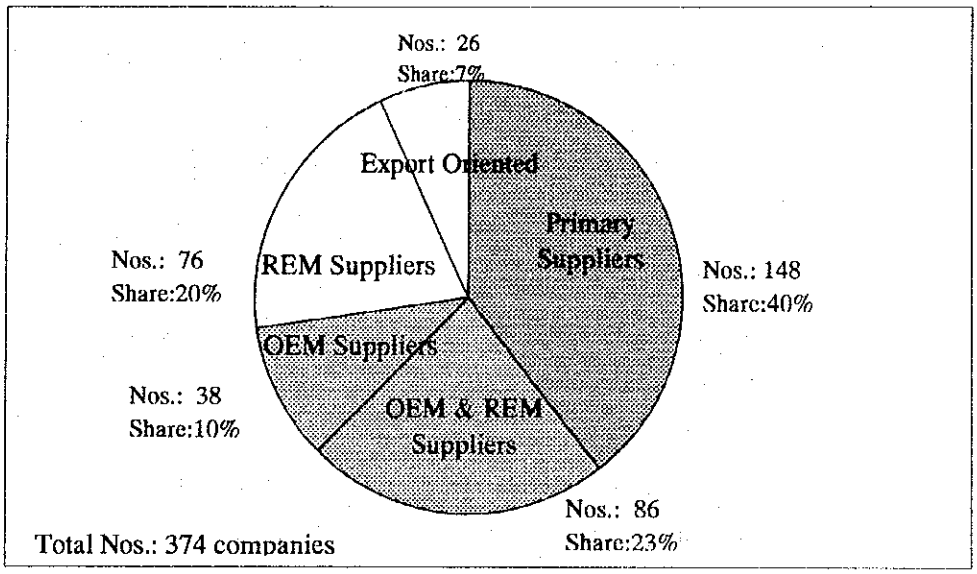


Figure 4.2–2 STRUCTURE OF AUTOMOTIVE PARTS INDUSTRY IN THE NUMBER OF COMPANIES

Primary suppliers	:	148 (40%)
Secondary or more down–stream suppliers	:	124 (33%)
REM suppliers	:	76 (20%)
Export–oriented suppliers	:	26 (7%)
Total	:	374 (100%)

4.2.4 Current status of the primary suppliers

In this study, primary suppliers are defined as the companies that deliver components and parts directly to assemblers. This section analyzes the situation of autoparts procurement from the primary suppliers of Thai automotive assemblers as of 1993, on the basis of information collected in the field survey.

All suppliers of autoparts to the said seven automotive assemblers that provided a list of their suppliers are as shown in ANNEX IV. In this annex, the names of suppliers are arranged in alphabetical order and for each the year of establishment (or start of production), number of employees, component(s) supplied to assemblers, and number of assembler customers are given. In all, there are 148 primary suppliers tabulated here.

(Note) The Directory mentioned above has 395 companies listed as supporting industry for the automotive industry including motorcycle parts supplier, the secondary and more down–stream

motorcycle parts supplier, the secondary and more down-stream suppliers and REM suppliers.)

The following analysis is made for the 148 primary suppliers based on ANNEX IV. Since data for the suppliers are not necessarily available for all items, the total number of companies differs by analyzed items.

(1) Scale of Enterprise

Table 4.2-7 COMPANY SCALE (BY NUMBER OF EMPLOYEES)

	Number of companies	Share
100 or less	29	22.3%
101-200	15	11.6%
201-500	47	36.1%
501 or more	39	30.0%
	130	100.0%

By comparing the distribution of companies by scale of employees with the corresponding data for 395 companies listed in the Directory, it is found that whereas here 66.1% of the companies have 201 or more employees, in the Directory the share for the companies of same size is 35.8%. The share for 501 or more is 30% here whereas it is 13.8% in the Directory. Thus, primary suppliers tend to be larger than those listed in the Directory.

(2) Ownership

The primary suppliers show the following capital source.

Table 4.2-8 OWNERSHIP

	Number of companies	Share
100% Thai owned	72	53.7%
100% foreign owned	4	3.0%
Joint venture	58	43.3%
	134	100.0%

Wholly Thai-owned companies comprise 54% (cf. 48% of the 395

companies in the Directory), somewhat higher than half. Among those companies there are many that have entered into technical licensing and technical support relationships with foreign companies. The number of such companies is not known, but according to information provided by an assembler, of that assembler's 59 primary suppliers, 44 (75%) have either equity or technology from overseas. Further, among 62 companies that are either fully foreign owned or jointed with foreign companies, 56 enterprises or 90% are invested by Japanese companies.

(3) Date of start of operations

The date of the start of operations in 148 primary suppliers is classified as follows. In this table, all companies with any foreign ownership are defined as foreign capital.

Table 4.2-9 YEAR OF START OF OPERATIONS

	Number of companies	Of which there is foreign equity
1953-57	1 1/	0
1958-62	4	2
1963-67	9	5
1968-72	15	8
1973-77	32	15
1978-82	22	9
1983-87	14	5
1988-92	27	18
	124	62

(Note) 1/ Investment in 1952

From the above table, it can be seen that foreign investment has increased, in keeping with imposition of local content requirements in 1974. During the 1983-87 period, such investment declined, but increased during the next five years. It is expected that such investment will continue to increase beyond 1992 in keeping with growth of domestic demand.

(4) Linkage between primary suppliers and assemblers

In order to examine the extent that primary suppliers are doing business with

more than one assembler, the right-hand column in ANNEX IV shows the number of companies with which business is being conducted. Because the survey here is limited to responses from the seven assemblers, the maximum measurable number of assemblers that primary suppliers are doing business with is seven. The following, Table 3.2-10 shows the extent of primary suppliers' diversification of customers. (Note: To maintain corporate secrets, details on which primary suppliers are vendors to which assemblers is not disclosed.)

Table 4.2-10 EXTENT OF PRIMARY SUPPLIERS' DIVERSIFICATION OF CUSTOMERS

Number of assemblers that primary suppliers are doing business with	Primary suppliers	
	Number	Share
Seven	8	5.5%
Six	13	8.8%
Five	8	5.5%
Four	15	10.2%
Three	9	6.1%
Two	23	15.6%
One	72	48.3%
	148	100.0%

From the above chart we can say that there are eight companies that do business with all seven assemblers, and they comprise 5.5% of the 148 companies.

Seventy-two companies deal with only one assembler (48.3% of the total). This group may be further studied as follows.

Table 4.2-11 EXTENT THAT SUPPLIERS ARE EXCLUSIVELY DEDICATED TO AN ASSEMBLER

	Number of exclusive suppliers	Of which suppliers also deal with other assemblers	Total
Nissan	23	45	68
Mazda	19	47	66
Honda	11	32	43
Mitsubishi	7	26	33
Toyota	5	39	44
Hino	5	32	37
Isuzu	23	3	35
	72	254	326

Note: (1) The numbers of suppliers varies somewhat every year. Some lists given by the assemblers include major suppliers only.
(2) One assembler did not offer its suppliers list. As for this assembler, official data are used.

The gist of the above analysis is as follows.

1) Many of the primary suppliers doing business with many assemblers specialize in common-specification parts, such as rubber products, safety glass, tires, electrical parts, car radios, lamps, bolts and nuts, and so on.

2) In many assemblers, engines and bodies are produced in-house or purchased from their affiliated primary suppliers.

3) Among the 72 exclusive suppliers, about a third are Thai-owned companies with 200 or fewer workers. Many of them supply small metal press and plastic products.

4) There is much difference in the number of exclusive suppliers each assembler has. One assembler has 23 exclusive suppliers, while another has only 2 exclusive suppliers. This seems to reflect differences in procurement strategy, products e.g. big trucks or passenger cars, and production volume.

5) In the future, primary suppliers are expected to increase the number of their

clients in Thailand because the domestic market remains still small for the exclusive subcontracting.

4.2.5 Current status of autoparts supply in Thailand

In ATTACHMENT 4–1, the extent that supply is through imports, domestic production, or a combination is shown by name of autoparts. In the case of domestic supply, the names of the Thai suppliers are given too. ATTACHMENT 4–2 gives materials and processing methods of major autoparts.

Components and parts marked by ○ in ATTACHMENT 4–1 are currently imported or continue to be imported for the time being for the following reasons:

1) Highly precise components directly linked to a rapidly advanced research and development area, which production facility (including prototype production) is difficult to be transferred to Thailand;

2) Those requiring highly costly and advancing machinery and equipment that need sophisticated maintenance techniques, and/or highly advanced production techniques;

3) Those produced by highly costly machinery and equipment that are already installed and operated in other country as a global strategy; and

4) Those which require volume production in view of cost reduction while Thai market is still small in size.

Components and parts marked by △ are partially localized and partially imported for the following reasons:

1) Those which are imported by some automakers according to their own procurement plans, despite the fact that they are locally available;

2) Those which are partially imported due to the insufficient capacity of local suppliers;

3) Those which local production has only recently started and has not still reached a commercial volume stage, or which automakers are slow to shift to instead of imported components; and

4) Those which are not locally available in a full range of the autoparts in terms of specification.

Using results of interviews at assemblers and the plants of autoparts suppliers, the situation of autoparts supply is as described below. The names of suppliers in ATTACHMENT 4-1 are all suppliers that are now OEM parts suppliers for the seven assemblers. That is, only names provided by the assemblers have been listed, and the Team has not introduced any assumptions. The supply conditions is described in conjunction with ATTACHMENT 4-1 by components. The number of clients as given in remark■, that indicates the number of companies with which the suppliers has any business relationship.

(1) Engines

Regarding "engine assembly", engines for one-ton pickup trucks were put on the local content list in July 1988 and it was implemented at a local content ratio of 20% from July 1989. This is to be increased 10% a year to the ultimate level of 70% in July 1995 (initial plan was for 80%). Of these trucks, 95% are powered by diesel engines. The mandate of local assembly of engines led to establishment of Siam Automotive Industry by Toyota-Siam Cement group, Isuzu Engine Manufacturing by Isuzu-Mazda and Thai Automotive Industry by Nissan. Peugeot too built an assembly plant. By 1993 the mandatory local content ratio, 50% of diesel engines, was achieved by the four diesel engine assemblers.

The engine assembly plants were authorized as such by BOI. The conditions that must be satisfied to secure BOI authorization involve the local contents (five parts) to be produced domestically, and assumption of an engine exports obligation, in exchange for which there are reductions of corporate tax, CKD import tax, and the tax on importing equipment and machinery.

It is also possible to build a plant without BOI authorization, but with approval of the MOI. Such approval provides none of the incentives given

by the BOI but only two parts are required to be domestically produced and local content requirements are lower, at 40% as of 1993 and 60% by July 1995. Mitsubishi established MSC Engine for processing and assembly work, using MOI approval.

The main points of the scheme for promoting domestic production of engines for one-ton trucks, under the authority of the BOI and MOI, are as follows.

Table 4.2-12 LOCALIZATION SCHEME FOR ONE-TON PICKUP TRUCK

Particulars	BOI Scheme	MOI Scheme
Target local content ratio	70%	60%
To be procured domestically	Materials and processing of * Cylinder blocks * Cylinder heads * Camshafts * Cone rods * Crankshafts	Materials and processing of * Camshafts * Cone rods
Target year, month	July 1995	July 1995
BOI incentives	Yes	No

Upto 1993, the car assemblers could clear the local contents regulation for engines by machining and assembling imported rods materials, namely cast or forged cylinder blocks, cylinder heads, shafts and road. In order to attain the target of 70% local content by July 1995, however, it is necessary to have the materials themselves made by casting and forging in Thailand.

A total of 3 automakers producing engines under the BOI scheme, namely Toyota, Nissan, and Isuzu, reportedly plan to initiate production sharing of the above 5 components (referred to as the 5 Cs). Under the arrangement, Toyota will manufacture cylinder blocks, Nissan will be responsible for cylinder heads, and Isuzu crank shafts and connecting rods. Cam shafts will be exception to this and will be either produced by each company or

subcontractors. It should be noted, however, that the automakers will not entirely rely on the production sharing agreement and have plans to develop their own local production capacities.

Toyota has completed a foundry in the Bangpakong industrial estate, which is capable of producing cylinder blocks, cylinder heads, cam shafts, and other castings. On the other hand, Isuzu asks Nippon Piston Ring Co., Ltd. to provide technical assistance for International Casting Co. (located in Bangpakong) in an attempt to start local production of chilled cam shafts for captive consumption. Also, the company is conducting a feasibility study on localization of crank shafts and connecting rods, jointly with TDF, Isuzu's affiliate specialized in manufacture of forged automotive parts. It plans to start local production in 1997.

MMC, that produces engines under the MOI scheme, has localization plans for two components, cam shafts and connecting rods (referred to as the 2Cs). As soon as a foundry constructed jointly by Somboom Malleable Iron Ind. and Asahi Tech of Japan in the Laem Chanbang industrial estate is completed (slated for March 1995), MMC will procure chilled cam shafts from it. It will also purchase connecting rods from Mahajak Autoparts that receives technical assistance from Tonan Drop Forging Co., of Japan, MMC's affiliate specialized in forging production.

The foregoing applies to one-ton pickup trucks, but in regard to gasoline-engine of passenger cars, there is no regulation requiring local content. Engines are being machine-processed and assembled at the assemblers' plants or engine companies mentioned above. Diesel engines for large buses and large trucks are imported in CKD form and mounted in Thailand.

Engine gaskets are made by four companies including joint ventures. Bearings are being supplied by Dyna Metal to four car assemblers and other than that, imports are used. Pistons are supplied by two Japanese J/V companies and piston rings and cylinder liner by a company so that domestic supply for these components are already completed. There is one J/V maker of valves and one J/V maker of rocker arms on the list, but some assemblers are importing these components. Valve springs and timing belts are both being made in Thailand.

Regarding "fuel systems," fuel pumps, fuel injection assembly and carburetors are being imported. These are critical components like engines and the design specifications vary from model to model so that large production runs are not easily attained. Hence, there has not been investment to produce these in Thailand.

Fuel filters are being made by the Siam Tsuchiya Mfg. that is on the list as a Japanese J/V company. But nearly half of the assemblers import filters for passenger cars. As for press-processed parts, notably fuel tanks, there are several all-Thai companies that are making these and there is no problem in regard to domestic supply capability. There are also four fuel rubber-hose makers, Inoue Rubber and International Rubber Parts, both having Japanese capital, Pongpara Coden Rubber and PC. Hose, both of Denmark.

Regarding "intake and exhaust systems," intake manifolds are aluminum alloy castings and about half of those for passenger cars are made domestically, while almost all commercial vehicle demand is being met by domestic products. Supply is by two Japanese-affiliated companies (Daisin Kogyo and Asahi Somboon Aluminum) and two 100% Thai companies (Thai Engineering Products and Thai Chanothorn). Exhaust manifolds, that are pig iron castings, are being provided by Siam Nawaloha Foundry, and Siam Machinery and Equipment, and the localization ratio for this component is higher than that for intake manifolds. As a supplier of air cleaners, there is the Japan-affiliated Siam Tsuchiya Mfg. company and most demand is being met by domestic output. Mufflers, pipes and silencers made by pressworks have been fully localized by seven local capital companies including Sammitr Motor Mfg. and Yarnapud companies.

As for "lubrication and cooling systems" production of oil pumps has been begun by TBK Krunthep (Japan-affiliated) in 1991. Domestic production, however, has just begun, and most demand is met by imports. This same company has begun to make water pumps but all assemblers queried (usable replies from five companies) stated that they were importing all of their requirements. Regarding oil coolers, the questioning revealed that all demand is met by imports. All oil filters are being made within Thailand. All radiators are being made in Thailand, mostly by Thai capital companies.

(2) Body and press parts

Body structure of automotives is broadly divided into monocoque structures for passenger cars and frame structures for commercial vehicles. The former has no frame and the body is made by pressworks, to give it the strength and durability to accommodate the components mounted on it.

Outer panels or skin panels for passenger cars and large buses and trucks, must have high dimensional precision and a smooth surface, and require large presses machines and dies for production. Thus, almost all of outer panels for them are being imported. Outer panels for pickup trucks are being made in-house or by subsidiaries of the assemblers. Components included in this category are as follows:

Outer panels (door, hood, roof, fender, pillar, side sill, trunk lid quarter, cowl top), roofs, fender panels, pillars, frames, side shills.

Inner panels are attached to the inside of the outer panels; these too are press-formed. All of these, for both passenger and commercial vehicles, are being made in Thailand by the assemblers or their vendors. Other body parts that are made using large presses are made in Thailand, in-house or by vendors. These body components are the following:

Dash panels, floor pan/panels, strut house panels, cross members, side members, reinforces.

There are many local suppliers as shown in item B1 of ATTACHMENT 4-1.

Bumpers are plastic in the case of passenger cars and pressed metal (steel) for commercial vehicles. Plastic bumpers are imported and steel ones are pressed in Thailand. There are five suppliers on the list and all are fully Thai owned.

Other small presswork products related to bodies; all of the requirements for these are being supplied by 100% Thai owned companies of which many are listed. The types of these products are:

Plackets, hinges, supports, gazettes, bars, stays

Dies for presses, jigs, and machine processing, are being made or performed by presswork companies mentioned above or by specialized companies. As

specialized makers of dies and jigs, or specialized machine processors, the list gives Thai International Diemaking, Ogihara, SNN Tools & Dies, all of which are Japanese-affiliated, and P.C.S. Machine (Thailand) and Thai Summit Engineering, that are 100% Thai owned.

(3) Chassis

Chassis are made up of four components:

Suspension system: absorption of shock and vibration and control of stable driving
Axles: support the body and transmit motive force
Steering system: control of moving direction
Brake system: reducing speed and stopping

As for the "suspension system," lower arms and upper arms are made of pressed steel plate or forgings of medium-carbon steel. According to the interview survey there are no local suppliers of these so that all demand seems to be met by imports. Coil springs, shock absorbers and stabilizers are all locally made by spring companies. Suppliers are NHK Spring (Thailand) and Siam Auto Parts, that are Japanese-affiliated, and Bangkok Spring Industrial and Sammitr Auto Parts, that are 100% Thai owned.

"Axles" have as their main components, knuckles, axles and hubs, that are castings or forgings, and all of these are imported.

The major components of "steering systems" are wheels, columns, shafts, gears and gear housings. These are now being imported.

Regarding "brake systems," brake master cylinders, and brake boosters, are imported. Disks for disk brakes, made of ductile iron castings, have recently become available from domestic suppliers but most of them are still being imported. As suppliers there are Somboon Malleable Iron Industry, Siam Nawaloha Foundry, and Thai Engineering Products on the list (SNF: casting, TEP: machining). Drums for drum brakes, terrous casting products are met by domestic supply. In addition to the suppliers mentioned above there are P.C. Products International, Siam Machinery and Equipment and Nawaloha

Industry, makers of castings, that produce drums. Only one assembler reported purchasing both drums and disks from Bangkok Spring Industrial, but in actuality the assembler may be buying only spring parts from this vendor. Presswork is used to make brake pedals and brake tubes, and all domestic demand is met by domestic production. The suppliers are about the same as on the list of B3. Small Press Parts and 6. Muffler/Pipe/Silencer in ATTACHMENT 4-1. As for rubber brake hoses, companies listed in ATTACHMENT 4-1 (Item I Rubber Parts) provide all of the assemblers' requirements by production in Thailand.

(4) Driving systems

Driving systems take the rotational energy of the engine via the clutch to the transmission, where speed is adjusted. Then driving force is transmitted to the wheels by the propeller shaft and differential gears.

Transmissions, made up of a case, gear, and shaft, had been imported in CKD form to met all of domestic demand up to 1992, and since the start of 1993, one company has begun to buy transmissions for pickup trucks from a domestic supplier.

Siam Auto Parts is supplying clutch assembly to three assemblers. Regarding the components of clutch assembly, a master cylinder and a release cylinder are both imported, and clutch housings are cast in Thailand so as to nearly satisfy domestic requirements. Suppliers of clutch housings are more or less the same as the casting companies that make brake drums and disks. Clutch pedals, made by presswork, are all supplied from domestic suppliers.

"Driveshaft systems" include uniform velocity joints, and differential gears, almost all of which are imported. There have been reports that a Japanese-affiliated company, Koyo Manufacturing (Thailand) had started production of propeller shafts in 1990 but this company's name does not appear on the supplier lists submitted by the seven assemblers so it is not listed on ATTACHMENT 4-1. There also have been reports that the Shinko Industries company of Japan had licensed its technology for propeller shafts to Thai Summit Autoparts Industry, in 1988, but it is not known whether this company has actually begun production. On the other hand, although it is for

only one company, there is an assembler that is buying propeller shafts for pickup trucks from a domestic source. The name of the supplier is not known, but it is generally thought that there is some domestic output. Wheels, whether made by pressing steel or casting aluminum, are made domestically. A supplier of steel wheels is Kallawis Autoparts Industry (Japanese-affiliated) that is selling to all seven assemblers. Aluminum wheels are made by Enkei Thai (Japanese-affiliated) and Yachiyoda AlloyWheel (100% Thai capital).

All tires are made in Thailand. The suppliers are Thai Bridgestone (Japanese-affiliated), Goodyear (Thailand) and Siam Tyre (both US-affiliated) and the French company Michelin Siam.

(5) Electrical parts

All meters, switches, relays and controls are imported. All other electrical components are made in Thailand. Batteries are made by three Japanese-affiliated companies, Yuasa Battery (Thailand), Siam GS Battery and Siam Furukawa Battery. In addition, Siam Battery, S.B. Siam Battery also exists but at present do not appear on the suppliers' lists obtained by the seven assemblers. Alternator and starters are made by three Japanese-affiliated companies, Nippondenso (Thailand),Siam Autoparts, and Oriental Electric Industry. Wire harnesses are made by the Japanese-affiliated Thai Arrow Products and the Thai-owned Thai Harness. Spark plugs are made by two Japanese-affiliated companies, Nippondenso (Thailand) and Siam NGK Spark Plug, and horns are made by two Japanese-affiliated companies, Nippondenso (Thailand) and Thai Nikko Metal as well as one all-Thai company, S.Y.K. Spare Parts Industry.

(6) Trim

Drivers' instrument panels and console boxes are made as large-size plastic injection machines. The same materials are used for both in order to maintain a uniform feeling for the interior. Those for passenger cars are moulded altogether laying padding materials and cover materials on the base plastics. These units are imported in one piece. For pickup trucks, padding and covering is not needed and there is supply both from domestic and non-

Thai sources. This may represent domestic parts for certain models and imported parts for others. The instrument panel for large buses and trucks and their console boxes are met by imports due to small quantity of demand except Thai Hino Industry's in-house production. Suppliers include Thai Summit Autoparts Industry for instrument panels and Narong Industry for console boxes; both are on the list and are 100% Thai owned.

As for seats, all demand is met by domestic products. There are two fully Thai owned companies, the Summit Auto Sets Industry and Siam Parts and Engineering as well as two Japanese-affiliated companies, NHK Spring (Thailand) and Bangkok Foam, that provide seats.

All floor carpets are made domestically. There are two all-Thai companies on the list, Carpet International Thailand and Thailand Carpet Manufacturing.

(7) Exteriors and accessories

All door locks and lock cylinders are imported. Almost all headlamps are imported too, and other lamps show a tendency toward use of imports for passenger cars, but not commercial vehicles. Domestic output is sufficient for all demand for car radios, car air conditioners, mirrors and tools. Suppliers of these are shown in item G in ATTACHMENT 4-1.

(8) Plastic, rubber and other materials

Plastic parts makers number ten on the list (they are mentioned in item H in ATTACHMENT 4-1) in which the plastic parts makers are not classified by parts-wise. However, those companies whose products are known by parts-wise are classified under the name of autoparts as well.

A total of eight rubber parts makers are given in item I of ATTACHMENT 4-1 and they are too classified by parts-wise. Rubber autoparts are entirely supplied from domestic producers.

Regarding basic materials, as shown in item J of the same table, information available is incomplete. This is because car assemblers often did not list their vendors of basic materials.

4.2.6 Results of interview survey of primary suppliers

The Study Team visited 26 primary autoparts suppliers for interviews choosing wide varieties of products. Primary suppliers have the nature of being both buyers and suppliers, as they purchase parts from secondary suppliers and they in turn supply their products to assemblers. There are among them both wholly Thai owned companies, and companies having foreign equity participation. The results of the interviews are presented below.

(1) Increase of capacity, and factory location

Interest in increasing capacity is strong, on the basis of the future growth in demand for automotives. About 90% of the companies are planning to increase capacity, at one time or another. There is a split of about half and half with regard to location, the choice being that of the present factory sites or a site close to assemblers so that just-in-time deliveries are easily made. In the case of new factories, they prefer to locate in BOI Zone II.

(2) Exportation of components

The majority of the companies export components, directly or indirectly. The quantity of exports on the average, however, is still low, at about 2-3% of total production. Most of the exports are to Asia, and the ASEAN region in particular. Some of them revealed the reasons why exports were at so low level: The existing production on capacities were full for domestic demand and they, especially companies owned by Thai capital, were unfamiliar with export businesses including correspondence by foreign languages.

(3) Manner of parts procurement

There are wide variations in parts procurement by company in the relative shares of outsourcing, from domestic suppliers, in-house production and importation used to make their components and parts. In the case of presswork companies, for example, the in-house share was 97%, while it was zero per cent at an oil pump maker. There were no companies that expressed interest in increasing procurement of parts through imports in the future. They would like to maintain or reduce the present ratio of imports for the

purpose of cost reduction.

(4) Problems in local procurement

Discontent with regard to purchasing parts from domestic suppliers had the ranking of quality as the most serious complaint, followed by delivery reliability and price in that order. A tendency was found for discontent regarding delivery reliability to be stronger among the primary suppliers than among assemblers. They wanted for domestic parts suppliers to grow in plastics processing and electric plating, but also included casting, forging, heat treatment and machine processing. Needless to say, they wanted development of domestic suppliers they needed..

(5) Economic Scale of production of components

The question, "At what scale of automotive production in a country do you decide to invest in construction of a new factory?" was asked to gauge the economic scale of autoparts industries. The answer was made, in terms of the number of assembled vehicles, as 100,000 to 200,000 for lamps, 200,000 for suspensions, 400,000 for wheels, and 100,000 for alternator and starters. It is necessary to note, however, that these number meant a lot of the order to a company so that it did not indicate total vehicle production throughout the country.

(6) Superiority of the investment environment in Thailand

About 80% of the companies replied that the investment environment was favorable, owing to the investment incentives provided by the BOI and the to the scale of the domestic market. In addition, labor and geographical location were cited as reasons for a high evaluation of the investment environment.

(7) Technical support

Components supplies or primary suppliers lei midway between assemblers and parts suppliers buying parts from parts suppliers and selling components and parts to assemblers. About 80% of the primary suppliers receive technical support from overseas, and about the same percentage of them have

obtained foreign cooperation for employee training in overseas. Contrary, nearly 70% of them are providing technical support to parts suppliers or subcontractors. Some 20% of the primary suppliers are providing technical support by means of employee training and materials supply to parts suppliers.

(8) Use of public technical institutions

MIDI, TISI and universities are relatively well used as sources of technical support. About a third of the companies used one of these. Privately operated laboratories (TPA, etc.) were also mentioned.

There were many instances of discontent, however, on the public technical institutions that application procedures were a nuisance, the nature of the services is not well known, or that equipment and facilities were inadequate.

(9) What is desired of government, and problems of corporate activities

Almost all the companies complained about the inequitable tariff structure as it affects component suppliers, as well as delay in customs processing. That the tariff on imported parts for CKD components is set at a higher level than that of CKD imported directly by assemblers was a source of dissatisfaction because it gives a price disadvantage to domestic CKD manufactures. There was an accusation that owing to the inequitable tariff at rupture the government impedes the development of supporting industries, rather than promotes it. Other comments related to the government were complicated with the process of tax refunds for exportation of products, as well as the need for improvement of export incentives and credit facilities for machinery purchase.

As problems related to business activities, the higher costs created by the inequitable tariff situation was the most prominent problem cited. Comments related to the ordering companies were made by almost half of the companies, that was, the lack of stability in orders, and excessively severe requirements for quality. About half of the companies also mentioned labor-related problems, including insufficiency of worker skills, rising wage costs, and job-hopping.

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (1/13)

A. Engine

A1. Engine Assy

Components/Parts	I/L	Supplier	Capital	No. of Client
• Diesel, big buses & trucks	○	(Note) Imported as CKD.		
• Gasoline, passenger cars	△	(Note) Imported or partly assembled by the following companies.		
• Diesel, pick-up truck	×	- Isuzu Engine Manufacturing	TH: 90 JP: 10	■■
		- Siam Toyota Manufacturing	TH: 60 JP: 40	■
		- MSC Engine	n.a.	■
		- Thai Automotive Industry	TH: 60 JP: 40	■

A2. Engine Body

• Cylinder Block	○	(Note) Local production of diesel engines for pick-up will start in 1994/95.		
• Cylinder Head	○			
• Engine Mount	○	(Note) Imported.		
• Engine Gasket	×	- Cheena Gasket	TH: 51 JP: 49	■■■
		- NHK Gasket (Thailand)	JP:100	■
		- Siam Sanwa Industry	n.a.	■
		- F.C.C. Industrial	n.a.	■

A3. Piston and Crankshaft

• Crankshaft	○	(Note) A Japanese firm has a plant to invest.	TH:100	■■■■■■
• Connecting Rod	○			
• Main Bearing • Connecting Rod Bearing	△	- Dyna Metal	TH: 51 JP: 49	■■■■
• Piston	×	- Izumi Piston	TH: 54 JP: 46	■■
		- Art Serina Piston	TH: 51 JP: 49	■
• Piston Ring & Cylinder Liner	△	- Siam Riken Industrial	TH: 51 JP: 49	■

(Note) • I/L : ○ - Mostly imported × - Mostly local production, △ - Mixture of ○ and ×
A supplier is often supplying different components to different clients so that "No. of Clients" doesn't necessarily mean clients only for the subject components.

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (2/13)

A4. Camshaft and Valves

Components/Parts	I/L	Supplier	Capital	No. of Client
· Camshaft	○	(Note) Production for 1 ton pick-up will start in 1994 by J/V.		
· Camshaft Sprocket	○	(Note) A local vender has a plan to produce.		
· Valve Guide & Sheet	○	(Note) It is said that a local manufacturer(s) has a plan to penetrate.		
· Engine Valve	△	– TRW Fuji Seina	TH: 24.5 JP: 24.5 USA: 50	■■
· Rocker Arm	△	– Jibuhin (Thailand)	TH: 51 JP: 49	■■■
· Valve Spring	×	– NHK Spring (Thailand)	TH: 25 JP: 75	■■■■■■
		– Siam Auto Parts	TH: 95 JP: 5	■■■■■■
		– Bangkok Spring Industrial	TH:100	■■■■
		– Sammitr Auto Parts	TH:100	■
· Timing Belt	×	– Mitsuboshi Belting (Thailand)	TH: 51 JP: 49	■■■■
		– Siamese-Bando Rubber Industry	TH: 51 JP: 49	■■

A5. Fuel System

· Fuel Pump	○	(Note) Imported as CKD.		
· Fuel Injection Assy	○			
· Carburetor Assy	○			
· Fuel Filter	△	– Siam Tsuchiya Manufacturing	TH: 51 JP: 49	■■■■
· Fuel Tank	×	– Thai Auto Industry	TH:100	■■■■
		– Thai Summit Autoparts Industry	TH:100	■■■■
		– Ch. Auto Parts	TH:100	■■■■
		– Siam Parts and Engineering	TH:100	■■
		– Siam Motors and Nissan	TH:100	■
· Fuel Hose	×	– Inoue Rubber	TH: 51 JP: 49	■■■■■■■
		– International Rubber Parts	JP:100	■■■■■■
		– Pongpara Codan Rubber	TH: 60 DE: 40	■■■■■■
		– PC. Hose	TH: 60 DE: 40	■

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (3/13)

A6. Intake and Exhaust

Components/Parts	I/L	Supplier	Capital	No. of Client
• Intake Manifold	△	– Thai Engineering Products	TH:100	■■■■■
		– Daisin Kogyo	TH: 51 JP: 49	■■
		– Asahi Somboon Aluminum	TH: 51 JP: 49	■
		– Thai Chanathorn Industry	TH:100	■
• Exhaust Manifold	×	– Siam Nawaloha Foundry	TH:100	■■■■■
		– Siam Machinery and Equipment	TH: 80 JP: 20	■■
• Air Cleaner	×	– Siam Tsuchiya Manufacturing	TH: 51 JP: 49	■■■■
• Muffler/Pipes	×	– Sammitr Motor Manufacturing	TH:100	■■■■■■
		– Summit Auto Body Industry	TH:100	■■■■■■
		– Thongchai Industry	TH:100	■■■■
		– Yarnapund	TH:100	■■■■
		– Siam Parts and Engineering	TH:100	■■
		– Able Sanoh Industries	TH:100	■
		– B.T. Engineering	TH:100	■

A7. Lubrication and Cooling System

• Oil Cooler	○	– Siam Tsuchiya Manufacturing	TH: 51 JP: 49	■■■■
• Oil Pump	○	– TBK Krungthep	TH: 51 JP: 49	■■■■
• Water Pump	○	– TBK Krungthep	TH: 51 JP: 49	■■■■
• Oil Filter/Cooler	×	– Siam Tsuchiya Manufacturing	TH: 51 JP: 49	■■■■
		– Union Nifco	TH: 52 JP: 48	■
• Radiator	×	– Siam Auto Parts	TH: 95 JP: 5	■■■■■■
		– Thai Radiator Manufacturing	TH:100	■■■■
		– Ch. Vatanayont	TH:100	■■
		– Radicon	TH:100	■■■

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (4/13)

B. Body and Press Parts

B1. Panel

Components/Parts	I/L	Supplier	Capital	No. of Client
• Outer Panel; doors, front hood, trunk lid quarter, cowel top	△	(Note) • Skin outer panels for passenger cars are mostly imported. • Those panels for commercial cars are partly manufactured by in-house or the suppliers listed below.		
• Roof & Roof Rail	△			
• Fender Panel	△			
• Front & Center Piller	△			
• Front & Rear Frame	△			
• Side Sill	△			
• Inner Panel; doors, front hood, trunk lid quarter	×	- Sammitr Motor Manufacturing	TH:100	■■■■■
		- Thai Summit Autoparts Industry	TH:100	■■■■
• Dush Panel	×	- Ch. Auto Parts	TH:100	■■■■
• Floor Pans/Panels	×	- KSK Autoparts	TH:100	■■
		- Thai Summit PK	TH: 60 JP: 40	■■
• Strut House Panel	×	- Bangkok Eagle Wings	TH: 19 JP: 62 USA:19	■
• Cross & Side Members	×	- Sammitr Auto Parts	TH:100	■
• Reinforces	×	- Siam Engineer Body Car	TH:100	■
		- Siam Motors and Nissan	TH:100	■
		- Sooksawatkolakarn	n.a.	■
		- Toyota Auto Body (Thailand)	TH: 0 JP:100	■
		- Bangkok Metal Works	TH:100	■

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (5/13)

B2. Exterior

Components/Parts	I/L	Supplier	Capital	No. of Client
• Plastic Made Bumper	○	(Note) Mostly imported for passengers cars. – Polymer Industrial	TH:100	■
• Steel Made Bumper	×	– Summit Auto Body Industry	TH:100	■■■■■■
		– Thai Auto Industry	TH:100	■■■■
		– Yarnapund	TH:100	■■■■
		– KLK Industry	TH:100	■
		– Thai Vehicle Industry	TH:100	■
• Radiator Grille	△	(Note) Some of manufacturers listed in B1 and B3 are suppliers.		
• Mogal/Side Protector/Garnish	△			
• Rear Spoiler	△			
• Wheel Cover	△			

B3. Small Press Parts

• Splash Guard, Brake Layer, Door Hinge, Hood Hinge Hood Support, Bracket, Gusset, Belt Bar, Bumper Stay, Gate Lock	×	– Able Auto Parts Industries	TH:100	■■■■
		– Asia Machinery & Construction	TH:100	■
		– CC. Auto Part	TH:100	■
		– Cheow Charn Industry (1989)	n.a.	■
		– HT. Sahakij	TH:100	■
		– KLK Industry	TH:100	■
		– L. Sutti Karnchang	TH:100	■
		– PCU	TH:100	■
		– S.P. Metal parts	TH:100	■
		– VCS. Limited Partnership	TH:100	■
		– Bangkok Diecasting and Injection	TH:100	■
		– Ch. Karnchang	TH:100	■
		– United Metal Manufacturing	TH:100	■

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (6/13)

B4. Press Die Making, Jigs, Machining

Components/Parts	I/L	Supplier	Capital	No. of Client
• Dies, Jigs, Tools, Machining	△	(Note) Large size & precision dies are partly imported.		
		- Sammitr Motor Manufacturing	TH:100	■■■■■■
		- Able Auto Parts Industries	TH:100	■■■■
		- P.C.S. Machine (Thailand)	TH:100	■■■
		- Thai International Diemaking	TH: 51 JP: 49	■■
		- Ogihara	TH: 51 JP: 49	■
		- SNN Tools & Dies	TH: 51 JP: 49	■
		- Sooksawatkolakarn	n.a.	■
		- Thai Rung Union Cars	TH:100	■
		- Thai Summit Engineering	TH:100	■

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (7/13)

C. Chassis

C1. Suspension

Components/Parts	I/L	Supplier	Capital	No. of Client
• Lower and Upper Arms	○	(Note) Imported.		
• Coil Spring	×	- NHK Spring (Thailand)	TH: 25 JP: 75	[redacted]
		- Siam Auto Parts	TH: 95 JP: 5	[redacted]
• Shock Absorber	×	- Bangkok Spring Industrial	TH:100	[redacted]
• Stabilizer	×	- Sammitr Auto Parts	TH:100	[redacted]

C2. Axle

• Knuckle	○	(Note) Imported.		
• Axle	○			
• Wheel Hub	○			

C3. Steering

• Wheel	○	(Note) Imported.		
• Column	○			
• Shaft	○			
• Gear	○			
• Gear Housing	○			

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (8/13)

C4. Brake

Components/Parts	I/L	Supplier	Capital	No. of Client
• Master Cylinder	○	(Note) Imported.		
• Brake Booster	○			
• Disc Brake Caliper	○			
• Brake Disc	△	– Somboon Malleable Iron Industry	TH:100	■■■■■■
		– Siam Nawaloha Foundry	TH:100	■■■■■
• Brake Drum	×	– Thai Engineering Products	TH:100	■■■■■
		– Bangkok Spring Industrial	TH:100	■■■■
		– P.C. Products International	n.a.	■■■
		– Siam Machinery and Equipment	TH: 80 JP: 20	■■
		– Nawaloha Industry	TH:100	■
• Brake Pedal	×	(Note) Some of suppliers in B3.		
• Brake Hose	×	(Note) Some of suppliers in I.		
• Brake Tube	×	(Note) Some of suppliers in A6.		

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (9/13)

D. Driving Mechanism

D1. Transmission

Components/Parts	I/L	Supplier	Capital	No. of Client
• Transmission Case	○	(Note) Imported.		
• Transmision Gear	○			
• Transmission Shaft	○			

D2. Clutch

• Clutch Assy	△	– Siam Auto Parts	TH: 95 JP: 5	[redacted]
• Clutch Master Cylinder	○			
• Clutch Release Cylinder	○			
• Clutch Housing	△	– Siam Nawaloha Foundry	TH:100	[redacted]
		– Bangkok Spring Industrial	TH:100	[redacted]
		– Nawaloha Industry	TH:100	[redacted]
• Clutch Pedal	×	(Note) Some of Small Press Parts manufacturers" in item B3.		

D3. Drive Shaft Assy

• Uniform Joints	○	(Note) Imported.		
• Differential Gear	○			
• Propeller Shaft	△	(Note) Suppliers' names cannot be identified.		
• Wheel, Steel	×	– Kallawis Autoparts Industry	TH: 57 JP: 43	[redacted]
• Wheel, Aluminum	×	– Enkei Thai	TH: 51 JP: 48 SG: 1	[redacted]
	×	– Yachiyoda Alloy Wheel	TH:100	[redacted]

D4. Tyre

• Radial Tyre	×	– Thai Bridgestone	TH: 40 JP: 60	[redacted]
		– Goodyear (Thailand)	TH: 46.5 US: 53.5	[redacted]
		– Siam Tyre	TH: 90 US: 10	[redacted]
		– Michelin Siam	TH: 51 FR: 49	[redacted]

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (10/13)

E. Electrical Parts and Wiring

Components/Parts	I/L	Supplier	Capital	No. of Client
• Meter, Switch, Relay, Cruise Control	○	(Note) Imported.		
		– Siam VDO Instrument	TH:100	■
• Battery	×	– Yuasa Battery (Thailand)	TH: 51 JP: 49	■■■■■
		– Siam GS Battery	TH: 61 JP: 39	■■■
		– Siam Furukawa Battery	TH: 60 JP: 40	■
• Alternator & Starter	×	– Nippondenso (Thailand)	TH: 56 JP: 44	■■■■■■■
		– Siam Auto Parts	TH: 95 JP: 5	■■■■■■
		– Oriental Electric Industry	TH: 60 JP: 40	■■
• Wire Harness/Cable	×	– Thai Arrow Products	TH: 10 JP: 90	■■■■■■
		– Thai Steel Cable	TH: 65 JP: 35	■■■■■■
		– Thai Harness	TH:100	■
• Spark Plug	×	– Nippondenso (Thailand)	TH: 56 JP: 44	■■■■■■■
		– Siam NGK Spark Plug	TH: 70 JP: 30	■■
• Horn	×	– Nippondenso (Thailand)	TH: 56 JP: 44	■■■■■■■
		– S.Y.K. Spare Parts Industrial	TH:100	■
		– Thai Nikko Metal	TH: 53 JP: 47	■

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (11/13)

F. Trim

Components/Parts	I/L	Supplier	Capital	No. of Client
• Instrument Panel	△	(Note) Partly in-house production. – Thai Summit Autoparts Industry	TH:100	■■■■
• Console Box	△	– Narong Industry	TH:100	■■■■
		– Wichien Auto Parts	TH:100	■■
• Seat/Cushion	×	– Summit Auto Seats Industry	TH:100	■■■■■■■
		– NHK Spring (Thailand)	TH: 25 JP: 75	■■■■■■
		– Bangkok Foam	TH: 51 JP: 49	■■■■
		– Siam Parts and Engineering	TH:100	■■
		– Polymer Industrial	TH:100	■
• Floor Carpet	×	– Carpet International Thailand	TH:100	■■■■■■
		– Thailand Carpet Manufacturing	TH:100	■
• Seat Belt	×	– Narong Industry	TH:100	■■■■
		– Mercury Accessories	TH:100	■
		– Asian Autoparts	TH: 51 JP: 49	■

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (12/13)

G. Exterior and Accessories

Components/Parts	I/L	Supplier	Capital	No. of Client
• Door Lock/Cylinder	○	(Note) Imported.		
• Sticker	△	– P.J. Design	TH:100	■■
		– ATT Sticker & Design	TH:100	■
		– Raks Enterprises	n.a.	■
• Lamp	△	(Note) Head lamps are mostly imported.		
		– Thai Stanley Electric	TH: 51 JP: 49	■■■■■
		– Narong Industry	TH:100	■■■■
		– Thai Koito	TH: 51 JP: 49	■■■■
		– Wichien Auto Parts	TH:100	■■
• Safety Glass	×	– Thai Safety Glass	TH: 55 JP: 45	■■■■■■■
		– Sanga Dumronka Industry	TH:100	■■
		– Siam V.M.C. Safety Glass	TH:100	■
• Mirror	×	– Ampas Industries	TH: 98 JP: 2	■■■■■
		– Wichien Auto Parts	TH:100	■■
		– Charoenchai Lohakij	TH: 50 n.a.: 50	■
• Car Radio	×	– National Thai	TH: 51 JP: 49	■■■■■■
		– Thai Electronic Industry	TH:100	■■■■■■
		– Mercury Accessories	TH:100	■
		– Summit Electronic Component	TH:100	■
• Air Condition	×	– Formula Automobile Industries	TH:100	■
		– Formula Industries	TH:100	■
		– Siam Kiki	TH: 70 JP: 30	■
• Hand Tool Set/Bolts & Nuts	×	– Aoyama Thai	TH: 0 JP:100	■■■■■
		– Mahajak Auto Part	TH:100	■■■
		– Mahajak Engineering	TH:100	■■
		– Mahajak Industry	TH:100	■■
		– Exparts	TH:100	■
		– Siam Senator	TH:100	■
• Antenna, Windshield, Wiper & Washer	×	(Note) Supplier's name is not identified but totaly localized.		

ATTACHMENT 4-1 PRODUCT-WISE PRIMARY COMPONENTS SUPPLIERS TO 7 AUTOMOTIVE ASSEMBLERS (13/13)

H. Plastic Parts (By Supplier's Name)

Supplier	Capital	No. of Clients	Components/Parts
Narong Industry	TH:100	■■■■	Plastic parts (Lamp assy, Console, Safety belt, Lamp outside)
Century Plastic	TH:100	■■	Plastic parts
T. Krung Thai Industry	TH:100	■■	Injection plastics (Garnish, Ornament road wheel, Mirror outside)
Wichien Auto Parts	TH:100	■■	Room lamp, Mirror outside, Console boot
General Chemical (Thailand)	n.a.	■	Plastic parts (Reserve tank)
Rehau	TH: 0 GE:100	■	Plastic parts
Srithai Superware	TH:100	■	Battery case
Union Plastic	TH:100	■	Plastic parts
Polymer Industrial	TH:100	■	Polyurethane Products, Bumper
Bangkok Metropolis Motor	TH:100	■	Handle door outer, Plastic parts

I. Rubber Parts (By Supplier's Name)

Supplier	Capital	No. of Clients	Components/Parts
Inoue Rubber	TH: 51 JP: 49	■■■■■■■	Window strip, Fuel hose, Engine mounting, Damper
International Rubber Parts	JP:100	■■■■■■	Mud gaurd, Hose, Mat, Cushion
Pongpara Codan Rubber	TH: 60 DE: 40	■■■■■■	Fuel hose, Window strip
Thai Fukoku	TH: 60 JP: 40	■■■	Bush, Pulley, Damper, Support
Chaiya Phon Rubber	TH:100	■	Mud gaurd, Bumper bound, Mounting insulation
PC. Hose	TH: 60 DE: 40	■	Hose
Felton	n.a.	■	Pad insulator
Asian Autoparts	TH: 51 JP: 49	■	Damper, Safety belt

J. Materials (By Supplier's Name)

Supplier	Capital	No. of Clients	Components/Parts
VIV Interchem	TH:100	■■■■■■■	Bond (Adhesive)
Cemedine (Thailand)	TH: 51 JP: 49	■■■■■	Adhesive & Sealants
Nippon Paint (Thailand)	TH: 60 JP: 40	■■■■	Paint
Thai Kansai Paint	TH: 60 JP: 40	■■■	Paint
Asia Kendy (Thailand)	TH: n.a. JP: n.a.	■■	Adhesive, Body sealer
Ferrari Asphalt	n.a.	■	Insulator
ICI Paints (Thailand)	n.a.	■	Paint
Summit Advance Material	n.a.	■	Steel
Thai Parkerizing	TH: 51 JP: 49	■	Bondorite material

ATTACHMENT 4-2 MANUFACTURING PROCESS OF AUTOMOTIVE PARTS AND COMPONENTS (1/4)

A. ENGINE

Components/Parts		Main Materials	Main Processing Method
Engine Body	Cylinder Block	Grey cast iron	Sand mould casting
	Cylinder Head	Grey cast iron	Sand mould casting
	Gasket		
	Engine Mounting Braket	Ductile cast iron/Steel sheet	Sand mould casting/ Stamping & Welding
	Engine Mount	Rubber & Steel sheet	Stamping
	Oil Pan	Steel sheet/Aluminum alloy	
Piston and Crankshaft	Piston	Aluminum alloy	Gravity die casting
	Piston Pin	Structural alloy steel	Cold forging
	Piston Ring	Grey cast iron	Sand mould casting
	Crankshaft	Medium carbon steel, Low alloy steel	Forging
	Connecting Rod	Medium carbon steel	Forging
	Main Bearing	Kelmet	Sintering
	Connecting Rod Bearing	Kelmet	Sintering
Camshaft and Valve	Engine Valve	Heat resistant alloy steel	Forging & Welding
	Valve Spring	Piano wire	Ceiling & Heat treatment
	Rocker Arm	Aluminum alloy/Alloy steel	Pressure die casting/ Precision casting/Forging
	Valve Guide	Grey cast iron/Sinterd alloy	Sand mould casting/Sintering
	Valve Sheet	Sinterd alloy	Sintering
	Valve Spring Retainer	Carbon steel, Alloy steel	Cold forging
	Camshaft	Grey cast iron/Carbon steel	Sand mould casting/Forging
	Camshaft Sprocket	Sinterd alloy	Sintering
	Timing Belt	Rubber	
Fuel System	Fuel Pump	Lowerbody parts: Aluminum die cast	Machining & Assembling
	Fuel Injection Assy		Machining & Assembling
	injector		
	pressure regulator		
	Carburetor		
	Fuel Tank	Steel sheet	Stamping & Welding
	Fuel Hose	Rubber	Blow moulding
	Fuel Filter		
Intake and Exhaust	Intake Manifold	Aluminum alloy	Low pressure die casting/ Gravity die casting
	Exhaust Manifold	Grey cast iron	Sand mould casting
	Air Cleaner	Case & Cover : steel sheet/Plastics	Machining & Assembling
	Muffler	Steel sheet	Stamping & Welding
Lubricating and Cooling Sytem	Oil Pump		Machining & Assembling
	rotor/gear	Fe-C-Cu Sintered alloy	Sintering
	case	Aluminum alloy	Pressure die casting
	shaft	Carbon steel	Machining & Heat treatment
	Water Pump		Machining & Assembling
	body	Grey cast iron/Aluminum alloy	Sand mould casting/ Pressure die casting
	impeller	Grey cast iron/Steel sheet	Sand mould casting/Stamping
	Radiator		Stamping & Soldering & Assembling
	fin	Copper sheet	
	tank	Brass sheet	
	tube	Brass sheet	
	Radiator Fan	Resin	Injection moulding
	Engine Oil Cooler		Stampimg & Soldering & Assembling
	Oil Filter		Assembling

Source: JICA team's preparation.

ATTACHMENT 4-2 MANUFACTURING PROCESS OF AUTOMOTIVE PARTS AND COMPONENTS (2/4)

B. BODY

Components/Parts		Main Materials	Main Processing Method
	Outer Panels	Almost all material of body is steel sheet.	Almost all processing method of body is stamping.
	doors		
	front food		
	trunk lid quarter		
	cowl top		
	Inner Panels		
	same as above		
	Roof		
	Roof rail		
	Fender Panel		
	Pillers		
	Front & Rear Frame		
	Side Sill		
	Dash Panel (Instrument Cluster)		
	Strut House Panel		
	Floor Pan		
	Cross & Side Member		
	Front End Upper Bar		
	Door Hinge Reinforce		
	Bumper Reinforce		
	Backbone Reinforce		

C. TRIM

Components/Parts		Main Materials	Main Processing Method
	Instrument Panel		
	foundation	ABS Resion	Injection moulding
	cushion	Polyurethane resin	Foaming
	cuticle	PVC Resin	
	Console Box		
	foundation	ABC Resin	Injection moulding
	cuticle	PVC Resin	
	Seat		
	seat frame	Steel sheet	Stamping
	cushion spring	Spring steel	Ceiling & Heat treatment
	back spring	Spring steel	Ceiling & Heat treatment
	cushion	Polyurethane resin	Foaming
	cuticle	Artificial leather, Fabric	
	Door Trim		
	foundation	Woodenfibre/Resin compound	Hot and cold compression moulding/ Injection moulding
	cuticle	PVC Resin	
	cushion	Polyurethane resin	Foaming
	Ceiling (Formed Ceiling)		
	foundation	Woodenfibre/Resin compound	Hot compression moulding/ Vacuum forming
	cuticle	PVC Resin	
	cushion	Polyurethane resin	Foaming
	Floor		
	carpet	Fibre	
	antivibration material	Asphalt sheet	
	insulator	Polyurethane resin, Felt	

ATTACHMENT 4-2 MANUFACTURING PROCESS OF AUTOMOTIVE PARTS AND COMPONENTS (3/4)

D. EXTERIOR

Components/Parts		Main Materials	Main Processing Method
	Bumper Fascia	Resin/Steel sheet	Injection moulding/Stamping
	Grille	Resin	Injection moulding
	Garnish	Resin	Injection moulding
	side garnish		
	rear pin garnish		
	rear panel garnish		
	Mogol	Stainless steel/Resin	Stamping
	Rear Spoiler	Resin	Blow moulding/Injection moulding
	Lamp		
	bulb	Glass, Tungsten firament	
	lense	Resin/Glass	Injection moulding
	reflecter	Resin/Steel sheet	Injection moulding/Stamping
	body	Resin	Injection moulding
	Wheel Cover	Resin/Steel sheet	Injection moulding/Stamping
	Window	Glass	
	front window scaled		
	side window		
	rear window		
	roof wondow		
	mirror		Assembling

E. CHASSIS

Components/Parts		Main Materials	Main Processing Method
Suspension	Spring	Spring steel	
	sheet spring		Stamping & Heat treatment
	coil spring		Ceiling & Heat treatment
	Stabilizer	Spring steel & Structural steel	Bending, Stamping
	Arms	Steel sheet/Medium carbon steel	Stamping/Forging
	Shock Absorber	Steel tube	Machining & Assembling
Steering Axle	Knuckle	Carbon steel/Ductile cast iron	Forging/Sand mould casting
	Axle		
	front axle	Medium carbon steel	Forging
	rear axle	Medium carbon steel	Forging
	Wheel Hub	Grey cast iron/Medium carbon steel	Sand mould casting/Forging
Steering	Steering Wheel	Steel tube/Aluminum alloy	Machining & Assembling/ Pressure die casting
	Steering Column	Steel tube	Machining & Assembling
	Steering Shaft	Medium carbon steel	Machining & Assembling
	Steering Gear	Carbon steel	Machining & Heat treatment
	Gear Housing	Aluminum alloy	Pressure die casting
Brake	Brake Master Cylinder	Aluminum alloy	Sand mould casting
	Brake Booster		Machining & Assembling
	Brake Hose	Rubber	
	Brake Tube	Steel tube	
	Brake Wheel		
	Disc for Disc Brake	Ductile cast iron	Sand mould casting
	Caliper for Disc Brake	Ductile cast iron	Sand mould casting
	Brake Drum	Grey cast iron	Sand mould casting

ATTACHMENT 4-2 MANUFACTURING PROCESS OF AUTOMOTIVE PARTS AND COMPONENTS (4/4)

F. DRIVING SYSTEM

Components/Parts		Main Materials	Main Processing Method
Transmission	Transmission		Machining & Assembling
	transmission case	Grey cast iron/Aluminum alloy	Sand mould casting/ Pressure die casting
	gear	Alloy steel	Machining & Heat treatment
	shaft	Alloy steel	Machining & Heat treatment
	Clutch		Machining & Assembling
	clutch housing		
	clutch pedal	Carbon steel	Forging
	clutch master cylinder		Machining & Assembling
	clutch release cylinder		Machining & Assembling
Driving Mechanism	Uniform Joints		Machining & Assembling
	Propeller Shaft	Steel tube	Machining & Assembling
	Differential Gear Mechanism		Machining & Assembling
	Wheel	Steel sheet/Aluminum alloy	Stamping/Casting/Forging
	Tyre	Rubber	Moulding

G. ELECTRICAL PARTS

Components/Parts		Main Materials	Main Processing Method
	Battery	Lead & Resin	Assembling
	Starter		Machining & Assembling
	housing	Aluminum alloy	Pressure die casting
	direct current motor	Magnetic steel sheet & Copper wire	Stamping & Wire winding
	magnet switch		Machining & Assembling
	Alternator		Machining & Assembling
	housing	Aluminum alloy	Pressure die casting
	stator	Steel sheet & Copper wire	Stamping & wire winding
	rotor	Carbon steel & Copper wire	Machining & Wire winding
	pulley	Carbon steel	Forging
	Wire Harness		Assembling
	Spark Plug		Assembling
	Horn		Assembling

ATTACHMENT 4-3 SUMMARY OF QUESTIONNAIRE SURVEY TO 7 AUTOMOTIVE ASSEMBLER

A. Market & Expansion Plan

A1. Expansion plan of automobile assembly factory

1)	Yes	=	5
2)	Possible	=	1
3)	No plan	=	1
			7

A2. Factory site for the expansion

1)	Existing factory site	=	2 (BOI Zone I=1,Zone II=1)
2)	BOI Zone II area	=	3
3)	BOI Zone III area	=	1
			6

A3. Superiority of Thailand in doing business (Plural answers)

1)	Domestic market size	=	4
2)	Competitive manpower	=	4
3)	BOI incentives	=	3
4)	Geographical advantage	=	2
5)	Others	=	2
			15

A4. Export of Complete Build-up (CBU) automobile

1)	Doing	=	2 (Small share of production)
2)	Considering	=	1
3)	No plan	=	4
			7

A5. Estimated demand in 2000 (Verbal answer)

Total number of cars	=	800,000 to 1,100,000 (average 1,000,000)
Share of passenger cars	=	50% to 60%

B. Local Procurement

B1. Local procurement policy

1)	To increase	= 4
2)	Uncertain so far	= 3
		7

B2. Prior subsectors to be promoted in Thailand (Plural answers)

1)	Foundry	= 4	5)	Machining	= 2
2)	Plastic	= 4	6)	Mould & Die	= 1
3)	Rubber	= 2	7)	Forging	= 1
4)	Electro plating	= 2	8)	Material (Resin, Steel)	= 1
					17

B3. Problems in local procurement (Plural answers)

1)	High price	= 5
2)	Insufficient quality	= 5
3)	Unstable delivery	= 3
4)	Insufficient production capacity	= 1
		14

B4. Request for overseas potential suppliers to invest in Thailand

		Yes	No
1)	Past experience	4	3
2)	Possibility in future	5	2

C. Linkage with Primary Suppliers

C1. Interest in exclusive and long-term subcontract with suppliers

1)	Interested	= 3
2)	Interested but impossible in Thailand	= 1
3)	No interest	= 3
		7

C2. Does your company have a club or a group consisting of local suppliers?

1)	Yes, it does.	= 5
2)	No, it doesn't.	= 2
		7

C3. Current assistance being made to suppliers

1)	Technical assistance	= 7
2)	Training in Thailand	= 6
3)	Training in overseas	= 5
4)	Supply of materials	= 4
5)	Managerial assistance	= 3
6)	Supply of mould & die	= 3
7)	Participation of capital	= 2
		30

D. Possibility of Collaboration or Co-work with Competitors in Doing Business

D1. On collaboration in attracting a common suppliers from overseas to Thailand

1)	We have collaborated and/or will do.	= 3
2)	We have not and will not do.	= 4
		7

D2. On collaboration in standardizing of parts/components for common use

1)	Basically impossible in collaboration with competitors.	= 5
2)	Suppliers will standardize them by themselves as necessity.	= 2
		7

D3. On collaboration in technology transfer to suppliers

1)	Ready to consider depending upon a detailed scheme of the proposed program.	= 2
2)	Ready to collaborate if any direct benefits to our company are expected.	= 2
3)	Collaboration is not necessary since we have own program.	= 1
4)	Difficult to collaborate with competitors.	= 1
5)	Others	= 1
		7

E. Globalization Policy

E1. Countermeasure to implementation of AFTA

1)	Considering	= 2
2)	No concrete idea yet	= 5
		7

E2. Labor of division in ASEAN area including BBC

1)	Doing	= 5
2)	None	= 2
		= 7

F. Request to Thai Government (free writing)

1)	Imbalance in import tax system	=	5
2)	Rigid local–contents regulation	=	2
3)	Retail price control system	=	1
4)	Insufficient infrastructure preparation	=	1
5)	Lack of technology education	=	1
			10

Source:JICA team questionnaire & interview survey

Chapter 5 Electrical/Electronic Industries and Related Parts Industries in Thailand

5.1 Electrical/Electronic Assembly Industries

5.1.1 History of electrical/electronic assembly industry development

Electrical/electronic industries grow with the growth of demand which follows increase in GDP or GDP per capita of the country. In general, the demand for the electrical/electronic appliances grows and expands in the following step. Domestic production is also born and developed as increase in the demand.

i) Dry Cell Battery, Electric Fan
ii) Radio, Audio, Black & White TV
iii) Electrical Home Appliances (Washing machine, Refrigerator, Air Conditioner, Rice Cooker, etc.)
iv) Color TV
v) VTR
vi) Telephone
vii) OA Equipment (Facsimile, Copier, Word Processor, Personal Computer, etc.)

Consumption level of Thailand may be positioned in the midway of iv) and vi).

The development history of electrical/electronic industries is reviewed by decade below.

(1) The 1960s

The Thai assembly industries of the electrical/electronic sectors started in the 1960s like the automotives as BOI investment incentives' policy of import substitution. Beginning with the production of dry cell batteries and incandescent light bulbs, by 1965 the industries reached a level of assembly for radios, television sets, electric fans, and refrigerators by imported CKD. Seven manufacturers of electrical home appliances which started up during 1962 and 1970 represented domestic Thai electrical/electronic industries until the appearance of the export orientated assemblers in 1980s. The output of

the above 7 domestic manufacturers was almost entirely for the domestic market. The following gives years of their establishment and the number of employees as of 1993:

Company Name	Main Shareholders	Estab. in	Employees, 1993
1. National Thai	Matsushita	1961	2,070
2. Philips Electrical	Philips	1962	540
3. Sanyo Universal Electric	Sanyo	1959	5,220
4. Hitachi Consumer Products	Hitachi	1970	1,560
5. Thai Toshiba Electric Industry	Toshiba	1969	1,360
6. Kang Yong Electric Manufacturing	Mitsubishi	1964	1,230
7. Tanin Industrial	Thai 100%	1962	1,000

(2) The 1970s

The topic of the 1970s was large scale investment made during 1973 and 1974 by three American semi-conductor manufacturers. This investment was carried out in response to the change in BOI investment incentive policies towards promotion of exports which had started in 1972. The above three American firms assembled semi-conductors in Thailand enjoining the benefits of the cheap labor and tax privileges for form export. Output was exported mainly to the USA and Singapore. The investment of these American firms not only contributed to job creation and exports but resulted in the introduction of electronics technology which was entirely new to Thailand. Moreover the investment led to a surge in foreign investment into Thailand. The following gives the year of company establishment and the number of employee as of 1993 for the three firms;

Company Name	National Affiliation	Estab. in	No. of Employees
1. National Semiconductor (Bangkok)Ltd.	USA	1973	3,800
2. Signetics Thailand Co., Ltd.	USA	1974	2,400
3. Data General Thailand Ltd.	USA	1974	550

Moreover in the 1970s, the assemblers who were established in the 1960s started in-house production of three parts. The parts produced were metal

frames, speakers, resistors, transformers, and some manufacturers started the surface mounting of the printed circuit board. In addition, ITT begun assembling of telephones by imported CKD. As for electrical items, export did not increase in the 1970s despite the export incentive policies of the government. The finished goods which were partly exported in the 1970s were assembled by imported parts and components.

(3) The 1980s

The policies for the electrical/electronic industries in the 1980s continued to be promotion of exports. In response to such policies there were a number of investments from leading electronics manufacturers such as Minebea group (Japan), Seagate Technology (USA) and AT&T Microelectronics. As a result of these investments not only assembly of electrical home appliances for the Thai consumer but also production of industrial use electronic items such as computer-related devices was started during this decade. Thai firms undertaking production on consignment appeared assembling supplied parts from foreign manufacturers. Assembly technology for a wide range of electronics products was introduced and increasingly diffused during this decade.

The latter half of the 1980s proved to be a watershed for the electrical/electronic industries in Thailand. Domestic demand for electrical home appliances showed a clear increase from the latter half of 1986, while export orientated investment rushed into Thailand from Japan and Asian NIEs as a result of the appreciation of the yen and Asian NIEs' currencies by the Plaza Agreement of 1985. The production volume of electrical home appliances in Thailand showed a marked growth penetrating export markets as well. The growth in Thailand from 1985 to 1990 is shown below:

	1985	1990	1990/1980
	('000 set)	('000 set)	(times)
Radio-cassette recorder	357	1,300	3.6
Color television sets	390	2,460	6.3
Electric fans	500	2,760	5.6
Refrigerators	270	900	3.3
Air conditioners	40	300	4.8

Table 5.1-1 shows the number of electronics industry projects which were promoted by the BOI between 1962 and 1992. Starting-up projects increased remarkably after 1987. The cumulative record up to 1992 is for 292 projects but over 200 of these projects started up operations in the four years from 1989 (however, it should be noted that since some companies make multiple investments the number of projects does not equal the number of firms). Particularly significant among the items concerned are the number of investments for electronics items and in particular for semi-conductors. Investments have been made in semi-conductor production by Japanese manufacturers such as Sony, Toshiba, Oki; in production of TV cathode ray tubes (CRT) undertaken as a joint venture between the Siam Cement Group and Mitsubishi (Thai CRT); Sharp in microwave ovens; and in printed circuit board and precision metal parts.

(Note) The domestic production of CRT was begun in 1990 as part of national promotion policy under BOI and so the customs duties imposed on imported CRT were raised from 10% to 30%. This has put pressure on the 13 domestic television assembly manufacturers to use locally produced CRT.

The electrical/electronic industries of Thailand have developed over the 30 years of their history from their beginnings under the import substitution policies in 1962 to become today a base for international production.

Table 5.1-1 ELECTRONICS INDUSTRY PROJECTS UNDER BOI PROMOTION

Year	Projects Starting Up		
	No. of Projects	Investment	No. of Workers
1962	0	0	0
1963	0	0	0
1964	1	3	510
1965	0	0	0
1966	0	0	0
1967	0	0	0
1968	1	39	169
1969	1	469	1,154
1970	1	620	1,266
1971	2	337	548
1972	0	0	0
1973	1	1,228	4,091
1974	3	428	3,423
1975	2	75	701
1976	1	14	104
1977	2	15	130
1978	0	0	0
1979	0	0	0
1980	4	505	1,313
1981	1	4	19
1982	3	542	2,205
1983	3	330	340
1984	5	4,369	3,780
1985	12	6,205	10,918
1986	4	736	1,533
1987	14	4,266	5,095
1988	27	9,583	11,328
1989	70	10,236	16,137
1990	48	11,595	8,925
1991	53	7,572	11,809
1992	33	12,176	9,127
Total	292	71,347	94,625

Sources: Investment Opportunities Study
Electronic Industries in Thailand, BOI.

5.1.2 Import, export and production of electrical/electronic equipment

(1) Scope of the present survey of electrical/electronic appliances

The present survey covers those parts industry for supporting the electrical/electronic equipment listed in Introduction (Page 2～3). It should be noticed that there are a number of items for which data are not necessarily available, so that these have not been covered on all occasions in the Study.

(2) Production of electrical/electronic equipment

Statistical data on the production of electronic/electric equipment are not officially compiled. The Study Team made up incomplete data and information into Table 5.1-3 including those obtained from interviews to manufacturers. Looking at annual growth rates over the five years between 1988 and 1992, rapid growth was experienced with an annual increase in quantitative output for refrigerators calculated at 20.9% up to the very high figure of 83.9% annual growth in production for air conditioners (Table 5.1-2). Taking all five appliances listed below together the simple average for annual growth in output was 47%.

Table 5.1-2 ANNUAL GROWTH RATE IN PRODUCTION (Quantitative base) 1988-1992

Refrigerators	20.9%
Electric Fans	33.6%
Microwave Ovens	34.8%
Air Conditioners	83.9%
Color TVs	61.9%
Simple Average	47.0%

Source: Table 5.1-3

ATTACHMENT 5-1 summarizes a list of the currently operating Thai assemblers of electric/electronic equipment soucing from various directories. In all 70 firms are covered. Table 5.1-4 has been drawn up on the basis of ATTACHMENT 5-1 and shows the number of assembly manufacturers. Here note that an assembler is often producing plural items. From the table there are 27 manufacturers for televisions, 20 for air conditioners, 16 for

radios, and 10 for refrigerators, and 10 for audios as the top five in terms of number of assemblers..

Leaving aside three companies whose equity share is unclear, it is learnt that 47 manufactures or about 70% of the remaining 68 companies are foreign affiliates.

Table 5.1-5 NUMBER OF INVESTMENT BY OWNERSHIP BY DECADE

Year estab.	Foreign J/V	Thai 100%	Ownership Unknown	Total
1960s	6	4	-	10
1970s	5	8	-	13
1980s	26	6	-	32
1990-1992	9	0	-	9
Year unknown	2	2	2	6
Total	48	20	2	70

Source: ATTACHMENT 5-1

The above table shows the foreign investment in the sector as follows. Since 1960s when four Japanese companies invested, the foreign investment took a rest over 1970s. Then, the foreign investment to Thailand boomed in 1980s, in particular in the latter hart of 1980s. The reason of the boom was that Thai government allowed foreign investors to have more than half to 100% of the share capital according to ratios of export of their products from Thailand.

Size of companies in terms of the number of employees is learnt by Table 5.1-6 below as well as by ownership, the foreign J/V or the 100% Thai owned companies:

Table 5.1-6 NUMBER OF EMPLOYEES BY OWNERSHIP

Capital	No. of companies with data	Total no. of employees	No. of employees per company
Foreign J/V	45	42,578	946
100% Thai owned	20	3,647	182
Total / avg.	65	46,225	711

Source: ATTACHMENT 5-1

Table 5.1-3 PRODUCTION OF ELECTRICAL/ELECTRONIC EQUIPMENT IN THAILAND

(Unit: sets)

	1985	1986	1987	1988	1989	1990	1991	1992
Refrigerator	266,981	296,601	408,545	560,849	747,581	904,100	1,084,900	1,200,000
Electric Fan	485,849	538,821	1,012,489	1,411,872	2,096,397	2,759,150	3,310,980	4,500,000
Rice Cooker	n.a.	457,948	n.a.	794,145	1,137,261	1,513,997	n.a.	n.a.
Microwave Oven	0	0	0	484,000	976,989	1,057,700	1,300,000	1,600,000
Washing Machine	n.a.	n.a.	n.a.	n.a.	52,250	120,900	170,000	n.a.
Air Conditioner	40,800	38,760	52,518	96,195	111,130	188,000	700,000	1,100,000
Color TV	386,300	413,123	512,216	756,460	1,339,096	2,459,650	3,900,000	5,200,000
VTR	0	0	0	0	0	0	3,100,000	4,200,000
Radio Cassette Recorder	357,472	373,978	636,795	835,339	1,016,720	1,307,400	n.a.	n.a.
Car Stereo	0	0	0	0	0	0	220,000	310,000
Telephone Set	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5,600,000	7,500,000
Copier	0	0	0	0	0	0	0	150,000
Printer	0	0	0	0	0	0	990,000	1,110,000
Facsimile	0	0	0	0	0	0	200,000	550,000

Source: Estimated by the JICA Study Team, on the basis of the statistical data from the Ministry of Industry, The Board of Investment and Bank of Thailand

Table 5.1-4 NUMBER OF SET-MAKERS BY PRODUCT 1/
(ELECTRICAL AND ELECTRONIC)

	Products	Total	Ownership		
			J/V 2/	Thai 100%	Unknown
1)	TV	27	15	11	1
2)	Air Conditioner	20	15	5	0
3)	Radio	16	7	9	0
4)	Refrigerator	10	10	0	0
5)	Audio	10	4	6	0
6)	Computer	8	5	3	0
7)	Telephone	6	5	1	0
8)	Washing Machine	7	7	0	0
9)	VTR	6	5	1	0
10)	Electric Fan	5	4	1	0
11)	Cordless Telephone	4	3	0	1
12)	Microwave Oven	3	3	0	0
13)	Rice Cooker	4	3	1	0
14)	FDD	3	2	0	1
15)	Keyboard	2	2	0	0
16)	Facsimile	1	1	0	0
17)	Printer	1	1	0	0
18)	Calculator	1	1	0	0
19)	Copier	1	1	0	0
20)	HDD	0	0	0	0
21)	Monitor	2	2	0	0
22)	Others	5	4	1	0
	Total	142	100	39	3

Source: ATTACHMENT 5-1
Note: 1/ Since some set-makers manufacture prural products, the above number of set-makers is not equal to that of establishments.
2/ J/V includes foreign-100% ownership.

Foreign J/V companies share 92% of total number of employees of this sector. Provided that the total number of employees would proportionate the production value, the foreign affiliates account for 92% of the production value of Thailand's electrical/electronic industry. The foreign investment to Thailand made by set-makers or assemblers in electrical/electronic industry will be further examined below.

Table 5.1-7 NUMBER OF FOREIGN INVESTMENTS BY RATIO OF EQUITY PARTICIPATION (1981-1992)

Ratio of foreign equity	Number of foreign investment
less than 50%	8
51-59%	3
60-69%	0
70-99%	6
100%	14
Total	31

Table 5.1-7 above shows the number of the foreign investment since 1981 to 1992 by the ratio of foreign equity participation for 31 companies for which data are available.

In the period between 1981 and 1992, 14 companies of total 31 foreign companies were 100% foreign owned. These 14 companies were completely export orientated (more than 80% of their output must go to export markets). A total of nine other export-orientated companies had less than 100% and more than 50% equity in company holdings. If the Thai government had not implemented investment incentive policies favoring exporting firms the only foreign investment attracted to Thailand over the same period might have remained the eight companies listed above as having less than 50% equity. The above also shows that the rapid increases in production shown in Table 5.1-3 were the result of increased exports.

Table 5.1-8 IMPORT AND EXPORT OF ELECTRICAL/ELECTRONIC EQUIPMENT (1/2)

(Units: Quantity in 1,000 sets
Value in Million Bahts)

Products	Import or Export	1989		1990		1991		1992	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
A. Electrical Home Appliances	**Import**	**557**	**2,294**	**1,248**	**3,159**	**1,415**	**3,383**	**3,230**	**3,057**
	Export	**3,120**	**5,028**	**4,632**	**6,977**	**5,390**	**11,537**	**6,733**	**15,527**
Air Conditioner	Import	76	571	76	609	44	719	76	679
	Export	50	330	247	1,474	710	4,049	1,205	6,605
Refrigerator	Import	24	941	41	1,520	34	1,702	64	1,419
	Export	187	989	219	1,271	496	2,687	543	3,321
Washing Machine	Import	135	554	166	704	140	704	129	699
	Export	19	48	47	155	62	218	86	302
Microwave Oven	Import	37	145	27	109	13	61	27	105
	Export	1,060	2,601	1,092	2,394	1,482	3,137	1,739	3,692
Electronic Fan	Import	285	83	938	217	1,184	197	2,934	155
	Export	1,804	1,060	3,027	1,683	2,640	1,446	3,160	1,607
B. Electronic Home Appliances	**Import**	**3,870**	**2,844**	**9,779**	**4,808**	**8,221**	**4,750**	**19,577**	**6,545**
	Export	**4,680**	**5,406**	**59,222**	**13,012**	**94,051**	**20,166**	**70,775**	**26,684**
TV (Color and B & W)	Import	461	998	957	1,649	1,707	1,691	7,247	2,365
	Export	535	1,857	1,598	6,488	2,909	11,886	5,668	17,004
VTR	Import	207	868	867	1,466	760	1,339	365	1,697
	Export	757	2,868	1,567	5,265	1,859	7,151	2,705	8,798
Radio and Stereo Set	Import	2,857	869	7,869	1,524	5,594	1,579	11,695	2,259
	Export	2,341	247	54,846	782	88,112	681	61,068	443
Tape Recorder	Import	345	109	86	169	160	141	270	224
	Export	1,047	434	1,211	477	1,171	448	1,334	439

Table 5.1-8 IMPORT AND EXPORT OF ELECTRICAL/ELECTRONIC EQUIPMENT (2/2)

(Units: Quantity in 1,000 sets
Value in Million Bahts)

Products	Import or Export	1989		1990		1991		1992	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
C. Communication Equipment	**Import**	**476**	**2,591**	**721**	**3,377**	**1,739**	**3,777**	**2,576**	**4,277**
	Export	**1,923**	**1,298**	**4,660**	**2,898**	**7,837**	**5,104**	**9,133**	**5,240**
Telephone Set	Import	409	250	556	466	1,553	386	2,257	365
	Export	1,116	781	3,493	2,282	5,854	3,786	7,322	4,108
Cordless Telephone Set & Transmission Apparatus	Import	67	2,341	165	2,911	186	3,391	319	3,912
	Export	807	517	1,167	616	1,983	1,318	1,811	1,132
D. Office Automation Equipment	**Import**	**231**	**1,462**	**956**	**1,676**	**686**	**2,107**	**798**	**2,512**
	Export	**867**	**513**	**6,589**	**1,350**	**23,793**	**3,332**	**35,855**	**5,408**
Facsimile	Import	–	2	382	13	–	9	–	37
	Export	–	–	–	–	2	4	4	2
Data Processor (Computer)	Import	14	849	15	816	27	1,259	59	1,418
	Export	0	0	7	275	13	352	23	61
Electronic Calculator	Import	193	68	532	96	633	90	709	88
	Export	867	511	6,582	1,053	23,777	2,954	35,736	4,184
Photo-copy Machine	Import	19	476	20	660	17	617	22	855
	Export	–	2	–	22	0.6	22	92	1,156
Word Processing Machine	Import	1	15	3	36	3	46	1	15
	Export	–	–	–	–	–	–	–	5
Cash Register	Import	4	52	4	55	6	86	7	99
	Export	–	–	–	–	–	–	–	–
GRAND TOTAL (A.+B.+C.+D.)	**Import**	**5,134**	**9,191**	**12,704**	**13,020**	**12,061**	**14,017**	**26,181**	**16,391**
	Export	**10,590**	**12,245**	**75,103**	**24,237**	**131,071**	**40,139**	**122,496**	**52,859**
TOTAL BALANCE (Export – Import)	**Balance**	**5,456**	**3,054**	**62,399**	**11,217**	**119,010**	**26,122**	**96,315**	**36,468**

(Note) See ANNEX V for classification codes of each item.

(Source) FOREIGN TRADE STATISTICS, Custom Department

Table 5.1-9 IMPORT, EXPORT AND BALANCE OF FINISHED GOODS, 1992
(ELECTRICAL AND ELECTRONIC EQUIPMENT)

	Value in 1992 (Million Bahts)					
	Export	(%)	Import	(%)	Balance 1/	(%)
A. Electrical Home Appliances	15,527	(29.4)	3,057	(18.7)	12,470	(34.2)
B. Electronic Home Appliances	26,684	(50.5)	6,545	(39.9)	20,139	(55.2)
C. Communication Equipment	5,240	(9.9)	4,277	(26.1)	963	(2.6)
D. Office Automation Equipment	5,404	(10.2)	2,512	(15.3)	2,892	(7.9)
Total	52,855	(100.0)	16,391	(100.0)	36,464	(100.0)

Source: Table 5.1-8
Note: 1/ Balance = Export – Import

(3) Exports and imports of electrical/electronic equipment

Table 5.1-8 shows the quantity and value of imports and exports of the various electrical/electronic equipment by product, while Table 5.1-9 is a summary by subsector of imports, exports and their balance. An analysis shall precede below referring to these two tables. (Note: The figures given for product value are at current prices and no adjustments have been made to take account of currency fluctuations or inflationary trends.)

The import-export balance for 1992 for the electrical/electronic equipment shows an excess of 36.5 billion Bahts in favor of exports. This excess is twelve times in value and 18 times in quantity in comparison with those for 1989. This resulted from the fact that the export value for 1992 was 4.3 times more than that for 1989 and export quantity was 11.6 times between the same two years in spite that imports 1992 had only increased 1.8 times more in value and 5.1 times more in quantity over their levels of 1989.

Looking at the share of export and import for 1992 by the product categories as shown in Table 5.1-9, exports of electrical home appliances and electronic home appliances shared 29.4% and 50.5% of the total exports in 1992 respectively, giving a total of 80% for the home appliance category. Communication equipment and office automation equipment taken together shared a 20% level of the total exports. On the other hand, a share of imports of home appliances (both electrical/electronic) was just under 60% and by just over 40% in the case of communication equipment and office automation equipment taken together. It can be said that the main thrust of development in electrical/electronic industries of Thailand has come from the home appliances sector.

By names of product items, Table 5.1-10 shows the value of export, import and their balance (exports minus imports) for the top three items in 1992. First place was taken by television sets which accounted for 32% of the total export value for electrical/electronic goods, being followed by VTR sets in second place with 17% and air conditioners in third place with 13%. The sum of these three products for 61% of the total export value of electrical/electronic goods. The first place in imports was occupied by telephones (including portable and wireless phones) with 24% of the total,

followed by televisions in second place with 14%, radios and stereo equipment in third place with 14%. The sum of the top three import items shares 52% of the total value of imports. The top three items showing the largest excess balance of exports over imports are the same items as the top three for export value in the same order. Summing up the main driving force of the Thai electrical/electronic industries comes from output of television sets, VTR, and air conditioners, and television sets are by far the biggest single item.

Note; The above summarizes the structure of imports and exports of electrical/electronic equipment in terms of finished goods. However, imports of parts inevitably support the increase in exports and so it is also necessary to carry out an analysis of this aspect. Overall analysis of exports and imports combining those for finished goods and parts will be made in the section 4.2.

(4) Domestic demand for electrical/electrical equipment

Although it is theoretically possible to estimate domestic demand on the basis of statistics for production and external trades (taking domestic demand to be production plus imports minus exports), in the country such a method is not practicable because of the lack of the industrial statistics. Accordingly, the Team has estimated the production quantities and domestic demand on the basis of information gathered through interviews with manufacturers and the fragmentary data available. These estimates are shown in Table 5.1-11. It is impossible to provide long term estimates or comprehensive coverage for all goods concerned and so the Team has restricted estimates to home appliances in 1992.

When the domestic production compared with the domestic consumption in quantity, the production exceeded the consumption for all items. And all the items except refrigerators and washing machines were exported more than 50% of the total domestic production: Electrical/electronic home appliances industries in Thailand have already grown to an export industry.

According to results of the interviews conducted with local set makers the annual increase in domestic Thai demand over the last 3 to 5 years are

estimated to have been as follows;

ANNUAL GROWTH RATE OF DOMESTIC DEMAND

Color TVs Sets; 7%	Washing Machines; 10%
VTRs; 10%	Electric Fans; 15%
Refrigerators; 14%	Rice Cookers; 8%
Air Conditioners; 14%	Microwave Ovens; 10%

The most of set makers forecast similar levels of annual increase in demand to continue up to the year 2000 with the exception of electric fans.

Table 5.1-10 EXPORT, IMPORT AND BALANCE OF TOP THREE PRODUCTS IN 1992

PRODUCTS	Value (Million Bahts)	Share of Grand Total
A. Export		
1. TV (Color and B&W)	17,004	32.2 %
2. VTR	8,798	16.6 %
3. Air Conditioner	6,605	12.5 %
Sub-Total	32,407	61.3 %
Grand Total	52,859	100 %
B. Import		
1. Telephone Set incl. Wireless	3,916	23.9 %
2. TV (Color and B&W)	2,365	14.4 %
3. Radio and Stereo Set	2,259	13.8 %
Sub-Total	8,540	52.1 %
Grand Total	16,391	100 %
C. Balance (A-B)		
1. TV (Color and B&W)	14,639	40.1 %
2. VTR	7,101	19.5 %
3. Air Conditioner	5,926	16.3 %
Sub-Total	27,666	75.9 %
Grand Total	36,464	100 %

Source: Table 5.1-8

Table 5.1-11 PRODUCTION, CONSUMPTION AND EXPORT OF ELECTRICAL HOME APPLIANCES IN 1992

(Unit : 1,000 sets)

ITEM	(1) PRODUCTION	(2) CONSUMPTION (Share of (1))	(3) ((1) - (2)) (Share of (1))
A. Electrical Home Appliances			
Refrigerator	1,200	730 (60%)	470 (39%)
Air-Conditioner	1,100	220 (20%)	880 (80%)
Microwave Oven	1,600	30 (2%)	1,570 (98%)
Washing Machine	240	200 (83%)	40 (17%)
Electric Fan	4,500	2,150 (48%)	2,350 (52%)
Rice Cooker	2,600	900 (35%)	1,700 (65%)
B. Electronic Home Appliances			
Color TV	5,200	930 (18%)	4,270 (82%)
VTR	4,200	260 (6%)	3,940 (94%)
Audio	4,000	1,200 (30%)	2,800 (70%)

(Source) JICA Team estimate

5.1.3 Interview to electrical/electronic assemblers

An interview survey was requested through the Ministry of Industry of Thailand with major electrical/electronic assemblers operated in Thailand. The following 12 firms were interviewed. These firms account for about 80% of the total production of color television sets and about 90% of total production of refrigerators in Thailand.

		Estab. in
1)	National Thai Co., Ltd.	1961
2)	A.P. National Co., Ltd.	1979
3)	Hitachi Consumer Products (Thailand) Ltd.	1970
4)	Thai Toshiba Electric Industries Co., Ltd.	1969
5)	Sanyo Universal Electric Co., Ltd.	1959
6)	Kang Yong Electric Co., Ltd.	1964
7)	Federal Electric Corp., Ltd.	1987
8)	Sharp Appliances (Thailand) Ltd.	1987
9)	NEC Technologies (Thailand) Co., Ltd.	1988
10)	Canon Hi-tech (Thailand) Ltd.	1990
11)	Fujitsu (Thailand) Co., Ltd.	1989
12)	Thai Heat Exchange Co., Ltd.	n.a.

ATTACHMENT 5-5 tabulates this interview survey. The following explains its gist.

(1) Market trends and expansion plan

All of the manufacturers foresee a steady growth of domestic demand for electrical/electronic equipment. Electric fans, rice cookers, refrigerators, color TVs, radios and radio cassettes are now comparatively popular in the Thai market. The number of these equipment sold in 1993 were estimated at 2.4 million for electric fans, 1.2 million for radios and radio cassettes, 1 million for color TV sets, 1 million for electric rice cookers, and 0.8 million for refrigerators. There will be also a growing demand for such equipment as air conditioners, washing machines, microwave ovens, VTRs, car stereo sets, and OA equipment.

A total of 11 of the 12 firms interviewed replied that they planned to expand production capacity, and 6 of these were considering expansion at the existing factory sites. An assembler currently located in BOI Zone I said that the company was considering to relocate its factory to BOI Zone III to get export incentives.

(2) Local procurement of parts/components

A total of 12 assemblers interviewed by the Study Team can be classified into two groups of local market orientated and export orientated firms in accordance with the principle market they are aiming at. The local market orientated firms tend to maintain in-house production of components and parts while the export orientated firms are rather committed to local procurement and imports.

Production processes for which there is a strong demand for local supply include electroplating, machining, press work, rubber processing and plastic processing. There is an especially strong demand among communication and OA equipment assemblers for the development of plastic processing capabilities.

The main problems indicated with regard to currently operating local parts suppliers were the low quality levels (10 firms) and unstable delivery (8 firms). Many of the local market orientated assemblers also pointed to the low levels of technology and productive capacity (5 firms).

Almost all of the assemblers, irrespective of whether they are locally capitalized or foreign-affiliated, consider that active investments and/or technical cooperation from overseas parts manufacturers will promote their local procurement of parts. Three Japanese assemblers had already requested Japanese parts manufacturers to invest in Thailand and such requests are expected to increase in the future.

(3) Linkages with parts suppliers

Two of the 12 firms interviewed said that they had a co-operation club for

local suppliers while three other firms expressed an interest in creating such a club. All five of these firms seem to have an idea for an exclusive sub-contracting with a long-term contract system in mind, but the overall feeling is that the strong spirit of independence among the local suppliers will make the realization of such systems difficult.

The majority of assemblers replied that they have given some assistance to their suppliers; technical assistance (9 cases), supply of moulds and dies (9 cases), and supply of raw materials (7 cases). A large number of assemblers said they would add managerial assistance, dispatch of senior staff, and training overseas in the future.

(4) Cooperation among assemblers

To date there have been very few cases for assemblers who were mutually competing cooperatively to request a parts supplier to invest to Thailand for a common supply of parts and most companies were negative about the future possibility of such collaboration (10 firms). Most assemblers also said that standardization of components and parts for common use among competitors would be difficult.

Companies were also asked whether they would be willing to cooperate in technology transfer programs for which three parties, the government, assemblers and part suppliers, would be together worked out in collaboration. A total of 9 companies expressed a positive attitude to such programs. Among the export orientated assemblers, however, there is a strong commitment to following their own programs.

(5) Global strategies and division of labor within the ASEAN region

About 40% of all assemblers had any complementary parts procurement plans within the ASEAN region. For example, a color TV assembler exported its plastic front cabinets from in Thailand to Singapore.

Nearly 75% of the assemblers said that they keep a close watch on trends relating to AFTA and are considering how to cope with AFTA. Some export orientated assemblers have found it necessary to further reduce production

cost to compete with their sister companies in the ASEAN region.

(6) Requests to the government of Thailand

Half of the assemblers requested reduction of the import duties on parts and materials. They pointed out that duties on electronic parts are very high. For example, a finished tuner is imposed a import tax of 20%, while tuner parts is imposed a much higher import tax of 65%, which has made it difficult to increase the local production of tuners.

There was a strong demand among the export orientated assemblers for simplification of trade procedures. Where parts locally supplied are assembled to export as a product, the procedures for refunding the import duties are complicated and time consuming.

Other requests frequently cited were reinforcement of technical education, relieving of traffic congestion, and promotion of foreign investment. Three local companies were ready to launch joint venture with overseas electronic parts manufacturers.

5.2 Electrical/Electronic Parts Industry In Thailand

5.2.1 Development history of the electrical/electronic parts industry in Thailand

The Study Team has identified 175 primary suppliers in electrical/electronic industries by using data and information obtained through interviews to the set makers and various directories. An alphabetical list of the primary suppliers is attached as ANNEX VI.

The following table summarizes the number of investment projects related to the electrical/electronic parts industry (limited to primary suppliers) by decade.

Table 5.2-1 NUMBER OF PARTS INDUSTRY PROJECTS BY DECADE (ELECTRICAL/ELECTRONIC)

Decade	Ownership				Total
	F. 100%	F. 51-99%	F. 1-49%	Thai 100%	
1950s	0	0	2	0	2
1960s	0	0	2	6	8
1970s	2	1	3	6	12
1980s	13	11	20	16	60
1990s-1992	3	2	6	2	13
Total	18	14	33	30	95

(Note)F.: Foreign share of capital
(Source) ANNEX VI

The following section briefly describes the development history of the electrical/electronic parts industry in Thailand by decade. Note that companies and the number of companies mentioned below are limited to those which are still operating in the country, together with the name of components and parts.

(1) 1950 - 1959

Two set makers, Philips Electric and Sanyo Universal Electric built their plants in 1950s. Two parts suppliers, both joint ventures, were established during the period. One is Sanyo Universal Electric herself because she is listed as a parts supplier as well. Another suppliers produces tin plates

which were used for not only the electrical/electronic industry but various fields of industries. Thus, it is regarded that no electrical/electronic parts suppliers existed during the period.

(2) 1960 – 1969

During the period, 8 set makers invested to serve domestic demand. On the other hand, parts suppliers amounted to 8 only (6 for Thai 100%, 2 for J/V) so that set makers procured components and parts by import or in-house production. In-house production has somewhat become the norm of set makers established during the period, and many of them still produce parts by themselves even now. There were 6 parts makers wholly owned by local capital, of which 4 make plastic parts and the other two also do not supply functional parts. There are 2 joint ventures, one produces speakers and another paints. Overall, not much growth was seen in parts suppliers in the decade.

(3) 1970 – 1979

A total of 5 set makers and 12 parts suppliers were established during the period. Of 12, 6 are wholly owned by Thai capital and mainly produce plastic parts, while one company produces a functional part, namely capacitors. And, 2 companies are wholly owned by foreign companies (Germany), and one produces pigments and another magnets, although they have not produced electrical/electronic parts only. The rest was 4 joint ventures: One company produces condensers, 1 plastic parts, and 2 paints. During the decade, not much investment by parts suppliers was seen to reflect relatively a small number of investment projects by set makers. Nevertheless, several manufacturers of condensers and capacitors were established to mark the beginning of explosive growth of parts makers during the subsequent decade.

(4) 1980 – 1989

The investment to the industry grew and flourished over the decade. In total, 60 parts suppliers were established during the decade: 44 are foreign

affiliates, and 24 more than 51% owned by foreign capital. The figures suggest two different patterns in foreign investment. One represents a group of companies who have established production bases in Thailand to export parts because of favorable investment climate, another group intended to serve set makers operating in the country to meet increasing demand in the domestic market. Compared to the automotive industry, the electrical/electronic industry shows a significantly high percentage of direct exports of component and parts. During the decade, investment projects by set makers amounted to 28.

In the area of raw materials, several coil centers to cut sheet metals into required sizes started operation. Commercial production of wires was started during the period, as well as a variety of functional parts, including ICs, PCBs, wire harnesses, capacitors, relays, switches, cassette tapes, compressors, and evaporators.

A total of 16 suppliers was wholly owned by local capital, with an increasing number of stamping press products as well as plastic parts. Production of functional parts, such as PCBs, wire harnesses, heads, aluminum diecast, and switches was commenced. The most notable event is production of cathode ray tubes started by Thai CRT in 1989.

(5) 1990 – 1992

New projects in components and parts industries numbered 13 during these 3 years, suggesting that momentum in 1980s still continued in the first half 1990s. Among 13, 11 projects were foreign-based companies. Investment in production of PCB, electronic parts, compressors of refrigerators and copper pipes was remarkable in the years.

5.2.2 Production, export and import of electrical/electronic parts

(1) Production of electrical/electronic parts

Production of electrical/electronic components and parts in Thailand could not be figured out neither in quantity nor value due to the lack of

industries statistics. Estimation is impossible too because new projects have rushed and caused dynamic change in these year.

(2) Export and import of electrical/electronic parts

In Table 5.2-3, export and import data on components and parts for electrical/electronic equipment are exerted and recompiled, as far as possible, from trade statistics published by Customs Department. Note that components and parts for heavy electrical equipment are not included. First of all, aggregate data show the following changes between 1989 and 1992 (Table 5.2-2):

Table 5.2-2 CHANGE OF IMPORT AND EXPORT BETWEEN 1989 AND 1992 (ELECTRICAL/ELECTRONIC COMPONENTS AND PARTS)

	1989 (Billion B)	1992 (Billion B)	1992-1989 (Billion B)	1992/1989 (Ratio)
(1) Import	30.3	60.7	30.4	2.0
(2) Export	21.5	44.6	23.1	2.1
(1)-(2)	8.8	16.1	7.3	1.8

Source: Table 5.2-3

As seen in the table, imports of electrical/electronic components and parts doubled between 1989 and 1992 from 30.3 billion Bahts to 60.7 billion Bahts. This represents an increase of 30.4 billion Bahts. On the other hand, exports grew by 2.1 times from 21.5 billion Bahts to 44.6 billion Bahts, representing an increase of 23.1 billion Bahts.

In terms of trade balance, the country recorded a deficit of 8.8 billion Bahts in 1989, which increased by 1.8 times to 16.1 billion Bahts in 1992. Looking at individual component categories by Table 5.2-3, integrated circuits dominated exports and imports in 1992, accounting for 61% and 64% of total respectively. IC trade also shows a deficit of 8.3 billion Bahts in 1992, which shares 52% of the total deficit of 16.1 billion Bahts. This is because (1) although Thailand is one of major IC exporters, parts for IC are mostly imported, (2) import of IC which are not available in Thailand in terms of specification have increased significantly, and (3) IC

imports for re-export purposes grew rapidly.

The second largest deficit came from cathode-ray tubes (CRTs) for TVs and amounts to 4.5 billion Bahts. While CRTs for the domestic market are mostly supplied by Thai CRT, those for re-export as a parts of TV have increased. Re-exports of CRTs are thus included in TV exports of 17 billion Bahts in 1992.

(Note) Imported parts for the assembly of finished goods for re-export are statistically recorded only in the classification of imports.

Other items producing the deficit are electronic elemental parts, including capacitors (2.4 billion Bahts), transformers (1.3 billion Bahts), and registers (0.9 billion Bahts)

On the other hand, printed circuit boards (PCBs) showed a major surplus of 2 billion Bahts in 1992. This reflects active investment by 9 PCB makers, 1 in the 1970s, 6 in the 1980s, and 2 in the 1990s (see ANNEX 5).

(3) Export and import of the entire electrical/electronic industry

With regard to the fact that exported finished goods include imports of their parts, they have to be viewed as exports and imports of the entire electrical/electronic industry. Table 5.2-4 shows the aggregated export and import data as a sum of exports and imports of finished goods (Table 5.1-8) and those of components and parts (Table 5.2-3).

Table 5.2-4 OVERALL TRADE OF ELECTRICAL AND ELECTRONIC INDUSTRY

(Unit : Million Bahts)

	1989	1990	1991	1992	Ratio 1992/1989
(1) Export of Finished Goods	12,245	24,237	40,139	52,859	4.3
(2) Export as Component/Parts	21,533	27,547	35,441	44,578	2.1
A. Export Total	33,778	51,784	75,580	97,437	2.9
(3) Import of Finished Goods	9,191	13,020	14,017	16,391	1.8
(4) Import as Components/parts	30,293	40,665	51,675	60,651	2.0
B. Import Total	39,484	53,685	65,692	77,042	2.0
(5) Balance (A. - B.)	(5,706)	(1,901)	(9,888)	(20,395)	-

Souce: Table 5.1-8 and Table 5.2-2

As seen in the table, the electrical/electronic trade for the country recorded a deficit of 5.7 billion Bahts in 1989 and 1.9 billion Bahts in 1990, then it turned to a surplus of 9.9 billion Bahts in 1991 and 20.4 billion Bahts in 1992. A major reason for this is a rapid increase in export of finished goods by 4.3 times during 1989 to 1992. Moreover, exports of components and parts grew by 2.1 times, and total electrical/electronic exports by 2.9 times. On the other hand, the entire imports of electrical/electronic industry remained by 2 times. In particular, imports of finished goods remained by 1.8 times.

In terms of value, components and parts accounted for the largest part of imports, 79% of total. Greater part of them are re-exported as part of finished goods.

Table 5.2–3 IMPORT AND EXPORT OF MAIN COMPONENTS AND PARTS (ELECTRICAL ELECTRONIC) (1/2)

(Unit: Value in Million Bahts)

Products	Import or Export	1989		1990		1991		1992	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
A. Components and Parts	**Import**	**—**	**1,883**	**—**	**3,028**	**—**	**4,033**	**—**	**4,369**
(Qty: ton)	**Export**	**—**	**744**	**—**	**1,307**	**—**	**2,354**	**—**	**3,828**
Air Conditioner	Import	776	193	3,516	486	2,671	751	2,250	679
	Export	2,380	499	2,422	480	4,162	854	3,649	735
Refrigerator	Import	1,150	287	922	286	1,736	537	1,236	450
	Export	189	36	736	164	405	82	475	100
Washing Machine	Import	317	55	588	113	565	127	32	4
	Export	5	1	–	–	6	1	900	167
TV and Radio excl. CRT	Import	3	1,348	7	2,143	4	2,618	7	3,236
	Export	1	208	2	663	4	1,417	6	2,826
B. Critical Parts	**Import**	**—**	**1,982**	**—**	**3,044**	**—**	**4,064**	**—**	**6,227**
(Qty: 1,000 sets)	**Export**	**—**	**7**	**—**	**428**	**—**	**867**	**—**	**972**
Cathode–Ray Tube (CRT) for TV	Import	1,492	1,980	2,313	2,560	3,550	3,438	5,234	5,413
	Export	22	7	362	428	1,434	853	1,460	950
Magnetoron for Microwave Oven	Import	0.1	2	1,040	484	1,487	626	1,685	814
	Export	0.7	0.3	0.7	0.3	3.2	14	234	22

Table 5.2–3 IMPORT AND EXPORT OF MAIN COMPONENTS AND PARTS (ELECTRICAL ELECTRONIC) (2/2)

(Unit: Value in Million Bahts)

Products	Import or Export	1989		1990		1991		1992	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
C. Electronic Parts and Device (Qty: ton)	**Import**	**—**	**26,428**	**—**	**34,593**	**—**	**43,578**	**—**	**50,055**
	Export	**—**	**20,782**	**—**	**25,812**	**—**	**32,220**	**—**	**39,778**
Registor	Import	715	269	1,567	504	3,923	1,076	5,074	1,442
	Export	37	119	39	121	532	389	1,479	522
Capacitor (Condensor)	Import	1,428	1,368	2,392	2,278	3,060	3,094	3,453	3,888
	Export	403	351	913	701	1,326	1,361	1,978	1,490
Transformer	Import	131	782	236	1,367	272	1,892	298	2,340
	Export	10	172	23	398	41	708	72	1,008
Micro Motor	Import	27	679	37	1,107	46	1,694	47	2,004
	Export	12	1,140	18	1,695	22	2,101	27	2,374
Printed Circuit Board (PCB)	Import	105	911	191	1,506	268	2,843	300	3,296
	Export	52	575	71	1,247	108	1,658	105	5,315
Relay	Import	3	110	4	199	5	214	5	200
	Export	–	1	4	70	16	249	34	450
Integrated Circuit	Import		22,309	–	27,632	–	32,765	–	36,885
	Export		18,424	–	21,580	–	25,754	–	28,619
GRAND TOTAL (A.+B.+C.)	**Import**	**—**	**30,293**	**—**	**40,665**	**—**	**51,675**	**—**	**60,651**
	Export	**—**	**21,533**	**—**	**27,547**	**—**	**35,441**	**—**	**44,578**

Note: See ANNEX V for classification codes of each item.

Source: FOREIGN TRADE STATISTICS, Custom Department

5.2.3 Structure of the electrical/electronic parts industry

(1) Analysis of types of parts suppliers

As mentioned earlier, statistics related to suppliers of components and parts for electrical/electronic equipment are not well developed in the country. This section attempts to analyze the structure of the electrical/electronic components and parts industry on the basis of "Directory of Supporting Industries in Thailand 1993" compiled by SEAMICO Business Information & Research Co., Ltd. The directory lists 393 companies as supporting industries for the electrical/electronic industry in Thailand.

From the directory, 18 subsectors have been identified as supporting industries, and the number of enterprises, ownership, and employment in each subsector are calculated and listed in Table 5.2-5. First of all, all the enterprises in the table, except for those lacking the data (indicated as n.a.), are classified according to ownership as follows:

Table 5.2-5 OWNERSHIP OF PARTS SUPPLIER (ELECTRICAL/ELECTRONIC)

Ownership	No. of enterprises	Composition
100% local:	172	46.0%
100% foreign:	82	21.9%
Foreign/J/V:	120	32.1%
	374	100.0%

Enterprises wholly owned by foreign capital account for 22% of total, and foreign-affiliated enterprises including joint ventures represent 54% of total. Japanese companies account for 57% of all the wholly owned foreign enterprises and 66% of all the joint ventures.

Table 5.2-6 COMPOSITION OF ELECTRICAL/ELECTRONIC SUPPORTING INDUSTRY SOURCED BY DIRECTORY

Code	Subsector	Total No. of Companies	By Ownership			By No. of Employees				
			Thai 1/	For.2/	n.a.	~100	101~200	201~500	501~	n.a.
11	Iron & Steel Basic Industries	10	5	4	1	0	4	3	2	1
12	Non-Ferrous Metal Basic Industries	10	4	6	0	3	1	3	2	1
21	Mould Making	6	4	2	0	5	0	0	1	0
22	Other Metal Machining	5	2	3	0	2	1	2	0	0
30	Spring & Wire Products	15	6	7	2	12	1	1	1	0
31	Precision Parts & Components	9	3	6	0	0	0	1	5	0
33	Other Metal Fabrication	20	9	9	2	3	5	4	2	2
40	Heat Treatment & Surface Finishing	1	0	0	1	7	0	1	0	0
51	Other Machinery & Equipment	5	2	3	0	1	0	1	0	0
60	Electrical Parts & Components	117	81	30	6	4	32	21	20	2
61	Electronic Parts & Components	132	27	99	6	42	22	31	36	8
70	Plastic & Synthetic Fibres	43	20	22	1	35	10	11	4	0
71	Rubber Products	4	2	2	0	18	0	2	0	0
72	Glass Products	3	2	1	0	2	0	1	1	0
73	Ceramic Products	1	0	1	0	1	0	1	0	0
74	Pulp & Paper Products	1	1	0	0	0	1	0	0	0
75	Chemicals	5	1	4	0	3	1	0	0	0
79	Other Non-Metal Parts & Process	6	3	3	0	2	2	1	1	0
	Total	393	172	202	19	140	80	84	75	14

Notes: 1/ Thai 100% ownership
2/ Jointventure with a foreign investor(s) or foreign 100% ownersh

Source: Directory of Supporting Industries in Thailand 1993, SEMICO Business Information & Research Co. Ltd.

Focusing on individual subsectors in Table 5.2-6, foreign-affiliated companies dominate electronic parts (Code No.61) with a 75% share. On the other hand, wholly owned local enterprises and foreign-affiliated ones get even in iron castings, forgings, and basic metal (Code No.11), metalworking products (Code No.33), and plastic components and parts (Code No.70). Local enterprises dominate electrical parts (Code No.60) with a 73% share.

Secondly, all the enterprises in Table 5.2-7, except for those lacking the data (indicated as n.a.), are classified according to employment size as follows:

Table 5.2-7 COMPANY SIZE OF PARTS SUPPLIER
(NUMBER OF EMPLOYEES)

Employment size	No. of enterprises	Composition
100 or less	140	36.9%
101 - 200	80	21.1%
201 - 500	84	22.2%
501 -	75	19.8%
	379	100.0%

Enterprises employing 101 - 500 persons exceed those with 100 or less employees in number, and those with 501 or more employees account for 20% of total. Thus, electrical/electronic components and parts suppliers seem to be larger in size than the industrial average for the country.

Looking at individual subsectors, enterprises with 100 or less employees account for major portions of metalworking products (Code No.33), electrical components and parts (Code No.60), and plastic parts (Code No.70). In particular, the enterprises account for 80% of those listed in metalworking products (Code No.33). On the other hand, electronic parts (Code No.61) and iron castings, forgings, and basic metal (Code No.11) are dominated by relatively large enterprises. In the electronic parts subsector, enterprises with 501 or more employees account for nearly 30% of total. All the enterprises listed in the castings, forgings, and basic metal subsector employ 101 or more persons.

(2) The number of the electrical/electronic parts manufacturers

As done for the automotive parts industry in 4.2.3 (2), the structure of the electrical/electronic parts industry is analyzed by using "the total number of enterprises" and "stratification of primary suppliers and secondary or more down-stream suppliers." The result of estimation is summarized as follows:

(Note) The figures in the parentheses indicate the number of enterprises which are producing autoparts as well.

(a) The number of enterprises serving the automotive and electrical/electronic industries:	744
(b) The number of enterprises manufacturing electrical/electronic parts:	402 (32)
(c) The number of primary suppliers producing electrical/electronic parts (See 4.2.4):	175 (11)
(d) The number of electrical/electronic parts suppliers other than primary suppliers:	227 (21)
(e) The number of export-oriented suppliers among (d):	73 (4)
(f) The number of parts suppliers serving the domestic market ((d)-(e)):	154 (13)

Then based on the results of interview surveys conducted by the Study Team, which supplement partial data available from the directories, the suppliers are grouped into OEMs and REMs. The interview survey on the domestic supporting industry has revealed that there are 67 electrical/electronic parts suppliers that are classified into (f) above. They are further divided into OEMs and REMs as follows:

Enterprises exclusively producing OEM products:	37 (55%)
Enterprises producing OEM/REM products:	18 (27%)
Enterprises exclusively producing REM products:	12 (18%)
Total	67 (100%)

Assuming that the above percentage distribution can be applied to breakdown of the 154 enterprises in (f):

Enterprises exclusively producing OEM products:	85 (55%)
Enterprises producing OEM/REM products:	41 (27%)
Enterprises exclusively producing REM products:	28 (18%)
Total	144 (100%)

From the above analysis, the general structure of the electrical/electronic parts industry in Thailand is estimated as follows:

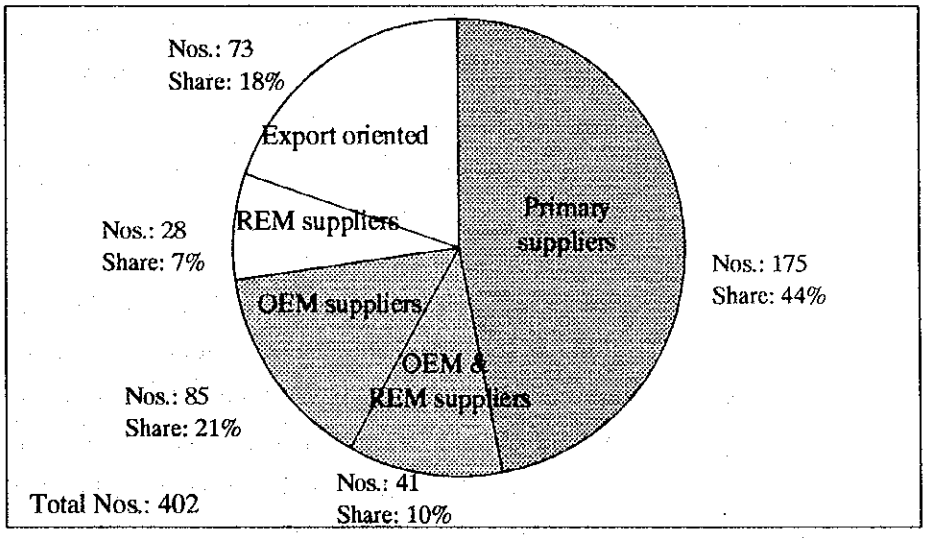


Figure 5.2-1 STRUCTURE OF ELECTRICAL/ELECTRONIC PARTS INDUSTRY

Note that enterprises producing and supplying OEM parts (including those also producing REM products), other than primary suppliers, are assumed to be secondary or more down-stream suppliers. Based on the estimates, 85 enterprises produce only OEM products, and 41 manufacture both OEM and REM parts, so that 126 enterprises are secondary or more down-stream suppliers. The overall structure of the electrical/electronic parts industry including export-oriented suppliers is estimated as follows:

Primary suppliers:	175 (44%)
Secondary and lower-tier suppliers:	126 (31%)
REM suppliers:	28 (7%)
Export-oriented suppliers:	73 (18%)
Total	402 (100%)

Compared to the automotive parts industry, the electrical/electronic parts industry has less REM suppliers (7% vs. 20%) and more export-oriented suppliers (18% vs. 7%).

5.2.4 Current situation of primary suppliers

In this study, enterprises directly supplying components and parts to set makers are referred to as primary suppliers. Unlike autoparts industry, in the electrical/electronic industry where set makers often produce large portions of components and parts by themselves (in-house production). Also, it is a normal practice for set makers to supply components they make to other set makers, thus resulting in the parts industry having a complex structure and distribution network.

During the field survey, only 2 set makers furnished the Study Team with a complete list of suppliers. To supplement the limited data, primary suppliers who apparently supply to set makers have been identified from the above mentioned directory, and added to the original list. The extended list is shown in ANNEX VI in an alphabetical order and is used as a basis of structural analysis of primary suppliers conducted below.

Note that the list contains 175 companies, but many of them lack some data (indicated as n.a.) especially for smaller-size companies. Thus, the following analysis was conducted only for the listed companies with relevant data being available.

(1) Distribution of company size of primary suppliers

Table 5.2-8 CLASSIFICATION OF PRIMARY SUPPLIERS BY SIZE (BY NO. OF EMPLOYEES)

Size of Employees	No. of enterprises	Composition
100 or less	26	25.7%
101 - 200	17	16.8%
201 - 500	33	32.7%
501 or more	25	24.8%
	101	100.0%

Enterprises with 201 - 500 employees account for one third of total, and those with 501 or more employees 25%. Thus, enterprises with 201 or more employees account for 58%, and 42% for less than 200 employees. In the said directory which gives an average figure of supporting industries, of all the enterprises listed, 37% employ 100 or less persons and 21% for 101 - 200 employees, totaling 58%. The figures clearly indicate that primary suppliers are larger in size than the average of supporting industries.

(2) Ownership of primary suppliers

Table 5.2-9 OWNERSHIP OF PRIMARY SUPPLIERS

Ownership	No. of enterprises	Composition
100% local:	30	30.9%
100% foreign:	20	20.6%
Foreign/local J/V:	47	48.5%
	97	100.0%

Foreign and local joint ventures account for nearly one half of all the enterprises. Compared to ownership distribution of enterprises listed in the directory, the percentage of wholly owned local companies is very small, 31% for primary suppliers, 46% for the directory, while that of foreign affiliated companies for primary suppliers is much higher, 69%

versus 54% for the directory.

When data contained in supplier lists furnished by the two set makers are combined, 29 or 64% out of 45 leading primary suppliers are wholly or partially owned by foreign capital, and 24 or 83% out of 29 are Japanese-affiliated companies.

(3) Year of commercial operation

The primary suppliers have been classified according to the year of starting commercial operation, every 5 years up to 1992.

Table 5.2-10 YEAR OF COMMERCIAL OPERATION

Year	No. of enterprises	No. of foreign-affiliated companies 1/
1958 - 1962	3	3
1963 - 1967	5	0
1968 - 1972	6	5
1973 - 1977	6	2
1978 - 1982	14	5
1983 - 1987	15	7
1988 - 1992	49	44
	98	66

(Note)1/ Foreign-affiliated companies include all the companies owned by foreign capital, regardless of equity interest.

In around 1960, 3 foreign-affiliated suppliers (all are joint ventures with Japanese companies) started commercial operation. Two of them are also set makers and sell components and parts to other set makers. In the 1960s, 6 local companies started operation: 3 produced plastic moulded parts and 2 packaging materials. Between 1968 and 1972, a number of foreign suppliers specializing in plating process invested in the country. During the decade between 1978 and 1987, 29 suppliers started production, 59% of which were locally owned. Then, the boom came between 1988 and 1992, and nearly one half of the existing suppliers or 49 enterprises

started operation within these 5 years. Foreign-affiliated companies account for 90%.

(4) Exports of components and parts

Data for export ratios were available for only 48 suppliers. They are classified according to the ratio of export to production, as follows:

Table 5.2-11 EXPORT RATIO OF PRIMARY SUPPLIER

Export Ratio	No. of enterprises	Composition
1 - 19%	13	27.1%
20 - 39%	4	8.3%
40 - 59%	2	5.2%
60 - 79%	2	5.2%
80 and above	27	56.2%
	48	100.0%

A total of 27 suppliers (56% of total) exports more than 80% of their total production, of which 23 are foreign-affiliated companies and 17 are Japanese affiliates.

5.2.5 Domestic supply of major components and parts

This section analyzes domestic supply of major components and parts for leading electrical/electronic equipment assemblers. Major components and parts here are defined as those requiring advanced design techniques and precise production technology, and accounting for large portions of the total production cost. Note that the localization rate and export ratio indicated in description below are approximated figures, since they vary greatly from one set maker to another.

Major components and parts have been classified into two categories; locally produced or to be imported; based on the interview survey for set makers (See Table 5.2-12). ATTACHMENT 5-2 shows names of domestic primary suppliers by each of components and parts. ANNEX VI is an alphabetized list

of the domestic primary suppliers. Reference is made to those tables for the following description.

(1) Air-conditioners

Major components of air-conditioners are compressors, condensers, and evaporators. There are three local suppliers of compressors, Siam Compressor, Thai Compressor Mfg. and Daikin Industries (Thailand). These companies received incentives under the BOI Promotion Project. Siam Compressor was established in 1990 as a joint venture between Siam Cement Group and Mitsubishi Electric, which has provided technology and 40% of capital. In 1992, the company shipped 340,000 units, 50% of which have been exported directly or indirectly. The localization rate of compressors is estimated to be 50%, the rate of subcontracting to local companies 30%, and the percentage of imported parts 20%. Daikin Industries (Thailand) is an export-oriented company.

Evaporators and condensers are mainly produced by set makers. There is no supplier specialized in evaporators for air-conditioners. The sourcing of plastic products, such as cabinets, fans, and grills, varies among set makers, but their procurement strategies are roughly divided into two types, in-house production or procurement from domestic sources.

(2) Refrigerators

Compressors and evaporators also are major components for refrigerators. Because of different specifications from air-conditioners, these components for refrigerators are manufactured by different companies from those for air-conditioners.

Compressors for refrigerators are produced by two companies who enjoy special incentives as the BOI Promotion Project. Sanyo Universal Electric uses Japanese technology and Kulthon Kirby uses U.S. technology.

Evaporators are supplied only by Thai Refrigeration Components under the BOI Promotion Project. The company is a joint venture between Thai

and Japanese capitals (70% vs. 30%, respectively), with a majority being controlled by the set makers who purchase evaporators produced. The company produced 700,000 sets in 1992, which more or less match domestic demand.

Large plastic products are internally produced by set makers themselves, and small ones are generally sources from local suppliers.

(3) Washing machines

Major components are wash-motors and gears for tubs, and spin-motors for dryers, which are partly imported and partly manufactured by set makers themselves or soured from domestic suppliers. For example, it was told that Kang Yong Electric was procuring motors from local suppliers and Sanyo Universal and Thai Toshiba Electric Industries were doing in-house production. The interview survey for set makers, however, could not reveal the names of local suppliers of motors. There is no motor maker in ANNEX VI, too.

Large metal press products, such as bodies and units, and large plastic products, such as washing tubs, pulsators, tub covers, and spinner tubs, are mostly produced by set makers. Small press and plastic products are produced by local suppliers who are classified under "press parts" and "plastic parts" in ATTACHMENT 5-2.

(4) Microwave ovens

Microwave oven makers are Sharp Appliances (Thailand) and Acme Industry, which are typically export-oriented. The most important component of microwave moves is magnetron that is imported from Korea and Singapore. There is no local magnetron supplier. Muramoto Electron is producing press parts for magnetron for export. The economic scale of magnetron product is to be 3 million units annually. In Thailand, 1.6 million microwave ovens were produced in 1992.

Other important components, fan motors and glass trays, are all imported

and there is no local supplier. For production of door glass that requires special production technologies, a foreign-affiliated company, Thai Sanei Company was established in 1987 but this company is export-oriented.

(5) Electric fans

Commercial production of electric fans in the country was started in the 1960s. Since then, production technology has developed to an advanced level, with a well-developed parts supply system. Fans, fan motors, and fan covers are mostly produced by set makers, and stands and other press parts by outside suppliers. All in all, supporting industries for electric fan production are fully developed.

(6) Rice cookers

In ATTACHMENT 5-1, 4 companies are listed as set makers of rice cookers, namely Thai Toshiba Electric Industries, A.P.National, Peacok Electric, and Sanyo Universal Electric. In addition, there are many small set makers not in the list, who supply their products to the domestic market. As seen in electric fans, key components listed in Table 5.2-12 are mostly produced by set makers themselves, except for wire products that are procured by local suppliers. Thus, set makers produce components by using materials procured from outside sources and assemble them at their own shops.

(7) Television sets

The most important component is the cathode-ray tube (CRT) that accounts for nearly 40% of the total production cost. There are two CRT makers in Thailand: One is Thai CRT established under BOI Promotion Project mainly for domestic market, and the other is Toshiba Display Device (Thailand) established by BOI incentives for wholly export market. The domestic market of CRT is actually monopolized by Thai CRT except those for re-exports and for different sizes which are not produced by Thai CRT. CRT parts imported are panels, shadow masks, electron guns, and getters, and wires. Thai CRT produces deflection yokes (DY)

internally and procures other small parts from local sources. The localization ratio for CRTs is around 65%. Funnels are produced by Siam Asahi Techno Glass for both the said two CRT suppliers in Thailand and direct export.

Functional parts other than CRT ("component chassis" in Table 5.2-12) are in-house produced or procured from local suppliers, whose names are listed in ATTACHMENT 5-2 by name of components and parts.

(8) VTRs

Key components are VTR magnetic heads and front loading systems. Summit Electronic Components supplies HVS heads and FDD heads, while magnetic heads for VTRs are mainly imported. So are front loading systems. Bodies and front cases are produced by local suppliers including Thai Mitsuwa.

(9) Telephones

LEDs, used as a light source for indicator lamps and level meters, are produced by Asian Stanley International. Speakers are supplied by Minebea Thai who is also a set maker. Body cases are made of plastic materials and are locally produced.

(10) Facsimile machines

There is only one facsimile maker, Sharp Appliances. Major components listed in Table 5.2-12 are all imported, except for some ICs (10%) that are procured from local sources.

Table 5.2-12 KEY COMPONENTS AND LOCAL SUPPLY OF ELECTRICAL / ELECTRONIC EQUIPMENT

Finished Products	Key Components	
A. Electrical Home Appliances		
Air Conditioner	· Cabinet × · Condenser × · Compressor △ · Evaporator △ · Fan Motor △ (Propeller Fan)× (Cross-Flow Fan) ×	· Chassis Assy × (Front Grille) × (Discharge Grill) × · Pachaging Box ×
Refrigerator	· Shell-liner × · Inner Door × · Evaporator △ · Compressor × · Water Evaporator ×	· Meet Tray × · Egg Tray × · Shelf Net × · Fan Motor △ · Packaging Box ×
Washing Machine	· Body Unit (Metal) × (Body Base) × · Wash Tub × (Pulsator) × (Tub Cover) × (Spinner Tub) ×	· Wash-Motor △ · Spin-Motor △ · Switch Control × (Panel Face) × (Time Switch) × · Packaging Box ×
Microwave Oven	· Magnetron ○ · Fan Motor ○ · Glass Tray ○	· Frame & Body Assy △ · Packaging Box × · Door (Shealed) ○
Electric Fan	· Fan Motor × · Stand × · Fan ×	· Fan Cover × · Metal Parts × · Packaging Box ×
Rice Cooker	· Lid, Pan, Body × · Switch Panel × · Thermal Fuse Assy × · AC-Cord ×	· Anodizing Process × (Automatic Paining) × · Packing Case ×
B. Electronic Home Appliances		
CTV	· Cathode Ray Tube (CRT) △ (Funnel) × (Panel) ○ (Shadow Mask) ○ (Shadow Frame) × (Electric Gun) ○ (Internal Magnetic Shield) × (Tension Band) × (Phosphor Screen) × (Wire) ○ (Deflection Yoke) ×	· Component Chassis △ (FB Transformer) × (Turner) × (PCB) △ (Speaker) △ (Condensor) △ (Transformer) △ · Cabinet ×
VTR	· Front Loading Systme △ · VTR Magnetic Head ○ · Body and Front Case ×	
C. Communication Equipment		
Telephone Set	· Body Case × · Light Emitting Diodes (LED) △ · Conector ○ · Speaker ×	· Cable × · Electronic Part and Device ○
Facsimile	· Thrmal Head ○ · Nickel Battery ○ · Mirror ○	· Cutter ○ · IC △

(Note): ○ : Mostly imported × : Mostly localized △ : Mixture of imported and localized
( ): Key parts of the components
(Source): JICA team interview survey

5.2.6 Real localization rates of electrical/electronic components

(1) Classification of components

ATTACHMENT 5-3 lists key components and their parts for each type of elemental and electronic equipment. For the purpose of this report, these key components and parts are classified as follows:

1) Elements
(Items 35 to 37 in ATTACHMENT 5-3, Details are in ATTACHMENT 5-4)

- Resistors, capacitors, coils, semiconductor devices, sensors, and filters

2) Assembly parts
(Items 7 to 34 in ATTACHMENT 5-3)

- CRTs, LEDs, PCBs, transformers, tuners, motors, speakers, microphones, harnesses, and switches

3) Bodies and casings
(Items 1 to 6 in ATTACHMENT 5-3)

- Panels, fitting metals, cabinets, and metal casings

Note that elements make up assembly parts. Attachment 5-4 shows a detailed list of elements used in electrical/electronic equipment by product type. The table indicates the names of elements by major category, but in fact, a variety of products are available according to specifications, e.g., a few hundred types for capacitors alone. And as an example, color TVs use approximately 800 parts.

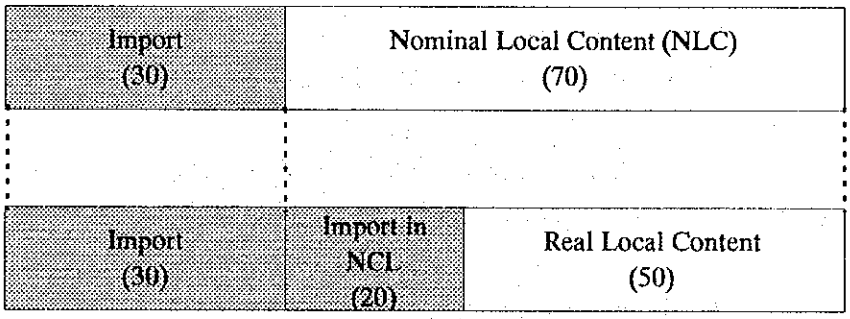
(2) Nominal and real localization rates

The localization rate of parts used for electrical home appliances in

Thailand has reached approximately 90% on a value basis. 70% of parts for audio and visual equipment are said to be locally produced, and those for communications equipment and office machinery 20%.

It should be noted, however, that parts counted as being locally procured are mainly bodies and casings as well as assembly work of assembly parts, while most of elements for assembly parts themselves are imported. The typical composition for audio and visual equipment is summarized as follows:

(Note) The above mentioned localization rates refer to those for equipment sold to local markets, while the localization rates of equipment for export are generally lower than those for the domestic market.



Imports (30): ICs, LEDs, transistors, diodes, connectors, switches, and sockets

Nominal local content (70): tuners, FBTs, deflecting yokes, transformers, remote controllers, volume controls, PCBs, and speakers

Imports in NLC (20): Chips, resistors, sensors, contacts, capacitors, cone paper, ICs, transistors, LEDs, diodes, boards, bobbins, and moulding frames

As illustrated above, while the nominal localization rate for audio and visual equipment is 70%, further breakdown reveals that the real rate is around 50%. In fact, 20% out of 70% are imported elementary parts incorporated into assembly parts to be assembled in Thailand. Table 5.2-