for casting, machining, welding, and heat treatment, and their primary purpose is to provide technical support conducive to the improvement of product quality and productivity in the metalworking and machinery industries. On the other hand, B4T is a testing organization handling metal materials and products, and construction materials. Both institutes perform contrast testing service for private enterprises, mainly material testing and inspection. Companies which do not have tension testing machines and other testing equipment send test specimen to these institutes which then perform chemical analysis and strength test and issue test reports. However, the institutes are located in Bandung and are not readily accessible by companies in other areas. Also, it takes around two weeks to obtain test results, and fees are fairly expensive, e.g., the tensile test on metal costs Rp. 22,500 per specimen. For these reasons, these institutes are not widely used by small enterprises.

Both institutes with relatively long history of operation, have a set of testing

equipment that meet general demand. However, they are aged and outdated posing various problems.

In Surabaya, one of regional laboratories under BPPI, B.I. Surabaya (Balai Penelitian dan Pengebangan Industri Surabaya : Laboratory and Test Institute for Industrial Products in Surabaya) provides testing services including metallic products and materials. However, some of its testing equipment do not satisfy testing requirements. For instance, universal testing machines have capacity of only 20 tons and 5 tons, which are insufficient for testing metallic materials. Chemical analysis can be performed for food, water, and oil, but instruments suitable for chemical analysis of metal are not available. The C-S analyzer is unserviceable. Since Surabaya is the second largest base for metal and machinery industries, next to Jakarta, B.I. Surabaya should be armed with sufficient testing equipment and analytical instruments for metal products and materials.

Large enterprises mainly ask the JNK member organizations such as MIDC and KIM-LIPI for calibration and certification of measuring instruments including tension testing machines, hardness testers, and micrometers.

Small and micro enterprises do not have much measuring instruments, which are rarely calibrated.

3.3 Certification System

3.3.1 Certification scheme in the metalworking industry

In Indonesia, SII/SNI marks for products are either mandatory or voluntary. In the metalworking industry, 14 products are required to obtain mandatory marking, including concrete frame steel, galvanized sheet steel, galvanized steel pipes, low carbon wire steel, carbon steel pipes for machine construction, carbon steel pipes for generation construction. These are steel materials or secondary iron/steel products, mainly steel sheet, pipe, bar, and wire. On the other hand, voluntary marking covers around 45 products including hand water pumps, steel wire ropes, cast iron brake shoes for railway trains, sickles, steel and iron piston rings, and steel filing cabinets.

3.3.2 Current use of certification by enterprises

For each of the 14 items or products subject to mandatory SII marking, the number of companies with certification ranges from 18 to 1. 18 companies are certified for concrete frame steel, and only one company has certification for round edge hot rolled channel profile steel.

On the other hand, there are only a few certified companies for products with voluntary marking. For instance, products for which only one company have certification are hand pumps, steel wire ropes sickles, and steel and cast iron piston rings, and screwed pipe fitting made of black malleable cast iron.

Among companies having the SII certification, very few affixes SII mark to products.

Most of manufacturers do not know about the shift from the SII marking to the SNI marking system.

Some steelmakers obtain certification under JIS and other foreign standards.

3.3.3 Expectations for improvement of the certification system, and major issues

Users in Indonesia tend to place priority on price over quality. For instance, although concrete frame steel is subject to mandatory certification under the SII/SNI marking system, many products without the mark are widely used in the market.

Lack of interest is found on the manufacturer's side as well. Manufacturers having SII certification do not always affix the mark to their products. Also, few of them know about the change to the SNI marking system.

Clearly, government efforts will be necessary to make the certification known to the public, including the advertising the need and value of the SII/SNI marks to general consumers, and further enforcing the duty enabling the use of SII/SNI marks on products subject to mandatory certification.

In light of the fact that few companies, including those having the SII certification, realize the change to the SNI marking system, the government should take this opportunity to step up its advertisement activity.

All in all, promoting public acceptance of the SNI and its certification system requires concerted efforts of the government, the industry, and consumers, including the exchange of information and the development of common understanding and goals.

3.4 Quality Control

3.4.1 Current level of quality control

3.4.1.1 Quality control system

Most of joint ventures with Japanese companies, companies under technical alliance with Japanese companies, and those receiving technical assistance have introduced Japanese-style quality control systems including TQC, QC circle activity, and suggestion program. Many of them have QC sections and have sufficient organizational set-up.

On the other hand, small and micro enterprises, mainly found in the foundry industry, and some of large and medium enterprises of local capital do not have competent personnel to promote quality control nor the equipment, although they recognize its importance. As a result, many of them are limited to product inspection prior to shipment, or do not conduct shipment inspection at all due to the lack of manpower or cost constraint.

3.4.1.2 Staff training

Many joint ventures with Japanese companies send their staff and workers to parent companies in Japan for training. Local companies supplying products to foreign-affiliated companies and those that actively promote quality control send their staff to official training programs in Japan, such as JICA and AOTS. Also, many companies invite experts from JODC (Japan Overseas Development Corporation) in Japan for intensive training. Larger companies send their employees to QC seminars held by PUSTAN and other institutes or QC workshops held by large corporations for group companies. There are some companies that have internal training schools providing skills training as well as quality control education.

On the other hand, many small enterprises and micro enterprises in the foundry industry, do not have resources for employee education and rarely use outside training opportunities such as seminars.

3.4.1.3 Company standards

Joint ventures with Japanese companies and large and medium enterprises which supply products to foreign - affiliated companies have developed, and use their own standards for acceptance inspection, production, product inspection, and other operations. Many of them also give work instruction by using forms containing easy-to-understand illustrations and checkpoints, which are kept in plastic cases and are provided at visible locations. These standards are based on drawings and specifications furnished by customers in the case of contract production. When foreign materials are used, the country standards of the manufacturer are adopted as company standards.

Small and micro companies (mainly foundries) make products directly using drawings, specifications, and samples furnished by customers and rarely develop their own standards.

3.4.1.4 Others

There are not many Indonesian-language textbooks and reference materials in the fields of quality control, standardization, and skills training. This situation is considered to be one of obstacles in the improvement of production techniques and quality control activities.

ASPEP (Asosiasi Pengerjaan Logam Dan Permesinam : Association of Indonesian Metalworks and Machineries) under GAMMA has translated to Indonesian textbooks on metalworks published by a Japanese vocational training organization upon the approval of the organization, and uses it at pilot training school held by its member companies.

3.4.2 Major issues related to quality control

Concern about quality control at the management level is fairly high among joint ventures with Japanese and other foreign companies, local companies receiving technical assistance from them, and those supplying products to the mentioned entities. On the other hand, the management of other companies tends to place priority on price over quality.

While many companies have introduced TQC, control charts and other SQC techniques, and other QC techniques, some of them do not seem to feedback the results to production fields, identify causes for defect and other quality problems, and devise and implement proper corrective measures. For instance, at some foundries, a control chart posted at a shop indicated that moisture content in molding sand deviates from control limits for 3 hours, and rate of defects is observed to have varied greatly between days. Two reasons may explain this occurrence. First , while owners and managers realize the importance of quality control and introduce a variety of quality control systems and techniques, field workers are not fully motivated and perform QC activity only as a matter of formality. Another reason may be attributed to the lack of technology and skills in finding the real cause for a quality problem thus, failing to take appropriate action.

As a first step in developing the ability to supply products acceptable to international markets, the management needs to realize the importance of quality and should be committed to quality-focused policy. Then, it should raise awareness and interest among employees on the importance of quality by raining full-time quality control staff.

In Indonesia, the interest in obtaining certification under ISO 9000 series heightens among large corporations and export-oriented industries. The certification requires tremendous time and effort including preparation of documents, and significant investment to provide sufficient inspection and testing facilities, which are not affordable to smaller enterprises.

Also, the SNI marking system gives some consideration, among others to, the establishment of Module I standards that seem to be intended for fostering small-and-medium-sized enterprises. Nevertheless, the SNI marking system is primarily designed for companies that produce SNI-conformed products. For manufacturers of parts and components, particularly those of basic materials requiring further upgrading of technical

levels, the system is very limited in scope. In fact, many parts and materials are not covered by SNI. To make up for this, a simplified certification system for the parts industry should be contemplated. Under the system, application is accepted for each of the metalworking subsectors, e.g., foundries, forging shops, or metal press work shops, and each enterprise is reviewed according to quality system standards specified in the SNI marking system (5 modules). If the enterprise is found to have production capabilities suitable for continuous and reliable production in the subsector, it will be designated as "an establishment having excellent quality control system" in the subsector, that is equivalent to a certification of the quality system under the respective module.

This will help and encourage small-and-medium-sized enterprises in the parts industry to improve their technological resources. At the same time, the certification system will serve as one of reliable criteria for assembly companies in choosing suitable suppliers.

Note that, since the certification system is designed to foster and upgrade parts suppliers, particularly suppliers of basic materials, which lagged behind in quality control practice, the review process should focus on field diagnosis and guidance, rather than on mere documentary evaluation.

Chart A1-3-1 Import of Foundry Pig Iron (1989 - 1993)

(Unit: Ton)

HS Code No.	Item	1989	1990	1991	1992	1993
720110100	Foundry pig iron	78,496	122,345	74,886	103,112	101,770
	Si > 0.5%, P < 0.5%					
	· Japan	464	768	33	27,750	42,652
	· Taiwan	292	705	1,982	107	218
	· China	2,053	25,630	11,986	31,912	8,511
	· Brazil	197	19,988	–	28,050	209
	· U.S.S.R.	21,015	52,746	11,430	–	22,450
	· Iran	54,475	–	35,500	–	–
	· Australia	–	500	13,955	15,293	–
	· Canada	–	20	–	–	–
	· Poland	–	21,988	–	–	–
	· India	–	–	–	–	27,730

Source: Indonesia Foreign Trade Statistics/Imports; 1989, 1990, 1991, 1992 and 1993, BPS

Chart A1-3-2 List of Forging Manufacturer in Indonesia

1. PT. BUKAKA FORGUNG INDUSTRIES *
2. PT. HOKURIKU UNITED FORGING INDUSTRIES *
3. PT. MENARA TERUS MAKMUR *
4. PT. FUKUYAMA GIKEN
5. PT. SHIMASHITA
6. PT. BOMA BISMA INDRA *
7. PT. PINDAD
8. PT. RODA PRIMA LANCAR
9. PT. PULOGADUNG TEMPA JAYA
10. PT. SURYA SUENYUEH
11. PT. SCKB
12. PT. POLISINDO EKA PERKASA

Source: Based on the hearing from Forging Manufacturers marked *

Chart A1-3-3 Permissible Deviations in Dimensions without Tolerance Indication for Iron Castings

1. JIS B 0407 - 1978 (Reaffirmed: 1989)

Table 1. Permissible Diviations without Tolerance Indication for Length

(Unit: mm)

Division of dimension	Material			
	Grey iron castings		Spheroidal graphite iron castings	
	Grade		Grade	
	Fine	Common	Fine	Common
120 and under	± 1.0	± 1.5	± 1.5	± 2.0
Over 120 to 250 incl.	± 1.5	± 2.0	± 2.0	± 2.5
Over 250 to 400 incl.	± 2.0	± 3.0	± 2.5	± 3.5
Over 400 to 800 incl.	± 3.0	± 4.0	± 4.0	± 5.0
Over 800 to 1,600 incl.	± 4.0	± 6.0	± 5.0	± 7.0
Over 1,600 to 3,150 incl.		± 10.0		± 10.0

2. SNI. 07-0359-1989

Table 2. Tolerance for Length of Cast Iron

(Unit: mm)

Nominal dimension (L)	Class		
	Fine	Commercial 1	Commercial 2
100 and under	± 1.5	± 2.2	± 3.0
Over 100 to 250 incl.	± 2.0	± 2.7	± 3.5
Over 200 to 400 incl.	± 2.5	± 3.7	± 4.5
Over 400 to 800 incl.	± 3.5	± 4.7	± 5.5
Over 800 to 1,600 incl.	± 4.5	± 5.7	± 6.5
Over 1,600 to 3,150 incl.	± 7.5	± 7.7	± 8.5

Source: JIS and SNI Document

4 Electrical Machinery and Equipment Industry

The electrical machinery and equipment industry is roughly divided into 1) industrial electrical machinery and equipment (including heavy electrical apparatuses[1], watt-hour meters, and cables and wires), and 2) home appliances[2].

4.1 Current State of the Industry and Major Issues Related to Future Development

4.1.1 Industrial electrical machinery and equipment sector

The industrial electrical machinery and equipment sector produces the following products.

1) Heavy electrical apparatuses
   a) Prime movers and boilers for power generation
   b) Motors and generators (including DC motors, generators, electric motors, and motor-powered machinery and equipment)
   c) Transmission and distribution equipment (including transformers and capacitors)
   d) Switchgears, control gears and switching devices (including switches, switchgears, circuit-breakers)
2) Watt-hour meters
3) Cables and wires

4.1.1.1 Overseas trends in the industrial electrical machinery and equipment industry

Demand for industrial electrical machinery and equipment in any country, particularly in less developed countries, grows proportional to investment in social capital led by public investment in the electrical energy sector and including other infrastructures including housing and industry. Thus, the market for industrial electrical machinery and equipment in any country emerges prior to the start of country-wide industrialization efforts. As a result, the industry often becomes a major target for import substitution.

---

1) Electrical equipment related to power generation, transmission and distribution, including generators, motors, distribution boards, and transformers (generally including power plant equipment, and transmission and distribution equipment, which are produced in Indonesia).

2) Recently, as more and more machinery and equipment uses electronic parts, it is very difficult to draw a border line between the industry and the electronics industry, particularly the consumer electronics industry. The study adopts conventional classifications, and home appliances refer to refrigerators, washing machines, electric fans, irons, rice cookers, and air-conditioners.

Within the industrial electrical machinery and equipment industry in Japan, prime movers and boilers for power generation account for approximately 15% in terms of value of production, motors and generators 25%, transmission and distribution equipment 20%, and switchgears, control gears, and switching devices 40%.

The industry has fully matured in industrialized countries and major market expansion cannot be expected. In contrast, demand continues to grow appreciably in less developed countries due to ongoing investment in social capital. In these countries, local enterprises receiving technical assistance through license agreements with foreign counterparts in industrialized countries are operating, whereas direct investment is relatively small in number. Thus, industrial electrical machinery and equipment tend to be produced near the market, and imports account for relatively small portions compared to home appliances, with some variation among individual products. Notably, this is the worldwide trend. In the U.S. which is the largest importer of industrial electrical machinery and equipment, imports account for 10% – 25% of total demand. In particular, imports are dominated by products having small capacities, such as 400KVA or smaller generators and 500KVA or less distribution transformers.

Recently, parts and components for industrial electrical machinery and equipment are increasingly manufactured outside industrialized countries due to the rise in production cost.

In the U.S., major industrial electrical machinery and equipment manufacturers include GE, Westinghouse Electric, Honeywell, and Emerson Electric. The U.S. companies have been making cost reduction efforts, such as the increasing use of imported parts and relocation of production bases to countries offering low labor costs. New production bases are mainly located in Mexico, Canada and Brazil. In Asia, they have been investing in the form of joint venture, acquisition of local companies, licensing, and the purchase of imported goods. The primary candidate for relocation in Asia is China because of its huge market size.

In Europe, many companies are struggling to survive in an increasingly competitive environment as a result of the unification of the EC and slow economic growth, through merger and restructuring. Among leading industrial electrical machinery and equipment manufacturers in Europe, Siemens of Germany and ABB of Sweden/Switzerland are active in Asian investment. They have been establishing joint ventures in ASEAN countries and China, entering into licensing arrangements.

Japanese industrial electrical machinery and equipment manufacturers have grown rapidly during the high growth period, as fueled by healthy growth of electricity demand. Then, they had to cope with sluggish demand after the oil crises by boosting exports,

together with investment by power companies. Recently, however, they are losing competitiveness in export markets due to the appreciation of the yen. Through several setbacks, many Japanese industrial electrical machinery and equipment manufacturers have transformed themselves to integrated electrical and electronics manufacturers. Also, despite the investment spree by Japanese companies in ASEAN countries, direct investment in the industrial electrical machinery and equipment sector is much smaller than chemical, textile, electronics, and automobile.

The value of worldwide trade in industrial electrical machinery and equipment amounts to approximately US$73.5 billion (SITC771-773, 1992), of which the U.S. is the largest importer (US$11.9 billion), followed by Germany (US$7.2 billion). Other major importing countries are found in Europe including France and Italy, followed by Asian countries led by Singapore and South Korea. Japan's imports totaled US$ 2.3 billion.

On the other hand, major exporting countries are Germany (US$12 billion), Japan (US$10.2 billion), the U.S. (US$9.5 billion), Italy, Switzerland, Taiwan, and the UK. Germany mainly exports to EC and the U.S., while Japan to the U.S., Europe, and Asia. U.S. exports are mainly destined to Japan and Canada. Germany, the largest exporter, account for 16% of the world total (see Chart A1-4-1).

Recently, ASEAN countries are facing a sharp rise in electricity demand due to economic development, which is accompanied by an expansion of the industrial electrical machinery and equipment market. In particular, Indonesia undergoes rapid growth in electricity demand that gives much more vigor to the industrial electrical machinery and equipment sector than its counterparts in Thailand and Malaysia. It should be noted, that these countries provide favorable treatment for local products in fostering the industry. Many industrial electrical machinery and equipment manufacturers in ASEAN countries and China are under technical assistance or license agreement with foreign companies. In particular, European manufacturers, particularly German companies are actively involved in technical assistance and licensing arrangement. Notable areas in licensing are generators and transformers.

4.1.1.2 Current state of the industrial electrical machinery and equipment industry in Indonesia

(1) Outline

A general outline of the industrial electrical machinery and equipment sector in Indonesia is shown in Chart A1-4-2. The sector produces a wide range of products from power generation equipment, power transmission and distribution equipment and cables (including communication cables) for factories, office and home, and small

generators and motors used at factory.

Many enterprises in the industry were established after 1970 and started commercial production under import substitution. As the Indonesian government emphasized infrastructure investment related to electricity supply, the local industrial electrical machinery and equipment industry grew rapidly. Chart A1-4-3 shows the recent increase in the number of industrial electrical machinery and equipment manufacturers, clearly indicating that it more than doubled over five years since 1987.

Import substitution in the industrial electrical machinery and equipment industry was promoted under a general localization policy launched during the implementation period of REPELITA IV. Initially, import restriction on manufactured goods and high tariff rates were imposed. Then, in 1990, most import restriction measures including the import quota system and restriction on importers were repealed. Tariff rates have been lowered through several stages and are mostly in the ranging between 5% and 20%.

Meanwhile, the Indonesian government intends to foster various subsectors in the industry, including motors, circuit-breakers, and watt-hour meters, to export industries.

More than 70% of enterprises in the industrial electrical machinery and equipment industry concentrate in Jabotabek District around Jakarta (consisting of Jakarta, Bogor, Tangerang, and Bekasi) mainly because the area (1) has well-developed transportation networks providing locational advantage in parts supply and product shipments; (2) is a large market consuming a variety of products, and (3) is endowed with other infrastructures compared to other areas. In addition to Jabotabek District, industrial concentration is seen in industrial zones including Surabaya and Medan.

(2) Industry size

According to industrial statistics in FY1991, the industry comprises of 112 enterprises of medium-size[3] or larger. Among them, the cable and wire subsector is largest in number of enterprises (29), and in terms of value of production (Rp710.2 billion), followed by the motor and generator subsector, 8 companies and Rp34.5 billion. Other subsectors are very small with an average number of employees ranging between 66 and 173 (see Chart A1-4-4).

The industry estimates the total value of production at US$700 million (Rp 1,460 billions).

---

3) Enterprises having 20 or more employees

(3) Market and production structure

In Indonesia, there is a trade organization for the industrial electrical machinery and equipment industry, called APPI(Asosiasi Produsen Peralatan Listrik Indonesia), having membership of 82 companies. Of total, 14 are joint ventures with foreign companies, of which 5 are German-affiliated, 4 Japanese, 2 American, 1 British, 1 Swedish, and 1 French. Other member companies, local enterprises or state enterprises, are largely under technical assistance or licensing arrangement with foreign partners including Japan.

3 out of 8 generator manufacturers (all numbers of company includes the manufacturers produce more than one product) are JV (Joint Venture) with French, British and Japanese firm, and 4 manufacturers out of the remaining 5 manufacturers include a state own company having technical corroboration or production under license.

2 out of 5 motor manufacturers are JV companies. 2 manufacturers (one JV and one local) have more than 200 employees. The companies in this group are relatively new, with all of the motor manufacturers having started their operation in 80's.

The group of transformer manufacturers consist of 7 local, one state JV and 2 German JV. 5 out of 10 companies have more than 300 employees.

The group of switchgears and control panel manufacturers is the largest group in APPI, having 39 companies. 6 companies are JV. The manufacturers have employees ranging from 30 to 9,000, however the number of firms with less than 100 employees is 24, capturing more than half of this gout. It seems that quite a number of non-APPI switchgear and control panel manufacturers exist, however, the exact number of the non-APPI company is unknown. These manufacturers normally sub-contract from APPI members companies or deliver their products not to PLN (Perusahaan Umum Listrik Negara, State Electricity Corporation) but only to a private company.

3 out of 5 Watt-hour meter manufacturers are Japanese related firm which produce 65% of local demand by estimate. The reason behind the setting up of the factories by these Japanese companies in Indonesia is because of an import embargo which made the companies switch from export to local manufacturing. One of the remaining 2 manufacturers is German JV producing less watt-hour meter than other companies, it being not a main product of the firm. The manufacturers in this group have relatively large number of employees ranging from 100 to 400 due to labor-intensive nature of work and assembly line operation.

Compared to the total production of US$700 million estimated by the industry, exports (total for SITC771 - 773, 1993) amount to US$128 million. Thus, the industry

primarily relies on the domestic market that consist of PLN, factories, construction projects, and buildings. PLN is the single largest customer.

Transformers are mainly used for power transmission and distribution, motors for production facilities and agricultural machinery, generators for PLN's power plants, emergency generation systems of factories and hotels, and electrical welding. The market for these equipment has been growing steadfastly with growth of electricity supply and consumption, as well as with the rise in electrification rate in rural areas.

The cable and wire subsector produces power cables, communication cables, special cables and enamel wires. Most companies manufacture low-voltage cables, and only 11 companies (as of 1992) produce communication cables as well. Major customers are PLN (accounting for approximately 80% of power cables), Telekom (70% of communication cables), construction companies, and oil companies. Production of power and communication cables in Indonesia surged between 1988 and 1992, mainly because, in addition to government investment in power and telephone networks, the construction boom spurred the market. At the same time, robust demand attracted many entries (Chart A1-4-5) to make the market more competitive.

On the supply side, imports total US$1,026 million exceeding domestic production of US$700 million (see Chart A1-4-6), because a relatively small number of items is locally produced, whereas supply of many products are imports. For instance, generators produced within the country are mainly small types used for lighting and welding at construction sites, and those for industrial machinery requiring frequent speed control are imported. Switchgears and other equipment highly demanded by the construction sector are also imported in addition to local production. The local production of transformers is mainly focused on low-voltage while mid- or high-voltage transformers are imported. Many of the raw materials, parts and components, not to mention parts imported for KD production, are largely imported. 28 items exceed the import value of US$10 million each. Major items include 500KVA or larger transformers, circuit-breakers, switches, boards and panels, conductors. Also, imports of high-voltage cables and optical-fiber cables are at an impressive level.

Switchgears show the largest import value and the highest growth rate. Also growing are transformers and distribution equipment due to the construction boom of buildings and factories.

The industrial electrical machinery and equipment industry is often protected by many countries, particularly in less developed countries, where local products receive favorable treatment. Indonesia is no exception to this. PLN, the largest customer,

follows the practice of a tender process by establishing the quota for local products adopting a favorable treatment factor. Similar measures are taken in neighboring countries. As a result, the industry's exports are fairly limited. The lack of marketing ability and the shortage of supply capacity for export markets due to the strong domestic market are also restraining exports. Export items exceeding US$10 million are achieved by some types of transformers, low-voltage panels, other electrical equipment (presumably including watt-hour meters), and coaxial cables.

(4) Production technology

Many enterprises in the heavy electrical apparatus and cable and wire subsectors have been or are in technical assistance or licensing arrangement with foreign companies, from which they have acquired production technology and know-how.

In contrast, manufacturers of watt-hour meters are divided into two gourds, joint ventures and local enterprises receiving technical assistance from foreign partners, and those having no foreign partnership. There is a significant difference between the two groups of companies in terms of technical levels, including engineers, the presence of quality and size of production and testing facilities and equipment. Also different is the fraction of defects of the products produced.

Generally, local companies have equipment of a generation before the latest one, partly because their equipment has been purchased from joint ventures. Another reason is that older-generation equipment is suitable for certain technologies or products, rather than that involving full automation, since anyway, low-cost labor in the country is abundant. In fact, expensive automated equipment is not always suited in the country's situation where production is very limited for some products.

Nevertheless, more problematic are high rates of defects and refitting work, indicative of the lack of efforts for technological improvement and development. For instance, some companies use machinery and equipment that are different in gauge, metrology, and standard. Large enterprises which own latest instruments for inspection do not use them fully. Few devices to check jigs and tools for production are seen. Clearly, old equipment is not always the cause for blame. The shortage of skilled workers to use equipment as well as poor maintenance seem to contribute greatly to the current situation. While latest electronically controlled machinery and equipment incorporate a lot of black box components which are not readily maintained, Indonesian companies use relatively a small number of automated equipment. Instead, efforts are required to minimize quality variation due to manual work, but few measures have been taken. For instance, the positioning for bending operation involves simple manual work

and requires uniform fitting carried out intuitively. Few jigs and tools are used. Finally, the shortage of testing equipment is clearly evident in small-and-medium-sized enterprises.

Most production processes in the industrial electrical machinery and equipment industry involve machining and assembly that require metalworking and machining technologies, not to mention those in the field of electrical engineering. In particular, a variety of raw materials including steel plates, castings, silicon steel sheets, and enamel wires are transformed to electrical parts through a wide range of metalworking processes, e.g., cutting, grinding, press, bending, coiling, and welding. The machined parts are combined with bearings, insulators and other components to create final products. Thus, the metalworking process is indispensable in the manufacture of industrial electrical machinery and equipment. However, Indonesian companies lagged behind in this area and only a handful of them can produce mechanical parts on a contract basis. In particular, there is no manufacturer who has equipment capable of handling advanced machining operation. As a result, most manufacturers purchase steel plates and other materials, and machine them at their own shops including thin plate working and welding. Only small portions of machining operations are contracted out to outside suppliers. Electrical characteristics of final products are governed by quality of raw materials and parts, as well as machining accuracy. However, small-scale captive production at each manufacturer does not lead to development of machining techniques, compared to contract manufacturers who are specialized in metalworking.

Nevertheless, there are a certain number of subcontractors which mainly produce and paint cases and frames for large manufacturers, some of which provide technical information or conduct training for subcontractors. Finally, there are local factories producing wires, steel plates and magnets.

Since little product development is being done, certain products entirely rely on imports. For instance, 10,000KVA or larger power transformers and high-voltage circuit-breakers are mostly imported. On the other hand, export items are not high value added products, such as ballast, lamps, and cables and wires. In Japan, small-and-medium-sized enterprises have been playing an important role in developing new parts and components in close cooperation with their customers. In Indonesia, given the existing production and testing facilities and equipment, and availability of qualified engineers indicate that even large enterprises are not capable of conducting research for product development.

(5) Procurement of raw materials

Generators, motors, and transformers use high percentages of imported materials and parts, 79%, 49%, and 63% respectively (see Chart A1-4-7). Notably CKD parts for generators and motors account for large portions. On the other hand, distribution panels and switchgears use relatively small percentages of imported materials, 35% on average.

Cables, both power and communication, mainly use relatively low-value added materials, including copper, aluminum, and copper and aluminum wires, all of which are locally available. As a result, imported materials remain at around 26% of the total (as of 1991).

Cores for electrical equipment including generators, motors, and transformers use soft magnetic materials such as silicon steel sheets (Fe-Si), permalloy (Fe-Ni), perminvar, ferrite, and pure iron. In addition, copper wires and insulators are consumed in large quantities. Almost all silicon steel used is imported, mainly from Japan. Insulation materials for transformers, special insulation paper for generators, and high-tension insulation materials are all imported.

Bolts and nuts are mostly available in the local market, except for special ones such as hard bolts that are imported.

Products that are highly localized are copper rods, round copper cables, insulation paper, and transformer boxes.

4.1.1.3 Major issues related to development of the subsector

The industry principally relies on the domestic market. It has been fostered under the localization policy that advocates relatively intensive protection. As a result, the industry is characterized by continuous use of technology and equipment introduced in its initial stage, without major upgrading or improvement. This is reflected in high rates of defects and refitting work resulting in poor productivity, while little progress has been made in diversification to new product areas. Technical standards required by the domestic market are lower than international ones, so that the industry does not face an urgent need for technological improvement.

Similarly, there are few efforts made to nurture subcontractors through procurement of parts and materials from domestic sources.

The industrial electrical machinery and equipment industry in industrialized nations has been constantly promoting technological development creating seeds of new products. In the process, most companies have developed into specialty manufacturers or integrated electrical and electronics manufacturers.

To promote further development of the industry in Indonesia, a primary target should

be set to spur technological improvement efforts of individual companies by introducing competition. Only then, support for efforts to improve productivity and promote local procurement of raw materials and parts need to be considered.

4.1.2 Home appliance subsector

4.1.2.1 Overseas trends in the home appliance industry

Chart A1-4-8 shows percentage share of Japanese manufacturers in world demand. Foreign production bases of Japanese home appliance companies, particularly those of refrigerators and washing machines, are concentrated in Asia. 18 out of 20 refrigerator production facilities worldwide and all (15) washing machine manufacturing plants are located in the region (as of May 1993, according to a survey of Japan Electrical Manufacturers' Association)[4]. Thus, Japanese electrical equipment manufacturers account for significant portions of home appliance markets in the ASEAN region, and in fact, any changes in the region's home appliance industry has large impacts on overseas deployment of Japanese electrical equipment manufacturers.

Japanese electrical manufacturers eye the potential demand in the region early and have been establishing joint ventures in the region since the 1960s to set up local production bases. During the period, ASEAN countries focused on their own markets in line with industrialization policy driven by import substitution, and did not think much about exports.

Then in the 1980s, especially after 1985 when the rapid rise of the yen occurred, Japanese companies became active in establishing production networks in Asia and realigned their businesses in the region. The move is manifested with the establishment of regional business divisions. The strategy aims to select and deploy a core business in each country, where local subsidies and affiliates form production and marketing networks. In the process, standardization progressed among group companies within the region. At the same time, group companies have established arrangement in the areas of parts standardization and horizontal integration to promote specialization according to strength, thereby accomplishing and enjoying economies of scale.

It should be noted, however, that, compared to other ASEAN countries – particularly Malaysia, Singapore, and Thailand, Japanese joint ventures in Indonesia have been deploying their operation in a somewhat different manner. In other ASEAN countries, Japanese companies concentrate on specific core products under well-defined regional strategies that position these countries as export bases to Japan and elsewhere. Chart A1-4-9

---

[4] In case of micro-wave oven, 4 out of 12 production facilities world wide is located in Asia.

shows some examples. In Indonesia, on the other hand, Japanese manufacturers focused their attention to the domestic market partly because the localization policy was vigorously promoted, and partly because the country offers a huge potential market opportunity. As a result, investment is confined to product areas that have small in production size and are protected by the government. Although export was promoted later, horizontal integration of industries in the region was already completed, and Indonesia had to be specialized in low-cost and low value added products such as electric fans, batteries and black and white TV sets.

Recently, Singapore, Malaysia, and Thailand encounter shortage of labor supply, accompanied by a rise in labor cost, and all the foreign manufacturers operating in these countries – not only Japanese, but Korean, European, and American as well – are turning their eyes to Indonesia, China, and Vietnam. Since 1990, Japanese and Korean companies have started to invest in Indonesia. In fact most of companies making new investment are electronic equipment and parts manufacturers.

4.1.2.2 Current state of the home appliance industry in Indonesia

(1) Outline

The home appliance subsector in Indonesia can be further divided according to product and type of manufacturer, as follows:

1) Home appliances including refrigerators, air-conditioners, electric fans, irons, and rice cookers, and lamps
2) Dry battery
3) Small equipment and devices used for wiring within customer premises

While dry battery industry is export oriented, other two subsectors mainly serve the domestic market.

The home appliance industry emerged in the early 1970s under the government policy to promote localization, that entails export restriction and high tariff rates. Joint venture and technical assistance served as a primary force (the country's tariff rates on major home appliances are compared to those in Thailand and Malaysia in Chart A1-4-10). While product items are diverse, the market size is relatively small, so is production size.

(2) Industry size

The number of manufacturers in the home appliance industry, and production volume are shown in Chart A1-4-11. Production is much smaller than that in

neighboring countries. (Chart A1-4-12 show production shares of major home appliances in Asia excluding Japan.)

(3) Market and supply structure

Most home appliances can be produced locally. There are only four joint ventures, and local enterprises mostly manufacture their products under technical assistance or license agreement with foreign companies, which are sold under foreign brands. On the consumer side, the middle-class which have sufficient product knowledge grows in urban areas where quality products are very popular. Consumers are familiar with brands and believe that foreign brands are equated with quality products. This makes it difficult for local brands to expand their share.

Many companies produce and market diverse products. Demand for refrigerators and electric fans shows conspicuous growth. However, operating rates are relatively low. Large population represents huge market potential that attract newly Japanese and Korean manufacturers for future market opportunities.

Most products in the subsector are consumed within the country.

There are 12 companies manufacturing incandescent and fluorescent lamps. Top three or four companies are large in size and export their products, albeit small in quantity. Lower-tier companies are not capable of manufacturing products with reliable quality and their rejection rate is very high.

8 companies are operating in the dry battery industry, of which 3 are foreign-affiliated companies with large production capacities. In Indonesia, alkaline dry cells represent only 4% of the total battery production and are mostly exported. Manganese dry cells account for the remaining share, and approximately 45% are exported and 55% are consumed by the domestic market.

Indonesia accounts for approximately 8% of worldwide battery production (1,428 million units in 1992). The country has successfully specialized in battery production after it has lagged behind neighboring countries whose electrical and electronics companies have quickly specialized in various products for expansion of production and export. The country's dry battery production grew rapidly after 1991.

(4) Production technology

The industry's production technology has been transferred from foreign partners in joint venture or licensing agreement. Quality and performance specifications are based on international standards. CKD production dominates and local procurement of parts

and materials is very low.

The industry has been fostered under strong government protection, and today it needs to improve productivity and increase capacity utilization rate.

(5) Procurement of raw materials

Electrical equipment is manufactured by assembling a variety of parts and components, which therefore must incorporate advanced technology and quality to create products with desired performance and quality. However, components and parts produced in the country are very limited in number and variety, and most of them are currently imported. In particular, large group companies have regional procurement offices (IPOs) in Singapore, which collect components and parts produced in neighboring countries and distribute them to production bases. Many components and parts consumed in Indonesia are procured through the route.

Manufacturers attempt to procure local products, which are mainly individual components and parts, rather than subassemblies. This reflects the fact that there is no production base where different suppliers work together to combine different technologies and products to offer advanced products as the supporting industry.

4.1.2.3 Major issues related to development of the subsector

The home appliance market has huge growth potential with the continuing progress of electrification, the increase in household income, and growth of the middle class. At the same time, the local industry previously protected by the government policy will be exposed to competition from foreign products accelerated with the market opening policy and the launching of AFTA, which will lead to lower tariff rates of home appliance products. To effectively compete, the industry has to strengthen their competitiveness. In particular, procurement of locally produced components and parts holds the key. At present, related industries supplying basic materials have yet to developed.

4.2 Need for Standardization and Promotion of Quality Control

4.2.1 Development status and need for future development and updating

4.2.1.1 Indonesian standards in the areas of electrical equipment

(1) Establishment of standards

In Indonesia, national standards (SNI) in the areas of electrical equipment are based on SII standards under control of the Ministry of Industry and SLI standards under the Ministry of Mining and Energy. When SII and SLI were unified into SNI, it was agreed

that standards for individual products would be under jurisdiction of the Ministry of Industry, and systems combining individual products by the Ministry of Mining and Energy. However, there are some areas where a boundary is not very clear.

In addition, PLN has maintained SPLN standards that have been used for purchasing of PLN equipment..

Note that all these standards have been developed on the basis of IEC standards.

Many companies obtain national standards (SII and SNI) as well as foreign standards through LMK (Pusat Penylidikan Masalah Keelistrikan; Electrical Power Research Institute), and rarely from the Ministry of Industry and the Ministry of Mining and Energy. This is because LMK conducts a variety of tests for manufacturers, including certification tests for products procured by PLN and tests for SII's compulsory standards.

There are 142 SII standards (Machinery Electrical Equipment and Electrical Appliances) and 235 SLI Standard under the Ministry of Mining and Energy. Comparing SNI's standards in the electric technical engineering field (227) and JIS's in electronic and electrical engineering (802), SNI is much smaller in number than JIS. Standards related to power transmission lines, ordinary cables and wires, and communication lines account for nearly one half of the total (see Chart A1-4-13).

In contrast, SNI contains relatively a small number of electrical and electronics standards. In addition, basic standards related to wiring accessories and household equipment are not available. It is necessary to make a comparative table between SNI and IEC to understand the progress of formulation of SNI and to set up priority for future standard formulation.

In incorporating IEC into SNI, it appears that non-general standards such as heavy electric equipment are included, whereas standards in widely applicable areas are relatively small in number.

For the establishment of SII/SNI standards, a technical committee (TC) is organized in line with IEC's TC. The committee members are mainly government officials (ministries), while scholars having advanced knowledge in related fields, and representatives of research organizations and manufacturers that are actually engaged in product development constitute minority membership.

In the transition process from SII/SLI to SNI, some old versions which have been updated in IEC standards remain unchanged. Periodical reviewing and updating of

standards are called for.

If there is no national standard that can be used as the basis of product specifications and quality standards, manufacturers, who are afraid of negative impacts on their brands due to equipment failure, design and manufacture products according to standards which are few levels above international standards by taking into account electricity supply conditions and the environment surrounding the use of products. This leads to significant cost increase. Other manufacturers may choose to produce inferior products in the absence or lack of standards. As a result, the market is filled with products having extremely varied quality that present serious problems in terms of safety, performance, and other aspects. This can only be prevented by early development of standards that cover a wide range of fields.

To establish SNI standards at an accelerated pace to fill the gap quickly, a plan of activity needs to be developed to ensure the well-planned process, development. In particular, basic standards and standards(ex. component standards) widely used should be developed. It is necessary to grasp the problem of standard users and take practical action in accordance with industrial structure.

With the rapid proliferation of home appliances as anticipated, there will be an increasing risk of equipment failure and accident due to misuse by consumers who are not familiar with electrical hazard. What needed now is to quickly establish standards necessary to ensure safety of electrical equipment widely used by general consumers. At the same time, a law should be enacted to exclude inferior products from the market not adhering to the above standards.

Future development of standards is expected to focus on evolution of electrical engineering and the safe use of electricity with the adoption of basic standards including parts and components. While the industry is inclines towards developing standards covering electrical and electronic products for export markets as well as high-tech industries, these standards can only be built upon basic standards serving as building blocks. In particular, the high-tech industry is founded upon precision processing that cannot do without metalworking standards and technologies. Thus, the scope of standards development should extend beyond electrical fields to include machining field.

(2) Use of standards

The industry rarely uses Indonesian standards such as SNI, SII and SLI. As discussed earlier, most companies in the electrical machinery and equipment industry are operating as joint ventures with foreign companies or are under license agreement, and

thus, technologies and specifications provided by foreign partners are mainly used, leading to the use of their standards. In fact, standards actually used are diverse including national standards, international standards, standards established by industries or industry associations, and internal standards of foreign partners.

In the industrial electrical machinery and equipment subsector, standards established by major customers, PLN and Telekom, are widely used.

Other reasons for unpopularity of Indonesian standards are summarized as follows:

1) Products manufactured in accordance with manufacturer's proprietary standards are marketable to eliminate the need for SII and other national standards.
2) There is no applicable standard, or standards not widely known because of their narrow coverage in terms of the number of products.
3) A small number of standards is not suitable for continuous use.
4) Existing standards do not meet industry needs, e.g., they are old or are not demanded by industries.

As pointed out above, the use of diverse standards due to technology transfer from various countries, and the use of foreign standards for production equipment and other products used by factories have resulted in their seemingly uncontrolled use. Nevertheless, many enterprises in the electrical equipment industry do not develop their own products, and rather, assemble and inspect specific products for customers on a contract basis by using major components and parts furnished by customers. In this way, the use of standards is limited for the purpose of assembling parts in accordance with specifications and instructions. Thus, the use of various standards has thus for, not produced any confusion.

4.2.1.2 Certification system and compulsory standards

SII is divided into compulsory and voluntary standards. Products subject to compulsory standards are those for the domestic market and are required to bear the certification mark upon factory certification. There are 47 compulsory standards, of which 15 are produced by the electrical equipment industry, including cables and wires, lamps (stabilizers for fluorescent lamps), and batteries.

Compulsory standards are applied only to locally manufactured products, not to foreign products of the same category because the latter are under jurisdiction of a different ministry. From the view point of technological uniformity, safety, and standardization, products distributed in the country, be it locally produced or imported, should be governed by the same set of standards.

However, compulsory standards are not always complied with, and some manufacturers do not understand nor recognize of it.

For instance, there are many manufacturers which ship products covered by compulsory standards without obtaining the SII certification mark. Reasons for noncompliance are summarized as follows:

1) Manufacturers do not know about SII itself.
2) Manufacturers know about SII but do not realize that it is compulsory.
3) Manufacturers realized SII as compulsory standards but believe that they can comply with standards on a voluntary basis.
4) Manufacturers do not realize that SII compulsory standards are part of the SII marking system.
5) Manufacturers believe that all the SII mark is voluntary because the same mark is used for compulsory and voluntary standards.
6) Manufacturers believe that locally manufactured products are not subject to SII because imported products are not.
7) Manufacturers know the compulsory nature of SII but just neglect compliance.

Most of reasons come from the fact that the purpose and nature of SII compulsory standards and the marking system are not clearly indicated, and that the system is not made known to manufacturers, marketers, and users (including contractors doing electrical work).

Also, the use of the same mark for both compulsory and voluntary certifications causes confusion on the certification system and discourages manufacturers in applying for certification. As a result, products subject to voluntary certification, with or without the SII mark are distributed, whereas some of products subject to compulsory certification are sold without the mark compounding misunderstanding on the system among general consumers.

In fact, inferior goods without the certification mark, both local and imported products, are widely sold in the market. Thus, the compulsory standard system does not achieve its purpose of maintaining product quality.

A similar situation is observed in the certification system. There is lack of understanding about the relationship between standards and certification system. When a manufacturer has a testing organization, (be it certified or not) it is widely held that the conduct of a compliance certification test for its product, verification of compliance does

not mean official certification, but rather a entail only self-verification and self-declaration of the test. However, some companies assume that such verification is equal to certification and publish the certification mark on its corporate profile and product list.

Usage of Product Standard

Indonesian Std.	Company Std.	Foreign & Regional Std.	International Std.
58%	22%	60%	58%

Note : Multiple Answer of 50 Electric & Electronic Manufactures
Source : Questionnaire Survey

To ensure dissemination and acceptance of system and standards, efforts should be made to make publications containing necessary information as well as related documentation immediately accessible. A library or information center may be needed for this purpose.

It is important to consider regulation of imported goods. At present, imported products are not covered by compulsory standards and are thus sold freely without the government's quality check. Such products include cables and other electrical equipment and accessories. Substandard products are widely used by price-sensitive consumers.

It is very questionable whether the current certification system treats the same product items differently from one that is locally made and the other that is imported. For the interest of consumer protection and to avoid confusion in the market, treatment should be unified for local and imported products.

As for factory investigation in the certification process, the recording of check items during factory visit and the exchange of documents containing investigation results are not always done. Full compliance with certification procedures is needed to improve reliability of the certification system.

Some companies have obtained certification by foreign organizations. Periodical follow-up through factory investigation is carried out by certification organizations in Singapore.

4.2.2 Testing and inspection resources and need for improvement

4.2.2.1 Outside testing and inspection resources

Public testing organizations handling electrical equipment are B4T under the Ministry

of Industry and PLN's LMK. In addition, the Ministry of Mining and Energy plans to establish its own testing laboratory by transferring part of PLN's testing facilities and equipment.

Among the electrical machinery and equipment manufacturers, joint ventures and local companies having foreign partners own minimum required testing equipment. In particular, home appliance and related companies use outside testing service only to obtain a third party's certification. Thus, outside testing organizations are not required on a regular basis.

Industrial electrical machinery and equipment suppliers are required to receive LMK's test because PLN, requires LMK's certification on procured equipment. On the other hand, other products supplied to customer other than PLN and general consumers do not require LMK's certification; some take LMK's test and others do not. LMK has a complete set of testing equipment on cables and wires, but they are mostly old. It is poorly equipped with testing equipment for home appliances, and request for such tests is very few.

Thus, the existing laboratory facilities are not well equipped to conduct product tests for certification, which are then substituted for by data submitted by manufacturers or test reports made by other testing organizations. The latter is mainly fulfilled by LMK, that is not an official testing organization accredited by the government and does not have a complete set of testing equipment.

Many companies are not satisfied with testing service by public organizations because of a long testing period and high testing fees involved.

Industrial electrical machinery and equipment manufacturers entrust calibration of measuring instruments to KIM or LMK, which also provide service for home appliance manufacturers. Measuring instruments that cannot be calibrated by KIM are handled by large companies having semi-standards (in the case of a group company), service centers of instrument manufacturers in Singapore or foreign partners.

Similar to testing service, many companies complain about a relatively long period of time required for calibration, not to mention the expensive fees. Calibration service by private companies is not accredited except for the facility under JNK. An accreditation system to increase the number of calibration organizations will help the effective use of capital expenditures by manufacturers, and reduce of calibration service costs and the period required for calibration.

4.2.2.2 In-house inspection and testing system

(1) Outline

Looking at the in-house inspection and testing systems, there is a large gap between joint ventures and local companies receiving technical assistance from foreign partners, and other local companies. Only a handful of large companies have a complete set of equipment to conduct required product tests (including functional and safety tests). Generally, speaking, large companies have in-house testing and inspection resources capable of conducting minimum required tests for quality assurance. On the other hand, the situation among local companies manufacturing under license by foreign companies varies greatly depending on the degree of equity participation by foreign capital. Another factor is the awareness of owners and managers of local companies, Particularly as they continue to use old measuring instruments and testing equipment that have been furnished by foreign partners when they started operation. Thus not all of them meet requirements desired by licensing companies.

A very few companies post standards for operating testing equipment, and most equipment are used without daily inspection. There are many cases where testing equipment has not been used at all.

Since all of testing equipment are imported, and there is no equipment manufacturer within the country, periodical maintenance and the securing of maintenance staff are difficult tasks for many companies. Companies having semi-standards for measuring instruments are very limited in number because they require sizable investment in standards, environmentally controlled rooms as well as special staff. Education and training for calibration technicians are mostly relied on foreign partners.

Voltage fluctuation occurs in power supply and affects inspection and testing operations, particularly the process demanding high dimensional accuracy.

On the other hand, local small-and-medium-sized enterprises have few testing equipment for home appliances and industrial electrical machinery and equipment. Those who have equipment do not perform necessary tests in accordance with standards. Having reviewed material tests (acceptance tests), in-process tests and final tests at factories, the study team found the former two are poorly performed in many cases.

(2) Current state by product segment

1) Transformers for power distribution

In case of JV and foreign capital manufacture, in-house testing system is well

organized under the support of partners. In particular, large companies mostly have a full set of testing equipment. However, some having latest equipment are observed not to use it fully for quality improvement purposes. Calibration is done by KIM annually.

2) Generators and motors

Joint ventures and local companies having foreign partners have the complete system covering acceptance, in-process and final tests, that is provided by foreign partners. Nevertheless, measuring instruments and testing equipment are all foreign made and maintenance service is difficult to obtain.

3) Power distribution and control panels

Almost all the manufacturers have the minimum required level of inspection and testing systems which vary greatly among companies.

The acceptance test for raw materials is conducted on samples. Final tests cover operation tests, live tests, insulation tests, and endurance tests. No company owns short-circuit/cut-off tester While some joint ventures ask it from foreign testing organizations, most companies accept test data submitted by suppliers and do not conduct in-house tests. LMK will have testing equipment by the end of 1995.

Small enterprises conduct acceptance tests visually. Many of them do not have sufficient testing equipment nor testing standards. Some companies do not calibrate measuring instruments.

4) Watt-hour meters

Almost all watt-hour meters produced in the country are supplied to PLN, which conducts periodical tests under the attendance of LMK's representatives, and maintains internal inspection standards developed on the basis of SPLN standards. Again, joint ventures have a complete set of equipment and sufficient staff, local enterprises have substandard equipment, measuring instruments and staffing.

4.2.3 Need for promotion of quality control practice

(1) Outline

Joint ventures and local companies under licensing agreement with foreign companies receive technical assistance from them. In particular, large companies enforce strict quality control in order to internally produce diverse parts and components.

Other companies often receive technical assistance from their customers (large joint enterprises and their customers which are foreign companies). The level of quality control, however, is only limited to that required by customers for products so ordered. As a consequence, the quality level tends to deteriorate without technical assistance from customers. In fact, the percentage of defects by a manufacturer goes up after an

engineer of the foreign partner has left.

This mainly arises from misconception about quality control. Only large companies understand that the level of quality control is closely related to production cost.

More precisely, there are a limited number of companies that take effective measures to prevent defects, including quality control practice involving the analysis of defects by production element, such as materials, machinery, worker, and production method. Data are collected, but they are used only for acceptance or rejection purposes.

Finally, many companies do not have work standards covering maintenance of machinery, equipment and tools, periodical and daily inspection (including testing equipment), and production activities.

While quality control managers are appointed, a small number of companies provide sufficient training related to quality control. Also, the lack of practical experience in quality control and proprietary technology prohibits effective quality improvement. Companies doing proper process control using process charts, based on control items and methods, quality control characteristics and inspection methods, and work methods, are limited to large joint ventures.

Also, despite the fact that a large number of defects are attributable to workers, education and skills training are not conducted. Given a significant difference in skill levels among workers, the redesigning of the entire work process seems to be important to cushion the work process or product design from human errors to some extent.

To promote quality control and standardization on a company basis, quality control campaigns using easy-to-understand slogans and measures, such as 5S, data collection aiming at standardization, and the development of control standards are called for. Many companies, however, do not promote such activities and are generally contented with inspection that is believed to equal quality control.

Also important is the rise in quality awareness of business owners, who should be given an opportunity to learn about the fact that the effect of quality control is directly related to production cost, and that effective quality control helps eliminate waste of management resources thereby contributing to the improvement of operating results, by referring to actual examples according by product item.

(2) Current state by product segment

1) Transformers for power distribution

There are many joint ventures and local companies having foreign partners who have introduced quality control systems of their partners. However, quality control geared towards the reduction of percentage of defects, or quality improvement have rarely been seen. Some companies do not even have control charts.

2) Generators and motors

Some companies have QC rooms and post histograms showing the fraction of defects and other data. In practice, however, few companies have successfully transferred quality control techniques to local staff, as evidenced in the case of a company where quality control activity virtually stopped when the resident engineer of its foreign partner is not predisposed. Technology transfer should include work manuals as well as inspection manuals at the shop floor.

3) Power distribution and control panels

While many companies have quality control departments, they do not have quality control systems using process charts or control charts displayed on process schedule. Since this subsector produces large products of highly customized designs unlike consumer electronics and parts, and does not involve a production line using conveyor belts, it would be difficult to introduce a standard quality control system. Nevertheless, paint shops within assembly shops use thinner and other flammable products that are fire hazards. At least, efforts should start from instilling safety practices including the shopkeeping and the 5S campaign.

4) Watt-hour meters

3 out of 5 joint ventures are Japanese affiliated and adopt Japanese quality control systems involving QC activities, control charts and other tools. As a result, they maintain a rate of defect below 0.7% after recycle rejections.

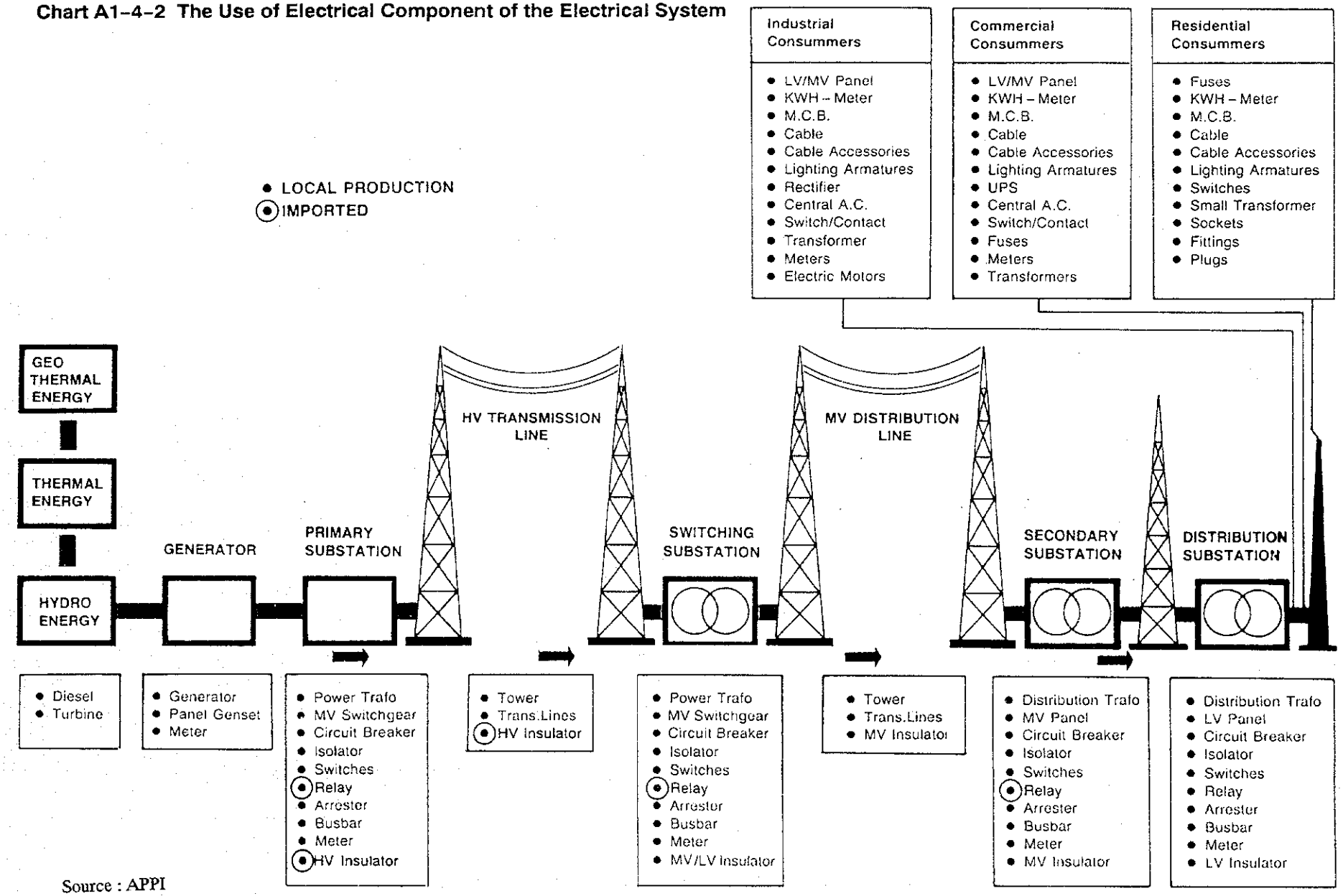
Chart A1-4-1 Trade of Electric Machinery and Equipment in the World

Unit: Million US Dollars

	Import					Export				
	1988	1989	1990	1991	1992	1988	1989	1990	1991	1992
Electric Power Machinery (SITC Code:771)										
World	9,423	9,094	11,085	12,174	13,385	8,141	8,536	10,417	11,226	12,419
Asia	2,619	2,691	3,137	3,948	4,616	3,578	3,220	3,511	4,337	4,921
Europe	3,107	3,501	4,525	4,706	4,868	3,533	3,814	5,117	5,067	5,558
USA	2,249	1,560	1,702	1,862	2,209	471	908	1,132	1,196	1,289
Germany	625	710	952	1,068	1,104	1,136	1,238	1,696	1,580	1,649
Japan	376	477	571	723	678	1,422	1,469	1,494	1,803	1,822
Switchgear & Parts etc. (SITC Code:772)										
World	30,018	30,265	37,247	39,331	41,810	28,225	28,614	35,050	37,479	39,495
Asia	7,523	6,435	7,710	9,359	11,296	8,126	7,512	8,077	9,620	10,864
Europe	12,478	13,397	16,716	17,194	18,306	14,572	15,320	18,853	19,986	21,465
USA	4,485	5,025	6,099	6,274	6,215	3,786	422	5,724	5,485	5,395
Germany	2,328	2,551	3,330	3,776	3,730	5,618	5,994	7,224	8,001	8,325
Japan	744	812	1,013	1,124	1,047	4,979	5,200	5,412	6,311	6,820
Electric Distributing Equipmet (SITC Code:772)										
World	12,026	13,163	15,319	16,531	18,330	10,775	11,216	13,211	14,131	16,169
Asia	2,389	2,596	3,178	3,830	4,488	2,965	2,386	2,754	3,212	4,058
Europe	4,419	5,141	6,434	6,802	7,633	4,913	5,612	7,152	7,259	7,985
USA	2,735	2,897	2,980	2,945	3,456	1,661	1,920	2,098	2,449	2,838
Germany	1,018	1,197	1,644	1,983	2,407	1,303	1,439	1,788	1,863	2,035
Japan	163	233	361	488	543	1,119	1,235	1,295	1,411	1,561
Total (SITC Code 771+772+773)										
World	51,468	52,521	63,650	68,037	73,524	47,141	48,365	58,677	62,835	68,083
Asia	12,531	11,722	14,025	17,137	20,400	14,670	13,119	14,342	17,169	19,843
Europe	20,004	22,038	27,675	28,702	30,807	23,018	24,746	31,122	32,312	35,008
USA	9,470	9,481	10,781	11,081	11,881	5,918	3,250	8,954	9,129	9,522
Germany	3,970	4,458	5,926	6,827	7,241	8,057	8,671	10,708	11,445	12,009
Japan	1,282	1,522	1,946	2,335	2,269	7,520	7,904	8,201	9,525	10,204

Source: UN International Trade Statistics Yearbook 1992

Chart A1-4-2 The Use of Electrical Component of the Electrical System



Source : APPI

Chart A1-4-3 Development of Manufacturers of Electric Power Equipment & Material

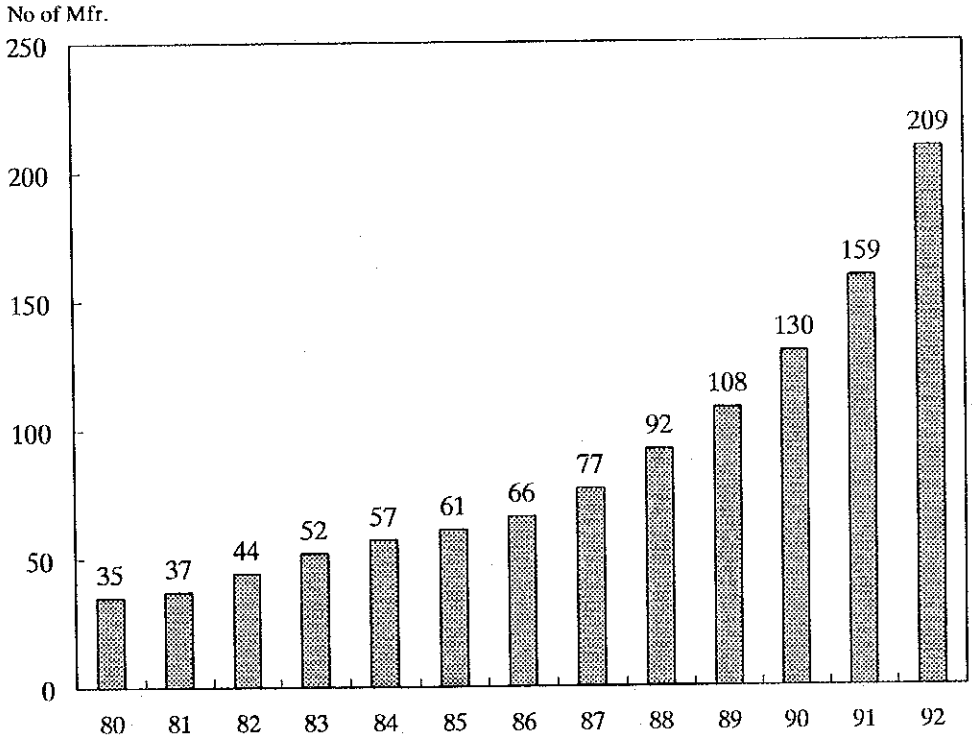


Chart A1-4-4 Electric Machinery and Equipment Industry

Subsector	No. of Company	No. of Worker	No. of worker per company	Production Million Rp.	Production per worker Million Rp./p	Value added Million Rp.
Electric Generators	3	198	66	28,381	430	7,407
Electric Motor	5	815	163	6,074	37	1,873
Transformer, Rectifier & Voltage Stabilizer	20	2,164	108	81,590	754	24,975
Electric Panel and Switchgear	18	1,306	73	26,687	368	11,195
Other Electrical Machinery	3	393	131	27,848	213	6,721
Other Electrical Apparatus and Component	34	5,878	173	147,957	856	59,221
Electric & Telephone Cables	29	8,347	288	710,249	2,468	175,456
Total	112	19,101		1,028,785		286,848

Source: Statistic Industry 1991 Indonesia

Chart A1-4-5 Cable Production and Manufactures

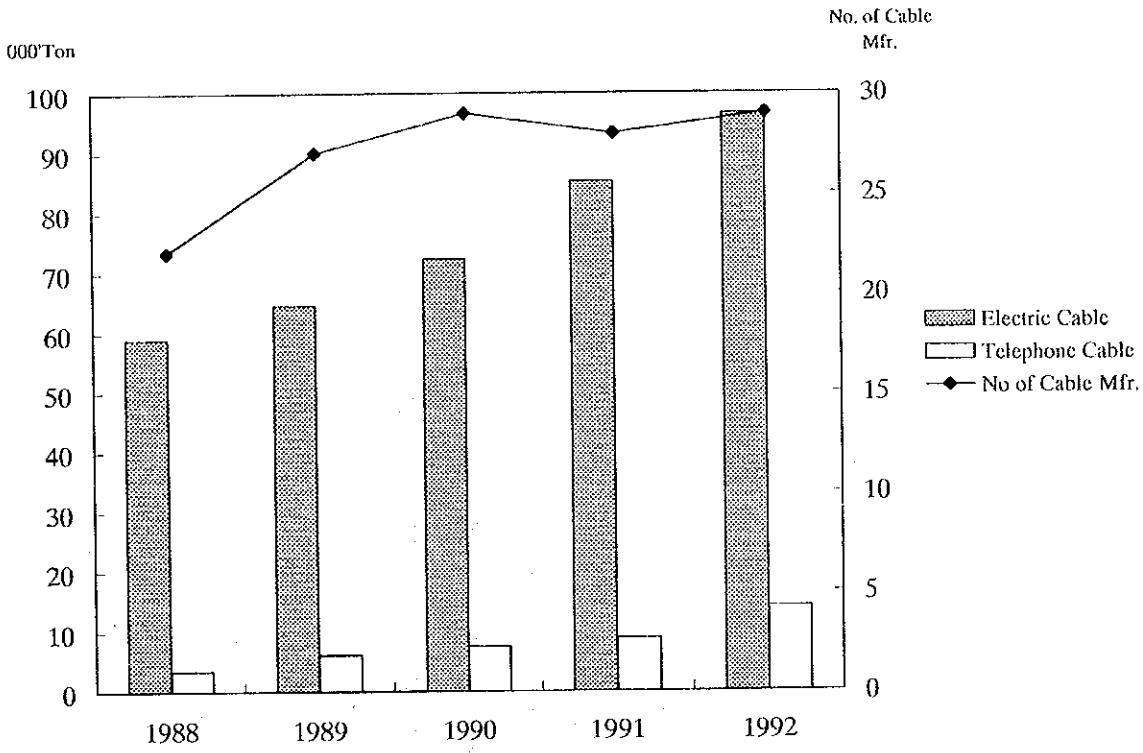


Chart A1-4-6 Indonesia Trade of Electric Machinery and Equipment

Unit: Thousand US Dollars

Item	Export		Import	
	1992	1993	1992	1993
Electric Power Machinery & Parts	21,389	32,908	175,685	240,239
Electrical Apparatus for making and breaking Electrical Circuit	44,575	61,019	550,634	571,241
Equipment for Distributing Electricity	21,791	33,616	179,761	214,336
Total	87,755	127,542	906,080	1,025,815

Source: Indonesia Foriegn Trade Statistics 1993

Chart A1-4-7 Material used by Electric Machinery and Equipment

Sub-group	Material used	Unit	Import Quantity	Import Value(M.Rp.)	Total (Local+Import) Quantity	Total (Local+Import) Value(M.Rp.)
Electric Generators	CKD AD Generator	unit	5,185	4,143	5,426	4,399
	Stator	000 bh	2	2,866	2	2,866
	Rotor	000 pcs	2	2,855	2	2,855
	CKD Generator Set	unit	301	2,334	301	2,334
	Braket	000 set			2	1,131
	Others			3,783		6,622
	Sub-Total			**15,981**	**(79%)** *	**20,208**
Electric Motor	CKD Electric Motor	unit	10,253	1,789	10,253	1,789
	Machine Wire	ton			70	582
	Stator Core	ton			157	410
	End Bracket	000 set			1,094	249
	Lead in Wire	000 pcs			48,145	193
	Others			267		971
	Sub-Total			**2,057**	**(49%)**	**4,194**
Transformer, Rectifier & Voltage Stabilizer	Tranformer Oil	000 ltr	2,517	4,386	454	7,535
	Sleting Silicon	ton	1,837	6,450	1,837	6,450
	Silicon Steel	ton	1,665	6,029	1,665	6,029
	Copper Wire	ton			533	4,703
	Rectangular Copper	ton	453	3,266	648	4,625
	Others			19,713		34,400
	Sub-Total			**39,843**	**(63%)**	**63,742**
Electric Panel and Switchgear	MCCB	pcs			14,022	2,178
	CKD Switch	000 bh	69	1,842	69	1,842
	Panel Component	pcs			41	1,248
	Iron Plate	ton			880	1,074
	Paint	ton			214	1,008
	Others			3,575		8,191
	Sub-Total			**5,417**	**(35%)**	**15,543**
Other Electrical Machinery	Insulator	000 pcs	14,542	7,697	14,542	7,697
	Dinamo Material	unit	11,707	2,874	22,089	5,423
	Shell	000 pcs			5,890	1,437
	Steel Bar	ton			694	1,047
	Raw Insulator	000 pcs	3,505	939	3,505	939
	Sub-Total			**13,100**	**(70%)**	**18,703**
Other Electrical Apparatus and Components	Plastic ore	ton	637	5,579	962	8,004
	Kwh Meter	000 set	33	6,796	33	6,796
	Steel Sheet	ton	537	1,857	1,687	5,306
	Wire	kg	299,508	2,785	455,445	4,065
	Base Top Cover	000 set			956	3,602
	Others			27,692		53,102
	Sub-Total			**44,709**	**(55%)**	**80,874**
Electric & Telephone Cables	Copper Rod	ton			19,134	115,339
	Aluminium	ton	2,437	12,427	14,484	60,438
	Copper	ton	752	5,432	8,488	50,338
	Copper Wire	ton	200	1,454	6,163	34,319
	Aluminium Wire Rod	ton	728	2,576	7,439	25,697
	Others			104,850		205,866
	Sub-Total			**126,739**	**(26%)**	**491,996**

Source: Statistic Industry 1991 Indonesia

Note: (%) shows percentage of imported materials used

Chart A1-4-8 Production Weight of Japanese Manufacturers

Unit: 000'piece, %

	1990	1991	1992
Refrigerator			
World Demand	47,920	46,736	46,140
Japanese Mfr. Production	7,302	7,682	7,471
Production Weight	15.2	16.4	16.2
Washing Machine			
World Demand	45,064	44,988	44,599
Japanese Mfr. Production	6,393	6,668	6,546
Production Weight	14.2	14.8	14.7
Micro-wave Oven			
World Demand	20,982	21,515	22,090
Japanese Mfr. Production	8,542	9,666	10,580
Production Weight	40.7	44.9	47.9

Note: Production Weight = Japanese Mfr. Production / World Demand * 100

Source: Association for Electric-home Appliances

Chart A1-4-9 Number of Factory by Products (As May 1994)

	Refrigerator	Washing Machine	Micro-wave Oven
Asia	18	15	4
North America	1	0	2
Central & South America	0	0	2
Europe	0	0	4
Africa	1	0	3

Source: Japan Electrical Manufacturers' Association (JEMA)

Chart A1-4-10 Import Duty of Asian Countries

Unit:%

		Indonesia (As Oct. 93)			Thailand (As May 92)		Malysia (As Nov. 92)
		Duty	VAT	Luxury Tax	Duty	VAT *	Duty
Electric Fun		40	10		50	7	35
Air Condition		40	10	20	30	7	30
Refrigerator		40	10	20	60	7	30
Washing Machine	< 6kg	40	10	20	<10kg 20	7	
	other	5	10		>10kg 10	7	30
Rice Cooker		40	10	10	40	7	30
Iron		40	10	10	40	7	30
Micro-wave Oven		40	10	20	40	7	30
Toaster		40	10	10	40	7	30

Note: CIF + Duty + Fee + Special Tax)x7%

Source:Japan Electrical Manufacturers' Association (JEMA)

Chart A1-4-11 Volume of Electric Home Appliances Production in Indonesia

Unit: piece

	1988/89	1989/90	1990/91
Air Conditioner	67,200	78,800	99,200
Refrigerator	104,000	138,300	158,900
Electric Fan	664,100	824,700	923,000

Souse : Government Statistics

Chart A1-4-12 Production Share in Asia

Unit:%

	Refrigerator	Washing Machine	Air Condition
Production Volume (unit=1,000 peice)	11,988	10,064	6,482
S. Korea	28.4	21.8	12.6
Taiwan	3.3	2.8	16
China	40.5	70.3	23.4
Malaysia	2.4		38.9
Thailand	10.8	2	6
Indonesia	1.3		1.5
India	10		0.6
Australia	3.3	3.1	0.9
Note:	w/o Philippine	w/o Singapore	w/o Singapore & Philippine

Source:Japan Electrical Manufacturers' Association (JEMA)

Chart A1-4-13 Comparison Number of SNI and JIS in Electrical Related Fields

Unit: No. of Standard

SNI		JIS	
General	15	General	68
Materials	39	Material	43
Measuring and Testing Equipments	6	Measuring and Testing Machine and Appliance	109
Transmission and Distribution	42	Electric Wire, Cable and Electric Line Apparatus	90
Power Generation	16	Electric Machine and Appliance	49
Electrical Appliances	27	Vacuum Tube, Lamp Bulb	68
		Illumination Appliance, Wiring Appliance, Battery	91
		Electric Application Machine and Appliance	60
Telecommunication and Electronic Component and Appliances	82	Communication Machine and Appliance	223
Total	227	Total	801

5 Electronic Equipment and Components Industry

5.1 Current State of the Industry and Major Issues Related to Future Development

Products supplied by the electronics industry are classified as follows (Chart A1-5-1 shows the definition of the electronic equipment and components industry, and classification of product items):

1) Consumer electronic equipment (video equipment, audio equipment, and other consumer products)
2) Industrial electronic equipment (telecommunications, data processing, and other business and industrial equipment)
3) Electronic components (active components, passive components, electro-mechanical parts, and discrete electronic components and parts)

By taking Japan as an example, production of the electronic equipment and components industry is shown in Chart A1-5-2[1]. 46% of electronic equipment and components production concentrates on industrial electronic equipment, followed by electronic components with 38% share. Consumer electronic equipment accounts for only 16%. In Japan, the value of exports exceeds that of imports in all the categories. Percentage share of domestic consumption is 57% for industrial electronic equipment, 30% electronic components, and 13% consumer electronic equipment. These figures clearly indicate that industrial electronic equipment occupies a dominant position in the electronic equipment and components industry.

Production systems of electronic equipment manufacturers are characterized differently according to their products. Those producing final products are mainly engaged in the final assembly process, producing only small portions of components and parts, with the remaining large share being purchased from suppliers.

Suppliers and their production systems are characterized by type of components they produce, i.e., active components, passive components, functional components, and working parts.

First of all, active components require a large amount of capital for production facilities and equipment, so it enjoy the scale of economies with increase in the volume of

---

1) Electronics Industry Almanac '95, p.3

production. Since active components govern performance of electronic equipment in which they are embedded, their production requires high levels of technology. For these reasons, active components are often manufactured by electronic makers themselves or their subsidiaries.

Passive components include many basic components, for which suppliers have been actively involved in joint efforts with electronic equipment manufacturers to reduce production costs and improve quality and performance. As a result, these suppliers have advanced technical know-how in production of passive components. Currently, they are actively relocating their production bases to overseas, while purchasing materials and parts from foreign sources, and promoting relocation of their subcontractors to overseas.

Other discrete components and parts are not produced by specialized suppliers. Rather they are produced by a large number of small-and-medium-sized suppliers, from which electronic equipment manufacturers can make purchases selectively. As a result, the relocation pattern is different, since these products can easily be produced by local companies in countries where electronic makers are newly settled.

5.1.1 Overseas trends in the industrial electronic equipment industry

Overseas expansion of the electronic industry in industrialized nations was initially designed to secure and maintain the foreign markets. Then, the purpose gradually shifted to international deployment of foreign production bases (export bases). Product items manufactured at foreign bases have been determined in consideration to relationship between the country of origin and major export markets (availability of preferential tariff, etc.) and availability of supporting industries.

Looking at the overseas production bases of Japanese electronics components manufacturers, those producing passive components account for more than 50% of the total, compared to functional components, 25% and working parts, 15%. In contrast, percentage share of facilities producing active components is limited to around 10%. Naturally, the composition varies from one region to another. Production bases in Europe and North America produce more active components compared to those in other regions. In the two regions, many countries impose import restriction on a wide variety of electronic components, such as integrated circuits, semiconductor devices, and picture tubes, so that Japanese companies have a compelling reason to have production bases – to secure the marketplace. At the same time, concentration of supporting industries in these regions make production of passive components viable. On the other hand, in other regions, particularly Latin America, South Korea, and Malaysia, production of passive components that require labor-intensive processes accounts for larger portions, while other

components are imported for local assembly.

The move for offshore production of electronic equipment was seen relatively long time ago, most of which focused on production of home appliances for the purpose of capturing local demand. At an initial stage, components were sent from parent companies and assembled locally to final products. Then, demand for localization heightened in host countries, prompting manufacturers to respond by increasing local contents. Today locally produced components are relatively diverse, depending upon the demand in each country.

In the late 1970s, offshore production was driven by a new force, trade friction. Color TVs became the first target. Production was transferred from Japan to overseas production bases, and domestic production plummeted.

The exodus of TV production from Japan caused the restructuring of electronics production structure in Japan, and particularly accelerated the development of VCRs. Suppliers changed their product items accordingly.

Key factors to consider in promoting overseas electronics production at that time were: 1) the intensification of trade friction, 2) the emergence of electronics industries in the NIEs, 3) demand shift in industrialized nations from consumer electronics to industrial electronics, and 4) the need for the reorganization of global production systems in response to the opening of the Chinese market.

The appreciation of the yen after 1985 has been further urging offshore production of Japanese electronics companies, who are increasingly building overseas plants for a variety of electronic equipment for exports to Japan as well as for other foreign markets. Such overseas production bases are specialized in certain products and operated on a large scale to serve the export market.

This is the time during which manufacturers started to pursue horizontal division of labor on an international basis – the strategy to shift production of low-end products to ASEAN countries and NIEs, while making domestic production bases specialize in high-end products.

Take audio equipment, for instance. Mainstream products manufactured in Japan have been shifted from radio-cassette recorders to emerging products of onboard audio equipment for automobiles, digital audio disk players. Today, radio-cassette recorders are dominated by imports. The similar situation is observed in Taiwan, where production of cassette recorders has been gradually declining, whereas that of stereos and CD players is on the rise. In contrast, production of radio-cassette recorder increases in Singapore and Malaysia to replace production of radio sets. As for color TVs, 19-inch or smaller sets are

increasingly produced in overseas production bases, and domestic bases are specialized in larger screen TVs and further high-grade products.

In industrialized countries including Japan, intensive competition has reduced product life cycle of electronic equipment considerably. In response, manufacturers have devised various measures. One of them is the reshuffling of product lines on an international basis. The primary effort above all, is the reduction of lead time which enables manufacturers to commercialize a new product quickly in response to market trends. This has been accomplished through, in addition to technological advancement such as CAD, the establishment of a joint development system between electronics companies and their suppliers by ensuring the involvement in research and development by related industries from the product development stage. More precisely, availability of suppliers having R&D capabilities is a prerequisite to the short time-to-market production system. Thus, it can be said that a product required to meet changing market needs in a flexible manner is unsuitable for overseas production.

Another factor encouraging the move is the advancement of mounting technology, which has automated many labor-intensive operations such as assembly of printed circuit boards, thus enabling manufacturers to effectively cope with the strong yen and the rise in labor cost.

At the same time, efforts are under way to reduce production costs by promoting overseas production of products which production technology is fairly established. In the initial stage of overseas production that focused on low-end products, the final assembly process was transferred to countries with low labor costs, to which component kits were exported. With the further rise in labor cost in Japan, however, together with the appreciation of the yen after 1985, export prices of component kits rose rapidly. That has made local manufacturers to look for cost reduction by boosting local contents.

To support such effort, Japanese suppliers have moved abroad with emigration of electronic equipment manufacturers and have complemented the general shortage of indigenous supporting industries.

The strategy to establish foreign production bases has recently evolved to procurement of necessary components for production in Japan and other countries (instead of importing from Japan).

Manufacturing arms of Japanese electrical and electronic equipment industry are currently operating in 41 countries throughout the country. Regionally, nearly 60% of the total, 514 companies, are located in Asia. Audio equipment produced on a labor-intensive basis, such as stereos, radio sets, and radio, has been shifted relatively earlier to foreign

countries, mainly Asia. Production of industrial electronic equipment and component has also been deployed to Asia and industrialized nations in response to the unification of the EC market and the establishment of NAFTA. Today, production of consumer electronic equipment is primarily based in Asia, and production bases of industrial electronic equipment are located in industrialized countries as major markets. Production of electronic components is mainly found in Asia, with the highest concentration in Malaysia, followed by the U.S., Taiwan, South Korea, Singapore, Thailand, and China.

In particular, Southeast Asia accommodates three production areas according to product positioning: 1) high-end equipment in which certain degree of production technology is necessary, in South Korea, Taiwan, and Singapore, with emphasis on PCs and peripherals (CRT displays, HDDs, and FDDs); 2) consumer equipment in Thailand and Malaysia; and 3) low-end consumer equipment in China. In Malaysia, however, labor shortage has become apparent, and manufacturers are increasingly moving to China and Indonesia. Indonesia seems to rank with southern, coastal China in terms of wage level. Also, the relaxing of restriction on foreign investment which started in June 1994, has made the country favorable enabling it to attract foreign capital. In particular, Batum attracts Singapore-based Japanese companies.

5.1.2 Electronic equipment and components industry in Indonesia

5.1.2.1 Production structure

In the 1960s, the industry in the country principally consisted of service companies and micro enterprises with 5 employees or less.

With economic expansion since 1973, industrial infrastructure has built up and joint ventures with Japanese and other foreign companies specializing in production of home electrical and electronic equipment have been established under the government's PMA foreign investment promotion program. The move responds to expected expansion of domestic demand. At this stage, the industry may be characterized as an assembly industry using components supplied by foreign partners or licensing companies.

In early 1980, the government changed its industrial policy and started to nurture labor-intensive, export-oriented industries. Then, exports of consumer electronic equipment and components were started.

Since 1990, direct investment by Japanese and Korean companies, mainly audio and video equipment for export, have been on the rise. The move reflects tightened labor markets in neighboring countries on one hand, and availability of abundant and low-cost labor force in Indonesia, the relaxing of restriction on foreign investment, and the increased development of large-scale industrial estates, on the other.

The electronic equipment and components industry in Indonesia is classified into the following three types: 1) local enterprises selling products under their original brands, 2) Japanese-affiliated companies and their licensees that manufacture and sell products under Japanese and other foreign brands for Indonesia; and 3) other export-oriented foreign enterprises.

While foreign companies investing in Indonesia are currently attracted by the country's advantage as a export production base with low labor cost, they also expect the country's market potential to produce large domestic demand in future.

Some enterprises having local brands are actively exporting their products, but their share of consumer electronics exports is fairly small. At present, there is a limited number of products supplied by these manufacturers having certain levels of technology, and they mainly make products that are currently well sold. It should be noted that these companies have received technical assistance from foreign companies at least at the initial stage of operation. Also included in this category are local companies having generic technology and not receiving technical assistance from foreign companies, who produce and sell low-cost products.

There are a relatively large number of companies in the second category, who supply products under foreign brands for domestic consumption. These companies have technical capabilities that have been transferred from parent companies to maintain reputation of their brands. Usually they are prevented from exporting products under the license agreement and their production activity is limited to the volume enough to meet domestic demand. However, factory operation and corporate management are chiefly governed by local owners who make the investment. For instance, the sending of engineers by parent companies or local engineers to parent companies needs to be financially borne by local companies, so that the scope and level of training is dependent upon the owner's policy and interest in technology transfer.

Companies in the third category are incorporated into international production and distribution systems of parent companies and are mainly dedicated to the manufacture of export products. Many of them are eligible for export promotion tariff exempt (EPTE).

Those in the second and third categories are characterized by relatively low local contents. They procure components or parts directly from countries producing component or via IPOs in Singapore. When they purchase locally manufactured parts, they obtain approval of parent companies.

5.1.2.2 Industry size

The sector's total output in 1993 was US$2,098 million, with imports and exports valuing US$2,048 million and US$1,137 million respectively. Nominal demand[2] amounted to US$3,010 million with self-sufficiency rate of 70% (see chart A1-5-3). Production has already shown high growth pattern, with the annual average rate of 55% between 1989 and 1993. It should be noted that consumer electronic equipment record strong growth, compared to industrial electronics and electronic components. Similarly, the value of consumer electronic equipment production accounts for more than 50% of total electronics production (see Chart A1-5-4).

As for the number of enterprises, 52 are engaged in consumer electronics production and 36 in manufacture and assembly of electronic components. Employment in consumer electronics production is over 21,000 persons. The value of production totals Rp 687.7 billion (US$354 million) (see Chart A1-5-5).

Most companies operating in this sector are private enterprises, except for the telecommunications subsector which is newly monopolized by the state enterprises, PT Inti.

In the sector, there are trade organizations representing consumer electronics manufacturers, communication equipment manufacturers[3] , and computer assembly companies[4] , which have recently started their activities. Around 40% of the industry participate in one of the trade organizations.

5.1.2.3 Domestic demand, imports and exports

Domestic demand for electronic equipment and components nearly tripled between 1989 and 1993. While demand for industrial equipment and electronic components grows steadily, consumer electronics demand is small in size and its growth seems to slow down due to inflation and the tightening money market. Growth in electronic components reflects that of consumer electronics production for exports.

Exports have recently grown significantly with increased investment by export-oriented consumer electronics companies. The value of exports increased by eleven times in 1994 compared to that in 1989. By subsector, consumer electronic equipment showed particularly strong growth. The value of exports that remained at the same level as that of

---

2) Production + Imports - Exports

3) The organization is participated by service providers and software houses.

4) This organization has originally started as a traders' organization. At present, around 40% of member companies are engaged in some sort of manufacturing activity.

electronic components up to 1991, grew 120% in 1993. On the other hand, industrial electronic equipment exports declined nearly 7% in the same year (see Chart A1-5-6).

Industrial electronic equipment accounts for large portions of total imports on a value basis. Electronic components show a high growth rate manifesting the above mentioned growth of consumer equipment production. Imports of consumer equipment are relatively small and in fact declined in 1993 due to the increase in domestic production. The value of overall electronics imports surged by 175% between 1989 and 1993.

5.1.2.4 Geographical distribution

80% - 90% of enterprises in the electronics industry are located in Java Island, and approximately 70% concentrate on the Jabotabek district.

In addition, an increasing number of electronics companies move to Batum Island, receive parts supply from Singapore to carry out labor-intensive production, and ship their products back to Singapore. Almost all of them are characterized as offshore type operation, making the island as an industrial area led by IPOs in Singapore. Major electronic equipment and components produced are wire harnesses, printers, FDD heads, and VCRs.

5.1.2.5 Consumer equipment

The domestic market for consumer equipment is still small because income levels of population are relatively low, as well as the rate of electrification. Nevertheless, production has recently been growing due to export growth that is reflected in increased investment by Japanese and Korean companies which establish production bases dedicated to exports. Consumer electronics accounts for 56% of total output of electronic equipment and components, whereas its share of domestic demand is only 18% on a value basis.

Products showing high output are color TVs, VCRs, cassette recorders (component type), many of which are bound to the export market.

5.1.2.6 Industrial equipment

Industrial electronic equipment produced in the country is mainly used by the telecommunications sector and primarily absorbed by the domestic market. Public demand represents major portions of the communication equipment. Communication equipment production has previously recorded impressive growth driven by public investment and the construction boom.

On the other hand, domestic production capacity does not keep up with demand that is largely satisfied by imports. Domestic demand for industrial equipment holds the largest

share, 46%, of total demand for electronic equipment and components, while domestic production accounts for 34%. It holds the lowest share in exports compared to consumer equipment and electronic components. The segment of industrial equipment with the highest production volume are communication equipment including telephones, telephone and exchanges. However, domestic production is very small and satisfies only 30% of total demand. In particular, in the telephone market for general consumers, including cellular phones, products bearing Japanese, European, and American brands are dominating.

The largest customer in the communication equipment market is Telekom. Japanese, European, and American manufacturers enter the Indonesian market by winning contracts to build telecommunications facilities for Telekom.

As for PCs, more than 20 assembly shops are registered and most of them produce around 10 units per day. Only two companies churn out more than 10,000 units annually. Manufacturers of peripheral equipment are small in number as well as in size, and products are limited to licensed production of printers and assembly of keyboards. In the information processing equipment market, imports account for around 40% of domestic demand. The PC market is not large enough (estimated at 250,000 units yearly) to boost the industry.

5.1.2.7 Components

Electronic components produced in Indonesia are mainly mechanical parts. Production of active and passive components is still limited in quantity, and imports are a major supply source. Growth in electronic component production mainly comes from that of consumer electronics production, mainly TV sets, radio and other equipment for exports.

Recently, the tightened labor supply in neighboring countries increasingly attracts electronic component manufacturers that follow equipment manufacturers. Accordingly, production of active and passive components is expected to increase in future.

The subsector accounts for 35% of domestic demand for electronic equipment and components. Domestic production accounts for 42% of the total. Among products, the share of domestic production is on the rise for "speakers," "antennas," and "mechanical parts for TV and radio sets." In addition, picture tubes for TVs – mostly imported – will soon be manufactured by Japanese– and Korean–affiliated companies, in quantities to meet domestic demand. Also, other electronic components will be localized at an accelerated rate.

Regarding production of semiconductor devices that are widely produced in Malaysia and Thailand, a manufacturer which has previously operated in Indonesia ceased operations, thus making the total production volume very limited. Nevertheless,

semiconductor demand is strong, particularly for home appliances.

5.1.2.8 Production technology

(1) Outline

Production of electronic equipment involves many stages of processing and assembly. In particular, production of electronic components relies on a variety of machining and shaping techniques including metalworking and plastics processing. In Indonesia, supporting industries capable of supplying parts with adequate quality and performance are not present, but CKD operations to import all the parts from parent companies or affiliates are common. Some companies have their own plastics processing and/or metalworking equipment. Also, some subcontract plastic molded components and parts that do not require high levels of accuracy and workmanship to local manufacturers, but their quantity is very limited.

Most consumer equipment manufacturers are joint ventures or local companies under licensing agreement with Japanese- and Korean companies. A handful of large local companies have introduced foreign technology at the initial stage of production. Production equipment is previously owned by parent companies or licensing companies in many cases. This reflects, in addition to savings in equipment investment, the intention of these companies to avoid adjustment and troubleshooting often required when new equipment is purchased, and to use abundant labor force in place of highly automated equipment. In fact, automatic equipment has been introduced where high quality and productivity is required.

Industrial equipment manufacturers are primarily doing assembly operations. Manufacturers in the communication equipment subsector manufacture commodity products under technical assistance from leading foreign makers. Commodity telephone receivers are mostly manufactured by CKD.

As for electronic components, functional components and working parts are made by local companies who receive technical assistance from foreign-affiliated companies thus, their own product development and design capabilities are fairly limited. A limited number of companies produce passive and active components, and they are mostly foreign-affiliated companies and joint ventures. As seen among manufacturers in the consumer equipment subsector, these companies use production equipment furnished by foreign partners who also provide product designs.

Because of poor power supply conditions including frequent outage and voltage fluctuation, most companies have emergency power generators and stabilizers.

(2) Consumer electronic equipment

Many consumer equipment manufacturers are joint ventures or receive technical assistance from foreign companies. They import nearly 100% of raw materials and parts from countries of parent companies or neighboring countries, particularly IPOs in Singapore. Raw materials locally procured are fairly limited, including commodity enamel wires, sheet metals, and screws and nuts. High-grade materials, such as enamel wires made of high quality materials (e.g., those for high voltage), are dependent upon imports from Japan and other countries.

Production equipment is mainly one generation old transferred from foreign partners. Although automated, most of them pose a problem related to operation and maintenance.

Improvement and modification of products, automation of production and inspection equipment, and development of jigs and tools are primarily done by foreign partners, with local companies making little effort. Recently, however, signs of self-help efforts are seen in a limited number of cases. Some joint ventures have successfully developed new products, and local small enterprises have been engaged in process automation and development of inspection equipment. Yet, none of small-and-medium-sized enterprises have done product development. This is partly due to the shortage of machine shops capable of providing advanced machining service.

(3) Industrial electronic equipment

Communication equipment and computer-related equipment account for large portions of industrial electronic equipment. Electronic components and parts used to make these equipment are mostly (over 90%) imported.

(4) Electronic components

As seen among consumer electronics manufacturers, most electronic component manufacturers are joint ventures or receive technical assistance from foreign partners. Raw materials and parts are mostly imported, including chemically processed aluminum foils, electrolytic paper, and pastes for electrolytic condensers, small transformers, and raw materials for coil production.

5.1.3 Major issues related to development of the subsector

Previously, the government has insisted on localization of industrial products, and as a result, the electrical and electronics industries in Indonesia have been neglected by foreign manufacturers in the international expansion process and have been left out as assembly companies serving the domestic market. It was during the early 1990s when the electronic

equipment and components industry targeting the international market started to emerge under the government's market opening policy and promotion of foreign investment.

Indonesia has large population that comprise market potential and provides abundant source of labor supply. Its investment climate has been improved with less restriction on foreign investment and the development of infrastructure including large-scale industrial estates. Furthermore, the tightened labor supply in neighboring countries serves as an opportunity to attract attention of foreign investors to the country.

Yet, the electronic equipment and components industry in Indonesia depends on foreign sources including IPOs in Singapore for supply of most materials and parts. Foreign-affiliated manufacturers operating in Indonesia are considering increased local procurement of raw materials and parts for cost reduction. To meet such demand, the country is expected to promote the development of local capabilities to supply materials and parts satisfying quality and performance requirements, including machining operation.

5.2 Need for Standardization and Promotion of Quality Control

5.2.1 Current status of standards development and future needs for development and updating

5.2.1.1 Standards related to electronic equipment and components in Indonesia

National standards (SNI) in the fields of electronic equipment and components are based on SII standards under control of the Ministry of Industry and SLI standards under the Ministry of Mining and Energy. When SII and SLI were unified into SNI, it was agreed that standards for individual products would be under the jurisdiction of the Ministry of Industry, and the systems combining individual products by the Ministry of Mining and Energy. However, there are some areas where a boundary is not very clear. The two standards were developed on the basis of IEC standards.

Nevertheless, there are a relatively small number of SNI (SII and SLI) related to electronic equipment and components available. There are not many technical committees in these fields. This seems to reflect the current state of the industry. Since production of electronic equipment and components is expected to grow in future, it is important to increase technical committees in these fields, while strengthening the relationship between the domestic TC and the IEC committee.

5.2.1.2 Use of standards

The electronics industry relies on foreign partners for its technological resources, including standards. General trends of the industry in relation to industrial standard are

consistent with the international move described as follows.

5.2.1.3 International move related to standardization

International standards for electronic machinery products (including equipment and components) are opt for unification into IEC standards that contain standards for all the products having electrical characteristics. Many countries in the world have their own standards which are increasingly set forth along the line of IEC.

In Indonesia, electronic equipment and components are often produced in accordance with national standards of parent countries or foreign customers because these are mostly exported. If the customer is a Japanese company, the product is manufactured on the basis of the company's internal standards or JIS. Inspection and testing methods are often based on EIAJ (Electronics Industry Association of Japan) standards. Likewise, if a customer or an end user is located in Canada, CSA is used, and ISA or NIST for the U.S. customer.

5.2.1.4 Standardization trends in Japan

Japanese standards related to electronic products are set forth in JIS–C Series that are comprehensive standards for electronic and electrical equipment. The C Series contain sub–series covering telecommunications, electronic equipment and components, totaling 210 types. Note that standards related to transmission and control protocols and interface modes for communication systems have been moved to those in the information processing area, called X Series. After separation of the X Series, the sub–series covering telecommunications, electronic equipment and components of JIS–C Series contain 121 standards that are organized as follows:

Basic standards:	4
Resistors:	23
Capacitors:	20
Crystal oscillators:	6
Transformers:	8
Connecting parts:	14
Printed circuit boards:	14
Wave guides and flanges:	2
Electronic tubes:	2
Semiconductors:	5
Standards related to reliability:	23

Testing methods for reliability of electronic components are set forth in JIS and EIAJ standards.

Electronic components undergo rapid technological innovations including the miniaturization of semiconductor chips, the increase in circuit density, rapid advancement of mounting technology for printed circuit boards, and the development of new-generation devices such as multi-layered LSIs. As a result, the need to promote standardization is strongly felt. In particular, standardization is being promoted for testing methods covering reliability, performance evaluation, operating environment, and service life.

5.2.2 Need for improvement of the certification system

Generally, electronic equipment bearing foreign brands somewhat represent quality and performance of each product. Thus, from the safety viewpoint, there are little benefits in the adoption of the certification system for electronic equipment.

While standardization of electronic equipment is progressed primarily in line with IEC, some products are based on proprietary standards of various countries, making the compatibility issue a very important aspect to be resolved. In this connection, standardization or the certification system, as the case may be, needs to be promoted on the basis of international standards or standards of international organizations.

5.2.3 Testing and inspection resources and need for improvement

5.2.3.1 Outside testing and inspection resources

In Indonesia, there is no public testing organization that will provide companies with testing service in accordance with standards in the field of electronic equipment[5], except for type tests for telephone sets conducted by Telekom. Thus, there is no demand by private enterprises.

5.2.3.2 In-house testing and inspection resources

Joint ventures and other local enterprises having foreign partners have adopted internal testing and inspection systems of foreign partners and are capable of conducting their own tests. However, local companies who only have the license to manufacture foreign products, without equity participation by foreign partners, do not necessarily have testing equipment desired by licensing companies due to local management policy.

Computer-related companies are generally small in size and mainly engaged in assembly. Visual inspection is only the means of acceptance inspection of procured parts

---

5) Some organizations have equipment for research purposes and do not provide service for private enterprises.

in which defects can often be identified at the time of shipment inspection. Similarly, manufacturers of working parts such as socket outlets and small switches are mainly small enterprises who do not have standardized testing and inspection systems. Acceptance inspection is limited to visual inspection and dimensional check, and shipment inspection is conducted on samples, mainly covering simple performance tests.

As production of components and parts is increasingly localized in the future, local enterprises will enter the industry causing the improvement of public testing and inspection resources necessary. Also, technical guidance accompanying testing service provides an opportunity to foster the local parts industry. This is particularly needed in the supporting industry sector including metalworking. Given present testing equipment and other resources, local enterprises (small-and-medium-sized enterprises) are unable to conduct their own research and development activities. University research facilities can be used for this purpose, including collaboration and assistance in product development.

Calibration of measuring instruments is mostly performed by KIM-LIPI once a year. Some of the equipment are calibrated by facilities of group companies, parent companies in foreign countries or equipment manufacturers in Singapore. To eliminate such inconvenience, some Korean manufacturers installed calibration facilities in Indonesia and attempt to provide calibration service for their affiliates.

There is a large need for improvement of calibration service among most enterprises including joint ventures and local enterprises having foreign partners. Likewise, it is not necessarily provided by public organization so the use of facilities owned by private organizations should be considered.

Chart A1-5-1 Industry Classification of Electronics Industry

Classification (1)	Classification (2)	Classification (3)	Products (Examples)
Consumer electronics	TV		
	VTR		
	Video camera		
	Radio		
	Audio component & equipment		
	CB Radio		
Industry electronics	Communication and its application equipment	Wired communication equipment	
		Radio communication equipment	
		Others	
	Electronics application equipment	Computer and its application equipment	
		Other computer application systems	Wordprocessor, high-grade typewriter, electronic calculator
Electronic components	General use	Active components	Resistor, Condenser, Coil, Capacitor
		Functional parts	Speaker, Small motor, Magnetic head
		Mechanical parts	Connector, Switch, PCB
		Others	Magnetic tape
	Active components	Electronic tubes	
		Semiconductors	
		ICs	
	LCDs		

Chart A1-5-2 Electronic Industry Production and Trade 1993

Unit: million Yen, 000'piece

Item	Production	Export	Import
Visual Equipment	2,008,305	1,078,540	82,255
VTR	598,234	395,517	11,416
(Volume)	19,993	14,814	680
Color TV	749,272	185,134	69,178
(Volume)	10,758	3,819	3,657
Other	660,799	497,889	1,661
Video Camera	487,423	417,730	–
(Volume)	7,598	6,669	–
Sound Equipment	1,250,611	673,181	90,202
Audio	1,105,127	627,168	82,230
Tape Recorder	609,505	358,819	65,093
Car Stereo	315,078	163,526	9,504
Stereo	495,621	–	–
Set	167,254	–	–
Component	328,367	268,349	17,137
Other	145,484	46,013	7,973
Consumer Electronic	3,258,915	1,751,721	172,457
Wired Communication Equipment	1,776,487	407,851	68,961
Radio Communication Equipment	1,020,034	404,700	43,324
Electric Application Equipment	5,541,792	2,077,967	498,404
Computer	4,790,394	1,878,167	442,786
Electronic Measuring Equipment	566,471	164,111	67,600
Office Equipment	921,259	375,546	19,386
Industrial Electronics	9,817,222	3,430,176	697,674
Electronic Component	3,325,213	1,133,166	226,977
Electronic Device	4,624,180	2,075,025	564,575
Electronic Tube	673,081	369,264	42,535
CTV Tube	249,636	74,749	30,959
(Volume)	14,261	5,386	3,654
Semiconductor	670,524	253,236	52,314
IC	2,878,450	1,452,525	469,726
Liquid Crystal Device	402,126	–	–
Mechanical Parts	–	2,355,484	516,324
Components & Device	7,949,393	5,563,675	1,307,877
Total	21,025,531	10,745,572	2,178,008

Source: MOI, Trade Statistics

Chart A1-5-3 Electoronic Products Trade and Prduction Statistics 1993

Unit:Thousand US Dollars

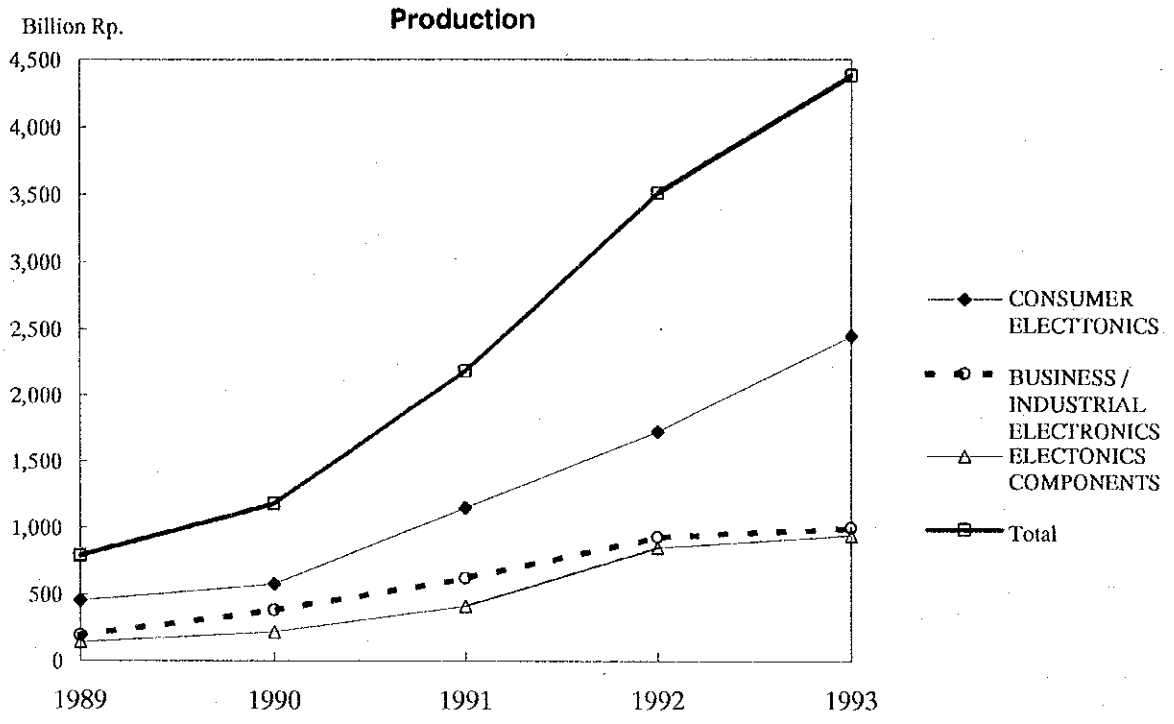
	Export	Production*	Import	Market
CONSUMER ELECTTONICS	**656,276**	**1,169,895**	**28,935**	**542,554**
Video Equipment	384,375	745,364	7,976	368,966
Color television	110,276	373,091	1,171	263,986
B/W and other monochrome	163	27,179	240	27,256
Video casset recorder	273,190	343,450	1,564	71,824
Other video equipment	745	1,644	5,000	5,899
Audio Equipment	237,097	347,731	14,295	124,930
Radio, Tape Recorder & Radio combination	147,960	233,553	4,629	90,222
Other Consumer Electronics	34,805	76,799	6,664	48,658
Economic musical instrument	1,692	3,734	3,420	5,461
Audio & video tapes	33,013	72,846	3,196	43,028
Others	99	219	48	168
BUSINESS / INDUSTRIAL ELECTRONICS	**184,304**	**478,114**	**1,106,975**	**1,400,785**
Telecomunication	56,276	237,755	682,603	864,081
Telephone sets	34,046	76,965	14,796	57,715
Telephone switching	11,123	153,302	383,914	526,093
Other telecommunication equipment	11,107	33,792	283,893	306,578
Data Processing	100,677	173,942	153,027	226,292
Computers	8,185	18,502	93,514	103,832
Pheriperals	66,415	146,501	28,739	108,825
Other data processing equipment	26,077	8,938	30,774	13,635
Office Equipment	19,394	48,431	28,998	58,035
Typewriter	16,851	38,094	517	21,760
Calculating machines	2,156	4,875	8,519	11,237
Copy machines		4,588	19,061	23,649
Other office machine	386	873	901	1,388
Industrial Electonics	7,909	17,879	203,442	213,412
Process control	334	756	8,192	8,613
Test/measuring equipment	7,575	17,124	195,250	204,799
Other Business / Industrial Electonics	48	108	38,904	38,965
Taffic signalling equipment	38	86	21,616	21,664
Security & Fire alarms	10	23	17,288	17,301
ELECTONICS COMPONENTS	**295,947**	**449,920**	**912,192**	**1,066,164**
Active component	42,628	44,496	296,419	298,286
Television tube	1,909	0	179,567	177,658
Integrated circuit	31,874	32,057	65,904	66,088
Other active compnents	8,845	12,438	50,947	54,540
Passive Components	56,476	98,136	218,862	260,522
Capacitor	2,100	2,953	60,122	60,975
Resister	256	361	22,018	22,122
Printed circuit	2,232	3,139	26,434	27,340
Other passive component	51,888	91,683	110,289	150,084
Electro-Mechanical Parts	51,726	108,739	70,203	127,216
Speaker & Microphone	37,466	83,736	24,701	70,971
Antenas	9,388	13,202	8,468	12,281
Other Electro-Mechanical Parts	4,872	11,800	37,035	43,963
Specific Electronics Parts	145,116	198,549	326,708	380,141
Parts for TV, Radio, & the like	122,063	171,650	270,250	319,838
Parts for telecomunication	19,625	22,079	29,067	31,520
Part for office machines	3,428	4,820	27,391	28,783
Total	**1,136,528**	**2,097,929**	**2,048,101**	**3,009,503**

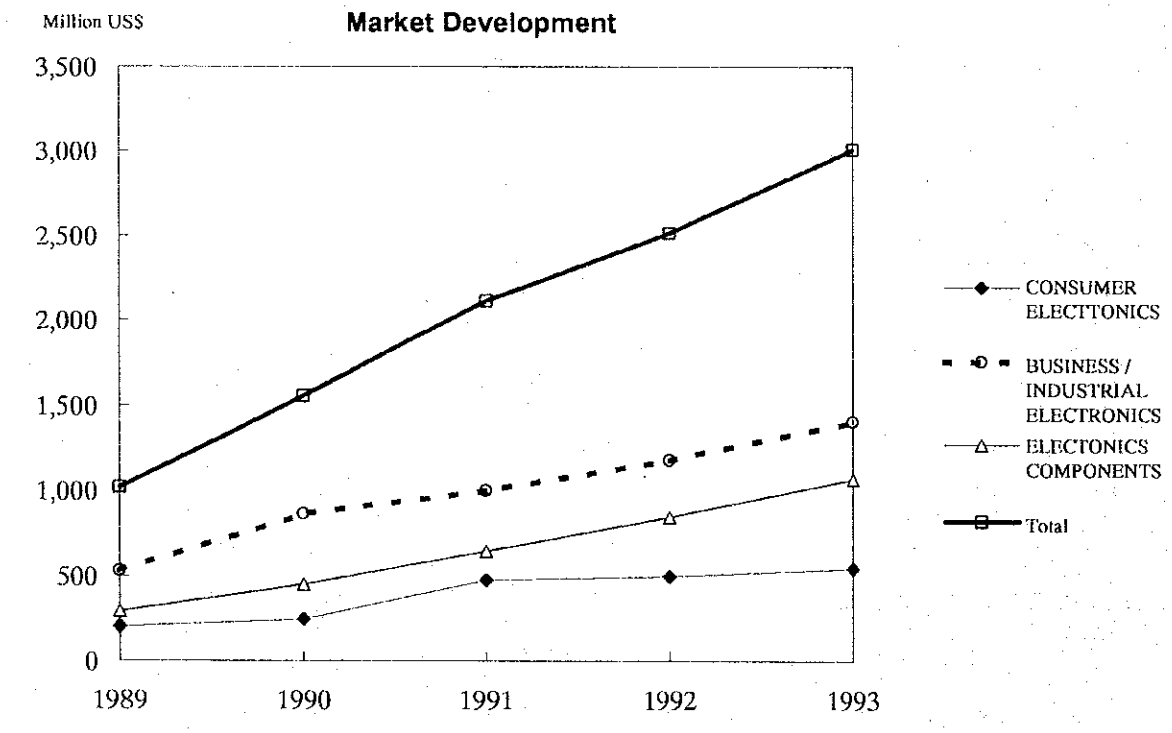
Note: Exchange rate for US dollor and Rupiah 1US$=Rp2,088

Note: Market=Production + Import - Export

Source: Ministry of Industry

Chart A1-5-4 Electronic Production and Market





Source: Ministry of Industry
Note: Market=Production + Import - Export

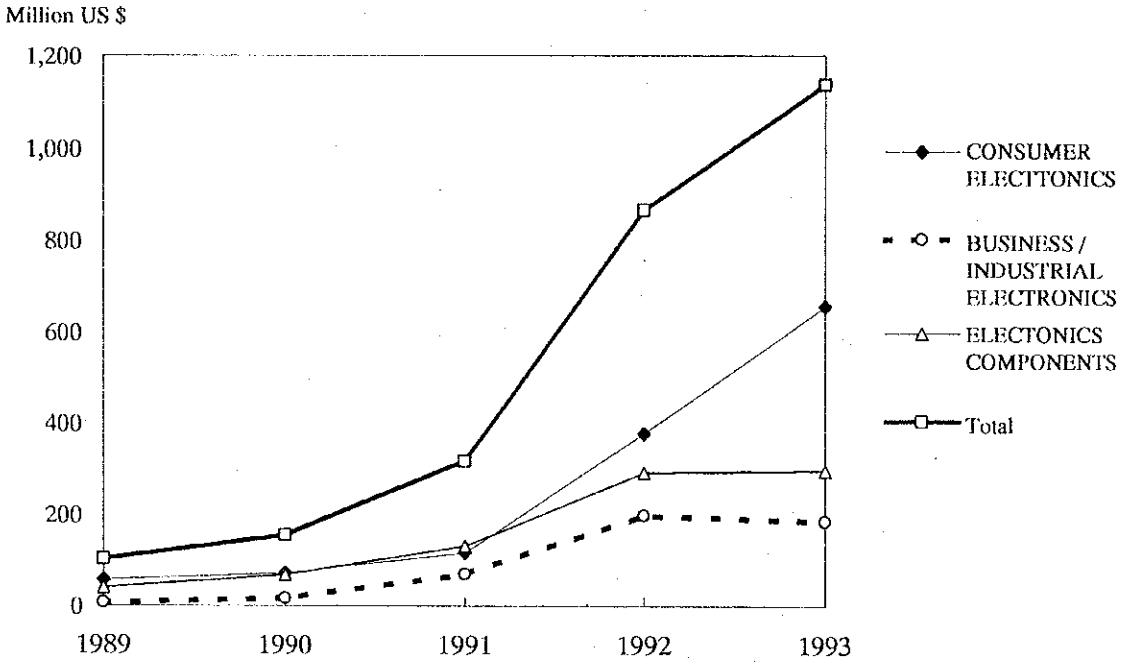
Chart A1-5-5 Electronic Product Manufacturers Profile

	No. of Establishment	No. of Worker	No. of worker per company	Production (Million Rp.)	Production per worker (Million Rp.)	Value added (Million Rp.)	Import (Million Rp.)	Total (Million Rp.)	Material Import Ratio
Radio, Television and Consumer Electronics	52	21,231	408	687,699	16,843	179,417	366,795	463,958	79%
Communication Equipments	9	4,635	515	187,738	3,645	145,610	64,407	67,596	95%
Manufacture and Sub-assembly of Electronic Components	36	9,214	256	200,679	7,841	91,738	127,654	139,248	92%
Household Electronical Appliances	16	2,870	179	159,651	8,900	40,472	69,500	107,768	64%
Electrical Accumulator	36	3,394	94	147,352	15,630	56,906	37,040	65,686	56%
Dry Cell Batteries	8	4,550	569	316,404	5,563	60,996	135,466	175,584	77%
Bulb, Spot Light and Ultra Violet Lamps	18	8,200	456	288,165	6,326	109,729	72,562	128,993	56%
Electric Lamp Components	5	230	46	798	173	455	15	264	6%
Total	180	54,324		1,988,486		685,323	873,439	1,149,097	76%

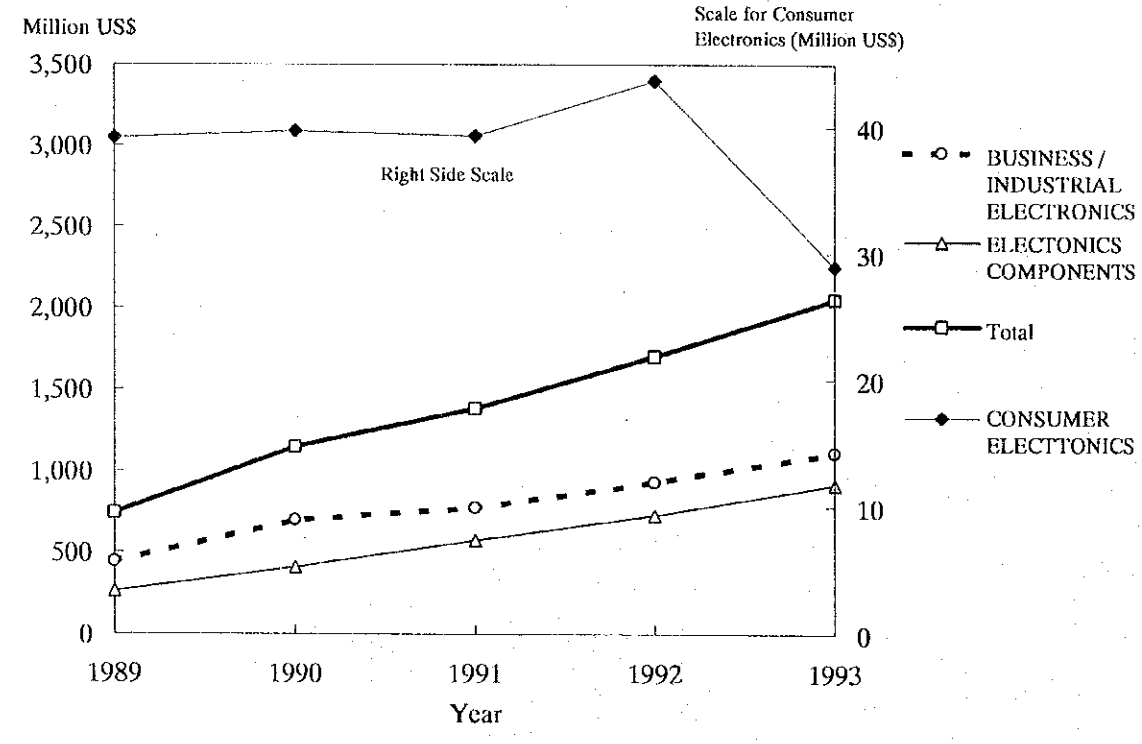
Source: Statistic Industry 1991 Indonesia

Chart A1-5-6 Electronic Product Trade

Export



Import



Source: Ministry of Industry