4.5 Present Situation of Technology and Management

(1)Technology

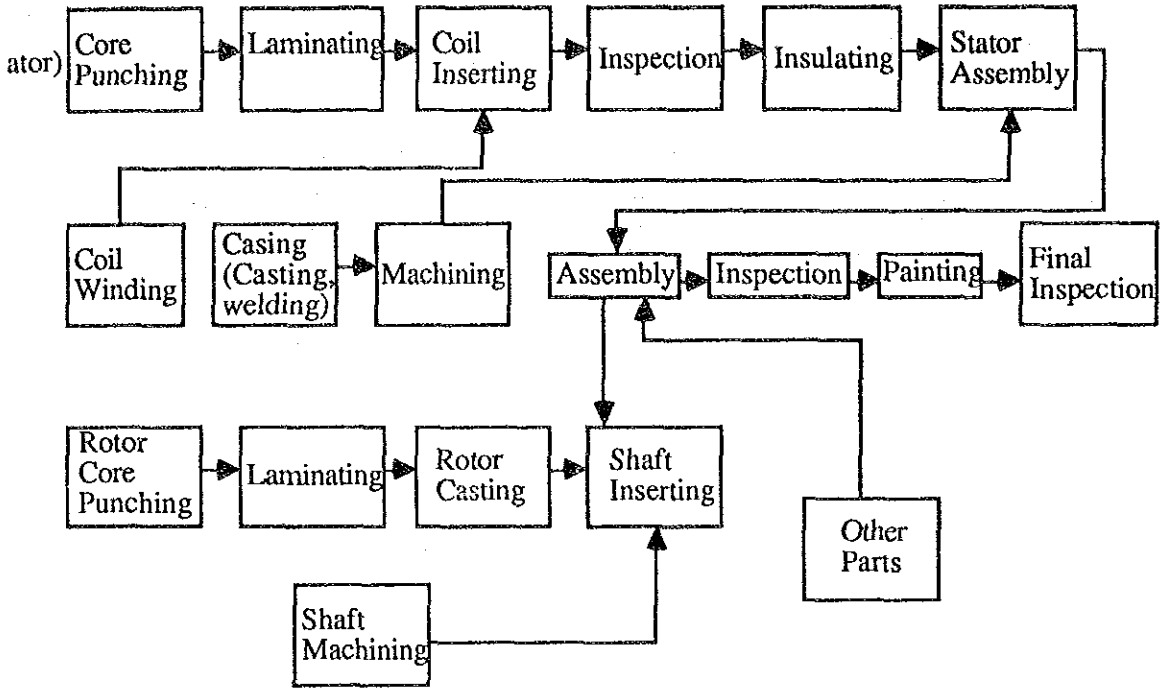
1)Production Process

[1] Characteristics of Production Process

The three designated products are generators, which generate electricity at places where electricity is not provided; transformers, which change the voltage of electricity so that various kinds of electrical machinery can be used; and motors, which produce mechanical force from electric power. All are closely related to each other.

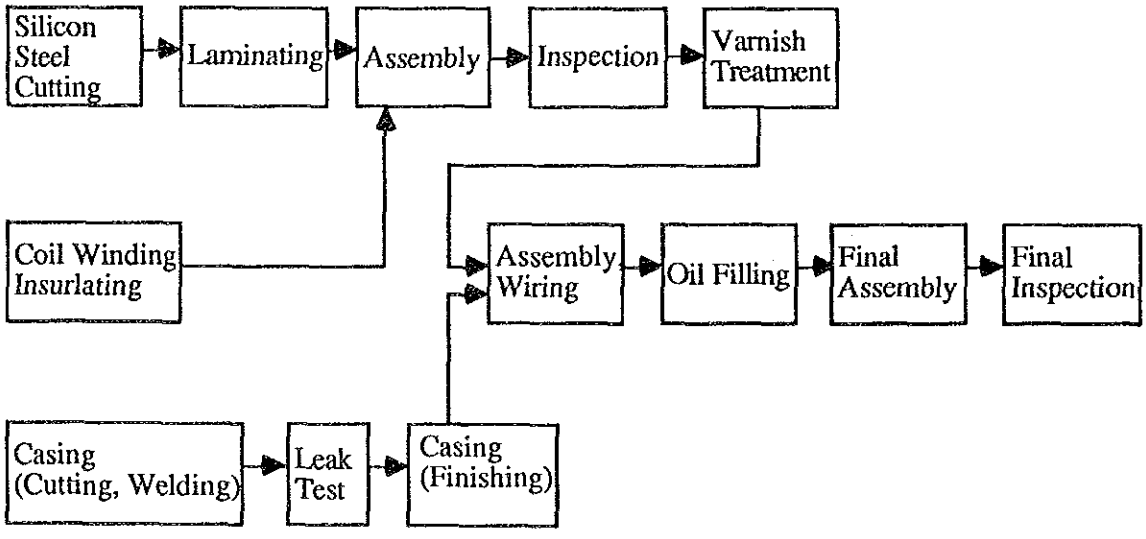
The production processes for the three designated products are depicted in Charts 4-5-1 and 4-5-2. In actuality, it would be better to regard them as machining and metal processing as most of the production processes are concerned with machining, metal processing and assembly of the processed parts.

Fig. 4-5-1: Production Process of Motors



Source: Books of Motors and Transformers, JEMA

Fig. 4-5-2: Production Process of Transformers



Source: Books of Motors and Transformers, JEMA

The level of technology in the field of metal processing, which is closely related to the production of electrical machinery, is summarized as follows:

(a)Forging and heat treatment

Forging and heat treatment technologies are increasing in importance as the machinery industry develops because many of the machinery parts are produced by forging. However, the present technology level is behind that of other technologies related to metal processing. Although there exist traditional blacksmiths who produce various tools for agriculture, their level of technology is far behind that of modern industry.

(b)Sheetworking and welding

Steel plates are cut by gas cutting machines or shearing machines, bent and formed by presses, and then assembled. This process is heavily dependent on the experience of skilled workers. They often do not use drawings or welding procedure sheets necessary for quality control. One of the technical problems is that knock-down inspection is rarely performed on the portions which are manually welded. Skilled workers usually conduct only visual inspection when the finished products are shipped.

[2].Present situation of main production facilities

The facilities used for the production of electrical machinery are made up of production machinery and testing and inspection facilities. As described in Table 4-5-1, all of the surveyed firms have at least a minimum level of production machinery. Some of the firms, however, are not always willing to invest in new facilities and continue production with old ones which have already fully depreciated. The use of the old production facilities may work to decrease depreciation cost, which is one component of the total production cost, but as production efficiency and processing accuracy lag behind that which is possible with modern facilities, it does not contribute to cost competitiveness in terms of finished products.

In terms of production facilities, metal working machinery from different countries, where different gauges, units and engineering standards are applied, are used. These countries include Japan, the U.S., the U.K., West Germany, France, the Netherlands, Belgium, Taiwan, China and Indonesia. This situation is the result of free importation of metal working machinery by each firm, a situation which is very common in developing countries. It was observed by the study team that several firms used machine tools with different units and engineering standards on the same production line. There is a great possibility that this causes serious problems with quality control.

Only a few of the surveyed firms have installed sufficient testing and inspection facilities. Most firms are equipped with a minimum level of testing and inspection facilities and, with electrical testing facilities in particular, incomplete facilities are used by most of them. Standard testing and inspections conducted in factories are divided into four categories: i) material testing/inspection, ii) on-line testing/inspection, iii) final inspection, and iv) outgoing inspection, which is observed by the customer. However, at most firms in Indonesia, material and on-line inspections are inadequate. In addition, final inspections such as high voltage impulse resistance inspections are not conducted, with the exception of a few firms. Some firms entrust the electrical testing which they cannot do themselves to LMK-PLN (Electric Power Research Center).

Table 4-5-1: Principal Production Facilities

Item	Firm	Principal Production Facilities
Generators	A	Balancing, Coil Winding, Lathe Machine, Drill Machine, Mill Machine, Testing, Oven, Coil Puller
	B	Winding Machine, Test Field Equipment, Drilling, Shaping, Lathe, Balancing, Varnish Dryer
	C	Winding Machine, Impreg. Machine, Hydraulic Press, Lathe(Horizontal), Test Bed, Trav. Crane, Jib. Crane, Generator Set, Air Compressor, Balance Machine
	D	Lathe, Balancing, Coil Winding, Drilling, Shaft Puller
	E	Compressor, Crane, Testing Motor, Load Tester, Coil Winding Machine, Tapping Machine, Dryer, Others
Motors	F	Stamping, Coil Winding, Injection Molding, Balancing, Lathe, Milling, Puller, Drilling, Sawing, Test Facility
	G	Foundry, Machining, Punching, Assembly Line, Testing Equipment
Transformers	H	Cutting Machine, Coil Winding, Lathe, Drilling, Milling, Press Working, Test Facility
	I	Cutting, Welding, Winding, Oven, Drilling, Lathe, Testing Facility, Painting, Rolling, Milling

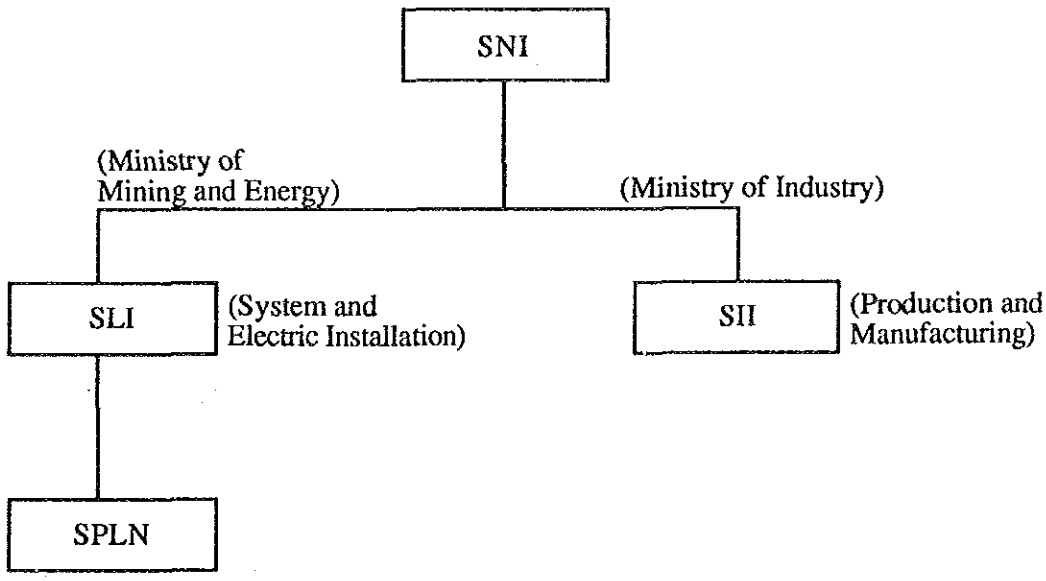
Source: Questionnaire Survey

[3] Industrial Standards

Substantial development of the Industrial Standards of Indonesia (SII) has taken place since the National Standardization Council (DSN) and its subordinate organization, the Technical Team for Industry Standardization (TTSI), were established in 1984. Since then, the improvement of the industrial standards system and the preparation of new industrial standards have been undertaken, mostly through the efforts of the TTSI. As of July, 1988, 2,246 industrial standards were registered, but their use has not spread widely among industries in Indonesia. It was made clear to the study team that most PMA firms adopt industrial standards and other specifications from their overseas parent firms. PMDN firms, which have technical agreements with overseas firms, also introduce various standards from their partners in overseas countries. Many industrial standards and specifications from many countries are used in Indonesia without any general rules and the situation makes it difficult to establish a single set of industrial standards which are applicable nationwide.

Another problem which makes the situation of industrial standards in electric fields even more complex is that in addition to the SII of the Department of Industry there is SLI, which is prepared by the Department of Mining and Energy for electrical systems, and under SLI, there is SPLN, which is specially prepared by PLN, a state-owned electric firm. Many of these industrial standards are still under development and cannot cover all the electric fields. With some items, SII and SLI overlap. As a result, the National Standardization Council is moving quickly to establish unified industrial standards, SNI. The Industrial Standard System in Indonesia is summarized as follows:

Fig. 4-5-3: Industrial Standards in Indonesia



[4] Industrial Standards in Use

According to the results of the interview and questionnaire surveys conducted by the study team, 11 firms out of 16 adopted IEC as shown in Table 4-5-2. JIS and VDE followed, having been adopted by five firms each. Indonesian industrial standards, SII, SLI and SPLN, were used by two firms. By commodity, SII, SLI or SPLN were adopted by manufacturers of transformers, while four out of six manufacturers of generators used JIS. This is judged to be reasonable due to the fact that the transformer manufacturers produce their products based on standards requested by their principal customer, PLN, while the generator manufacturers adopt standards from Japanese tie-up firms, from which they have introduced technology.

Table 4-5-2: Industrial Standards

Standards		Number of Firms Generators	Motors	Transformers	Total
JIS	(Japan)	4	1	0	5
NEMA	(USA)	1	1	0	2
IEC	(Int'l)	2	3	6	11
JEC	(Japan)	1	0	0	1
VDE	(West Germany)	2	0	3	5
UTE	(France)	1	0	0	1
NEN	(Netherlands)	0	0	1	1
CEMA	(Canada)	1	0	0	1
ANSI	(USA)	0	0	1	1
CSA	(Canada)	1	0	0	1
BS	(UK)	1	0	1	2
SII	(Indonesia)	0	0	2	2
SLI	(Indonesia)	0	0	2	2
SPLN	(Indonesia)	0	0	2	2
DIN	(West Germany)	0	1	0	1

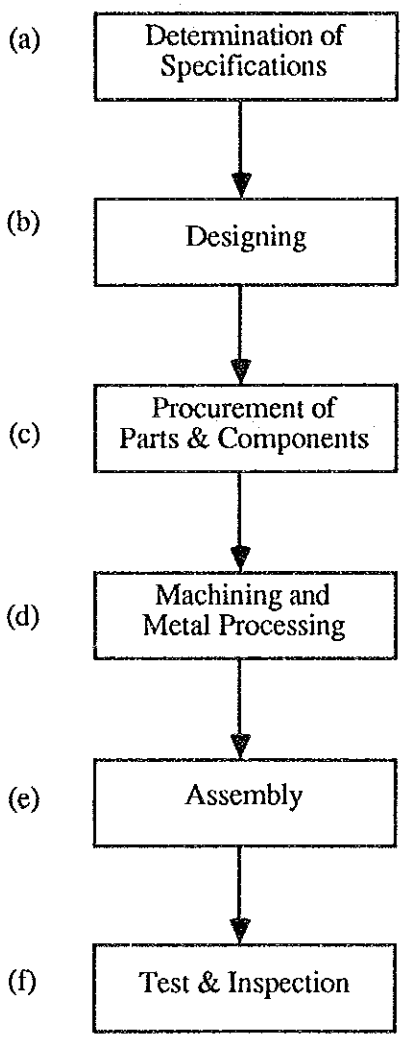
SOURCE: Questionnaire Survey

2)Technology Level

[1] Technological Characteristics of Electrical Machinery

The manufacturing processes of the designated electrical machinery, generators, motors and transformers, are depicted generally in Chart 4-5-4.

Fig. 4-5-4: Manufacturing Process of Electric Machinery



In the above depiction of the manufacturing process, processes which involve electrical technology are marked (a), (b), (c) and (f), while the machining and metal processing and assembly, which are marked (d) and (e), are more related to metal processing technology. Factory workers at electrical machinery firms can be roughly divided into the electric related departments (10 percent), machining and metal processing (55 percent) and material selection and testing, inspections (35 percent).

Technology in the field of electricity deals with such invisible objects as electric current and magnetic fields and is applied to generate mechanical power or heat energy from electric energy. The three designated items are concerned with the following technological factors:

i)Generators : generate electricity from mechanical energy
ii)Motors : generate mechanical energy from electricity
iii)Transformers: change one voltage of electricity to another voltage of electricity

As these kinds of electrical machinery are designed to change the status of energy, the level of electric technology should be judged by the success of the energy change. Further, the level of electric technology cannot be determined by the appearance of the products but only by the results of electric testing and inspection, as is stipulated in the specifications.

Specifications are usually devised based on customer requirements. Specifications are based on various factors such as required power output, size and weight of finished products, voltage of electric power, environmental conditions where the products would operate, etc. Unit systems, industrial standards, maximum and minimum requirements of operation and conditions of continuous operation are some of the most important requirements.

In Indonesia, unification of industrial standards, which should be the most basic level of technology, has not been done, and various standards are used together. It was observed by the study team that assembly firms and sub-contracting firms adopted different standards and this caused inconsistency among components used for production. As a result, the finished products did not operate as expected. From this point of view, establishment of national industrial standards and unification of various unit systems currently used by the industry must be expedited.

The electrical machinery industry in Indonesia depends for the most part on technology from advanced countries. Joint venture firms in developed countries supply Indonesian partner firms with many types of assistance, from technology, key components and raw materials, to training of workers and engineers. As shown in Table 4-5-3, more than half of the surveyed firms have concluded technical agreements with foreign firms. According to the in-depth interviews conducted by the study team, it is evident that almost all of the surveyed firms have the experience of having had technology introduced from developed countries.

Although some products made in Indonesia can meet international levels, the overall level of technology in the country is regarded as very low compared with other countries from which many parts and components as well as assembly technology are imported.

Table 4-5-3: Present Situation of Technical Agreements (Number of Firms)

		Generators	Motors	Transformers	Total
Has Technical Agreements		3	1	1	5
Does Not Have Technical Agreements		1	0	3	4
No Reply		2	2	3	7
Countries with Technical Agreements	Netherlands	0	0	0	0
	Japan	2	0	0	2
	U.S.	0	0	0	0
	Italy	0	0	0	0
	France	0	0	0	0
	W.Germany	1	0	0	1
	U.K.	0	0	0	0
	Others	0	1(Taiwan)	1(Belgium)	2
Contents of Agreements		Overall Technology	Overall Technology	Design	

Source: Questionnaire Survey

[2].Quality Control

The basic purpose of quality control is to prevent production of defective products. In contrast to usual inspections, which basically deal with the random inspection of finished products, quality control is intended to produce quality products through the management of entire production lines. Quality control may be regarded as the management of the 4 M's: Material, Machine, Man, and Method.

As one indicator of the overall level of quality control in the electrical machinery industry in Indonesia, the quality control activities of the surveyed firms are summarized in Table 4-5-4. From the table, it can be seen that eight firms out of the 10 which responded to the questionnaire had in-house quality control departments, and five and six firms had adopted QC circles and suggestion systems respectively.

Table 4-5-5 shows the changes in defect ratios between 1986 and 1988. All the firms shown in the table decreased their defect ratios, indicating that they have actively worked on quality control. On the other hand, poor quality control was pointed out at some of the surveyed firms and this may have been caused by insufficient activity by quality control departments or QC circles. Following are some of the examples.

i) Insulation oil will deteriorate if it is stored in humidity. Several factories did not have appropriate storage places for insulation oil. None of the factories had a separate building for handling insulation oil, which can easily catch fire and explode.

ii) Most factories were not equipped with adequate measuring instruments or jigs which are necessary for basic quality control.

iii) Layers of silicon steel sheet were not banded tightly. This could cause vibration of the products and generate noise.

iv) Insulation oil is poured in and used to cool down cores and other conductive parts of transformers. Leakage of the insulation oil occurred due to improper welding of tanks and pipes of transformers.

Table 4-5-4: Quality Control

Item	Firm	Quality Control Department			QC Circle		Suggestion System	
		Have	Nbr.of People	Have Not	Have	Have Not	Have	Have Not
Generators	A			o		o		o
	B	o	3		o		o	
	C	o	6		o		o	
	D	o	3		o		o	
	E	o	2			o		o
Motors	F	o	15		o		o	
Transformers	G	o	2					o
	H	o	2			o	o	
	I	o	10		o		o	
	J			o				

Source: Questionnaire Survey

Table 4-5-5: Ratio of Defective Products

Item	Firm	Ratio of Defective Products (%)		
		1986	1987	1988
Generators	A	2	2	1
	B	1	0.8	1
	C	1	1	0.5
Motors	D	17	12	8
Transformers	E	0.5	0.3	0.1
	F	7	5	5
	G	3	2	1

Source: Questionnaire Survey

[3].Testing and Inspections

In general, there are two kinds of tests and inspections for electrical machinery: mechanical testing inspection dealing with machine processing and raw materials, and electrical testing inspection dealing with the electrical performance of the products. Mechanical testing inspection is further divided into visual inspections and functional tests. Electrical testing/inspection usually includes the following items as key tests:

i) Conductivity tests to check whether insulating materials are properly used
ii) Short circuit tests to check whether circuits are correctly designed
iii) Load tests to check whether products perform as specified

Although electrical machinery should be sold only when the products satisfy the specifications demanded by customers, only a few firms among those surveyed installed sufficient testing and inspection facilities. The present situation of testing and inspection at the surveyed firms is, as shown in Table 4-5-6, that 13 firms out of 14 had quality inspection departments and 12 firms performed out-going inspections on all finished products. Most firms conduct production with a minimum level of testing and inspection facilities and, as a result, some find that their products are defective only after their customers have used them and report the defects. Some firms consign electrical testing which they cannot do themselves to LMK-PLN(Electric Power Research Center).

Inadequate testing and inspection facilities at electrical machinery firms result in a negative image of locally-made products among domestic customers and obstruct the expansion of exports. To promote exports of the products, it is imperative that firms gain the confidence of overseas customers who are not familiar with Indonesian products. For this purpose, it is necessary for each firm to modernize testing and inspection facilities.

Testing and inspection facilities are roughly divided into two categories: facilities used for daily production and ones necessary for special specifications. Facilities for daily production must be installed by every firm, regardless of the price. The special facilities for special specifications, which are not used in the daily production process, need not be installed by each firm. It is possible for a public research center to have such special facilities and conduct testing and inspections for the private firms. In addition to testing and inspection, evaluation and assurance by a third party such as a governmental institution would work effectively to promote exports of domestically-produced electrical machinery.

There are two kinds of testing and inspection: one is of mechanical and structural aspects and the other is of electrical aspects. For mechanical and structural testing and inspection, several governmental centers already exist and operate actively. On the other hand, governmental or semi-governmental testing and inspection institutions in the field of electricity do not exist in Indonesia, except for LMK-PLN, which is governed by the Department of Mining and Energy, and B4T, which is governed by the Department of Industry. At the moment, however, these two institutions are not prepared to respond to requests from the private sector for testing and inspection due to the quality, quantity, geographical location and insufficient modernization of their facilities.

Table 4-5-6: Quality Inspection

	Generators		Motors		Transformers		Total	
	Have	Not Have	Have	Not Have	Have	Not Have	Have	Not Have
Quality Inspection Departments	4	0	3	0	6	1	13	1
Quality Inspection Standards	4	0	3	0	7	0	14	0
Boundary Samples	4	0	2	0	5	1	11	1
Sampling Inspections	4	0	2	0	5	1	11	1
Outgoing Inspections of all the products	3	1	3	0	6	1	12	2
Incoming Inspections of all the products	4	1	0	1	4	2	8	4

Source: Questionnaire Survey

3)Raw Materials and Parts

[1].Selection of Raw Materials and Parts

There are three types of raw materials and parts used for electrical machinery: electrically conductive materials, insulation materials and magnetic materials. Those which best suit the product specifications are selected. High quality raw materials and parts are necessary to produce quality products. For materials and parts that are not domestically produced, electrical machinery firms have to depend on imported ones. Table 4-5-7 shows the source of procurement by percentage in terms of value based on three categories : in-house production, import and subcontracting. It can generally be said that, for components excluding raw materials, most of the firms depend on imported materials for 30 to 50 percent, with the exception of one firm which produces motors and has achieved almost 100 percent local procurement.

Selection of parts should be done based on two factors: the quality of the raw material of the parts and the level of processing. As for raw materials, many of them, including silicon steel sheet, insulation oil, insulation paper, varnish, and special alloys such as S45C and SMC415 for production of press dies, are imported. As for the level of processing, it is highly correlated with the level of processing facilities. Many firms among those surveyed were equipped with out-dated facilities and the facilities included only basic ones such as milling machines, lathes, press machines, drilling machines, etc. Special parts which require accurate processing are imported after being wholly or semi-processed.

Table 4-5-7: Breakdown of Procurement by Source

Item	Firm	Ratio of Procurement by Source (%) Import	In-house	Subcontract
Generators	A	25	35	40
	B	40	25	35
	C	60	30	10
	D	50	40	10
Motors	E	0	70~75	25~30
Transformers	F	30	40	30
	G	30	60	10
	H	10	40	50
	I	30	60	10
	J	60	40	0

Source: Questionnaire Survey

[2].Imported Raw Materials, Parts and Components

Imported materials and parts are used for items such as stator cores, rotor cores, rotor conductors, bearings, shafts, terminals and varnish for production of generators, fans, bearings, varnish and epoxy resin for motors, and cores and bearings for transformers. For the production of large size transformers, valves, fans, thermometers, tap chargers, gauges and oil filters are also imported. Silicon steel sheet, which is common to the three items, is also imported, mostly from Japan, because such specialized steel is not produced in Indonesia.

Through interviews conducted by the study team, four major reasons for using imported materials and parts were observed:

i) The material or component is not produced in Indonesia.
(for instance, silicon steel, tap chargers, oil filters and special gauges)
ii) The quality and delivery of the local material or component is poor.
(for instance, small size bearings and insulation oil)
iii) The cost of the local material or component is high.
(for instance, shafts and cores)
iv) Use of an imported material or component is requested by the customer.

The key to the success of the electrical machinery industry in the future lies in how effectively domestic manufacturers can achieve a stable supply of quality materials and parts at a lower cost to the industry. At the same time, it is necessary for the Indonesian government to proceed with prompt standardization of several industrial standards so that material suppliers, parts manufacturers and assembly firms can communicate with one another. Imported materials and components, and their countries of origin, are summarized in Table 4-5-8.

Table 4-5-8: Country of Origin of Imported Materials and Components

Item	Firm	Materials and Components	Country of Origin
Generators	A	Core Pack	U.K.
		Shaft	U.K.
		Cable	U.K.
		Suppl. Material	U.K.
	B	Main Comp.	Japan
	C	Generator	W-Germany
	D	Armature Core	Japan
		Commutator	Japan
		Press Board	Japan
		Spring Washer	Japan
		Rotor	Japan
		Bush Holder	Japan
		Rheostat	Japan
		Varnished Press Tube	Japan
		File Tube	Japan
		Conical Spring Washer	Japan
		Spring Press	Japan
Motors	E	Stator Core	Taiwan
		Rotor Shaft	Taiwan
		Fan Cover	Taiwan
		Fan	Taiwan
		Terminal Cover	Taiwan
		Terminal Housing	Taiwan
		End Shield	Taiwan
		Drum	Taiwan
		Controller	Taiwan
		E.C. Coupling	Taiwan
Transformers	F	Copper Wire	Japan/France
		Oil	France
		Silicon Steel	Japan

Source: Questionnaire Survey

[3].The Present Situation of Raw Materials, Parts and Components

The major raw materials and parts for generators, motors and transformers were categorized into three groups by source of procurement, namely, in-house, outside and import, and each firm's reason for selecting the source of procurement was studied. This study was made using a check sheet during interviews. Results of the study are shown in Tables 4-5-9, 4-5-10 and 4-5-11.

a)Generators

Generators are theoretically the same as motors and many basic components used for the production of generators are very similar to those used for motors. Generators, however, need more highly reliable components than motors due to the nature of use including electricity supply in emergencies. As a result, more imported parts are used for the production of generators than for motors. This was made clear in the compilation of the check sheet results, as shown in Table 4-5-9. In-house production and domestic procurement together exceed imports for only three items - stator windings, shafts and terminals. However, for shafts, most of the firms do local machining of imported materials or import semi-finished shafts, which have usually been forged or cast.

The same tendency was seen in the procurement of raw materials. Most varnishes and epoxy resins are imported and all of the silicon steel sheet is imported.

b)Motors

Since one of the three firms surveyed by the study team was just recently established and puts emphasis on the production of high-grade motors, it imports almost all of the components (knock-down parts) from its overseas principal firm and is basically an assembler. The other two firms produce in-house or procure locally many materials and components.

In particular, one of them achieved almost 100 percent local procurement of small motors except for some raw materials such as silicon steel sheet. The firm, however, cannot produce large-sized motors without depending on many imported materials and components. The reasons for using the imported materials and components are not only technical problems but also available quantity and production costs. For instance, one foreign affiliated firm produces casings for small motors in-house, while for bigger casings for large motors, it imports from its overseas principal firm. The firm intends to expand an international horizontal division of labor between the subsidiary and its overseas principal firm in the future.

In the motor industry in general, localization of materials, parts and components procurement is steadily proceeding. At this moment, materials and parts for which local production is still very limited are such precision components as brushes and slip rings, and such raw materials as varnish, epoxy resin and silicon steel sheet. Table 4-5-10 shows the present situation of procurement.

c)Transformers

As shown in Table 4-5-11, most of the materials and components used for the production of common transformers are obtainable in Indonesia. For some parts, however, a number of firms use more imports than domestic ones. These items include bushings and bushing transformers, which require a high level of technology to produce. For instance, low level bushings (class B insulation level) are produced locally, while high level bushings (class F insulation level) are not produced locally but are imported from foreign countries such as Japan, France and Italy. One of the firms surveyed

pointed out the poor quality of locally-made bushings, which often do not satisfy the required standards.

Materials and components produced in-house or procured locally include yoke clamps, clamp rings and name plates. Two firms out of the eight surveyed produce nuts and bolts in-house and one firm imports them. According to one of the two firms which produce them in-house, many of the locally-made nuts and bolts which are sold in the markets are not of good quality and nuts and bolts in different unit systems are often sold together. As a result, the firm said it was quite difficult to procure the required volume of parts when needed.

Table 4-5-9: Procurement of Major Parts by Number of Firm (Generators)

Main Parts	Local		Import
	In-house	Out-house	
1)Stator Core	2	0	4
2)Rotor Core	2	0	4
3)Frame (Iron Casting)	2	1	3
4)Stator Winding	5	0	1
5)Rotor Conductor	0	0	3
6)Bracket	1	1	4
7)Fan (Ventilation)	1	1	4
8)Bearing	0	3	5
9)Shaft	2	2	3
10)Terminal	3	1	3
11)Commutator (DC)	0	0	4
12)Brush (DC)	0	0	5
13)Slip Ring (AC)	0	0	4
Material			
1)Bolt, Nut	0	7	0
2)Varnish	0	2	5
3)Epoxy Resin	0	2	4
4)Silicon Steel Sheet	0	0	3
5)Aluminium Casting	0	0	1
6)Enamel Wire	0	5	1
7)Silicon Tube	0	1	0

Table 4-5-10: Procurement of Major Parts by Number of Firms (Motors)

Main Parts	Local		Import
	In-house	Out-house	
1) Stator Core	2	0	1
2) Rotor Core	2	0	1
3) Frame (Iron Casting)	2	0	1
4) Stator Winding	2	1	0
5) Rotor Conductor	2	0	1
6) Bracket	2	0	1
7) Fan (Ventilation)	1	0	2
8) Bearing	1	2	1
9) Shaft	2	0	1
10) Terminal	1	1	1
11) Commutator (DC)	0	1	1
12) Brush (DC)	0	0	1
13) Slip Ring (AC)	0	0	1
Material			
1) Bolt, Nut	0	2	1
2) Varnish	0	0	2
3) Epoxy Resin	0	0	2
4) Silicon Steel Sheet	0	1	1
5) Aluminium Casting	0	1	1
6) Enamel Wire	0	2	1
7) Silicon Tube	0	1	1

Table 4-5-11: Procurement of Major Parts by Number of Firms (Transformers)

Main Parts	Local		Import
	In-house	Out-house	
1) Core	5	0	4
2) High voltage winding	6	0	0
3) Middle voltage winding	6	0	0
4) Low voltage winding	4	0	2
5) Insulation cylinder	4	0	1
6) Lead wire	6	0	2
7) Bushing	1	0	5
8) Bushing current transformer	1	0	3
9) Base	3	0	0
10) Radiating pipe	4	0	0
Special Parts			
1) Unit cooler	3	0	0
2) Radiator valve	1	0	5
3) Cooling fan	1	1	3
4) Dial Type Thermometer	0	0	5
5) On-load tap-changer	0	0	5
6) Dial type oil level gauge	1	0	4
7) Control gear for tap-changing equipment	0	0	4
8) Oil filter for tap-changer under the energized condition	0	0	4
Material			
1) Bolt, nut	2	5	1
2) Yoke clamp	4	1	0
3) Clamp ring	3	1	0
4) Name plate	1	5	0

4)Research & Development (R&D)

[1].Present Situation of R&D Activities

The history of the electrical machinery industry in Indonesia is relatively short and, since the beginning, the industry has been dependent on foreign technology. As a result, original technology has not been developed or accumulated in Indonesia.

To improve technology levels, it is first necessary to master the basic technology and then to accumulate know-how through everyday improvement of technology. For this purpose, many firms have tried to transfer technology from overseas countries through the establishment of joint ventures or technical tie-ups. However, it is not easy to master the imported technology in a short time and usually the imported technology needs to be modified to suit the situation in Indonesia. At the same time, firms have to work hard to keep up with the latest technology, which advances day by day.

Among the 16 firms surveyed, five did not respond to the questionnaire but six of those who responded said that they had in-house R&D departments. By volume of capital, no significant difference was observed between firms with large amounts of capital and those with small amounts. Three firms out of eight with capital below 1 billion rupiah and three firms out of eight with capital over 1 billion rupiah had R&D departments. On the other hand, by source of capital, only one out of seven joint-venture firms had an R&D department, while five out of nine domestic capital firms had such departments. A similar result was obtained through interviews in that the domestic firms were more eager to develop their own technology while the joint venture firms were much more dependent on technology being developed by their overseas principal firms. The results of the survey are shown in Tables 4-5-12 and 4-5-13.

As shown in Table 4-5-13, the average number of people working in R&D departments is 5.2 persons per firm. None of the firms had more than 10 people in their R&D department. The R&D budget of one of the two firms which responded was 100 million rupiah and accounted for 1.5 percent of the total sales while that of the other firm was 50 million rupiah and 1 percent. Judging from both the value and the percentage of total sales, R&D activities by the surveyed firms are insufficient.

Two firms out of the eight who responded to the questionnaire took out patents. Each firm, however, has only one patent and it is reasonable to assume from this that the total number of patents taken out by the Indonesian electrical machinery industry as a whole is very small. One of the major reasons for not taking out patents may be the sluggish state of R&D activities in Indonesia. However, the biggest reason may stem from the present situation regarding patent law. Since intellectual property, which includes patents, has not been well-protected in Indonesia, manufacturing firms are discouraged from conducting their own R&D activities and tend to import overseas technology. In light of this, it is urgently necessary to establish an intellectual property act. If the industry continues production with imported technology, it cannot move beyond its dependence on imported technology. In addition, it cannot move into overseas markets as sales areas are usually restricted by technical agreements.

As described above, to generate healthy development in the electrical machinery industry in Indonesia, one of the most important problems to be solved is how to create domestic technology. With its own technology, the industry could become a full-fledged one, where firms correspond to customers' specifications quickly, produce products less expensively and export the products to overseas countries without restriction.

Table 4-5-12: Research and Development (R&D) Activities

R&D Department	JV(PMA) Firms	Domestic Firms	Total
Have	1	5	6
Not Have	4	1	5
No Answer	2	3	5

Source: Questionnaire Survey

Table 4-5-13: Number of Persons Working for R&D Department

	Capital (Billion Rupia)	Number of People
(JV Firms) Company A	16.5	9
(Domestic Firms) Company B	0.4	3
Company C	3.0	5
Company D	0.8	6
Company E	11.8	6
Company F	0.8	2
Total		31

Source: Questionnaire Survey

[2].Supporting Institutions

Five of the firms surveyed used outside R&D institutions as shown in Table 4-5-14. The names and locations of the institutions are as follows:

Name of Institution	Location
1.Metal Industries Development Center (MIDC)	Bandung
2.Institute for R&D of Industrial Materials and Technical Products (B4T)	Bandung
3.R&D Center for Metallurgy (LIPI)	Jakarta
4.Control Laboratory for Calibration (LIN)	
5.Surabaya Institute of Technology (ITS)	Surabaya
6.Electric Power Research Center (LMK-PLN)	Jakarta

The focus of the above institutions, except for LMK-PLN and B4T, can be categorized into either metallurgy and materials, or measurement and calibration. LMK-PLN is historically a central research center for PLN and its research and development activities are fully centered on PLN. It has been said that the center is not equipped to meet the potential R&D needs of the electrical machinery industry in Indonesia in light of both the quality and quantity of the existing facilities and their geographical location. On the other hand, B4T, which is under the authority of the Department of Industry, is not equipped with the modern sophisticated testing and inspection facilities necessary to support the electrical machinery industry. A list of testing and inspection facilities owned by B4T is in paragraph (3)-2)-a) of section 4.5.

Bandung Institute of Technology (ITB), which was not named in the questionnaire survey, may be another institution to support electric R&D activities. The institute is performing joint R&D activities with PLN but it is not ready for public service, nor is it equipped with sufficient facilities. In addition to B4T, the Department of Industry has eight central R&D institutes including MIDC and nine regional R&D institutes throughout Indonesia. These institutes cover the fields of chemistry, agriculture, metal processing, fiber, pulp, industrial material, ceramics, leather and plastic, handicrafts, and batik. However, none of them can carry out electric R&D activities.

Table 4-5-14: Use of Outside R&D Institutions (number of firms)

Use Outside R&D Institutions			Not Use	No Answer
5*				
University	Gov't Org.	Others	4	7
1	2	1		

*Note: One firm did not state the name of the institution.
Source: Questionnaire Survey

(2) Management

1) Human Development

[1].Present Situation of Employment

a) Composition of work force

Based on the five firms which responded to the questionnaire, the number of employees by level of position and the percentage each level accounts for out of the total number of employees are shown in Tables 4-5-15 and 4-5-16. These five firms include three generator manufacturers, one motor manufacturer and one transformer manufacturer. The total number of administrative personnel, including both managerial and clerical staff, was 107. The number is regarded as high, accounting for 18.4% of all employees. Among factory workers, supervisors accounted for a high 11.3%, while skilled workers and technicians jointly accounted for 40.1%. On the other hand, semi-skilled workers and unskilled workers accounted for 18.0% and 12.2% respectively, together accounting for about one-third of the total number of employees. The high ratio of factory workers with inadequate skills in the actual work force could worsen production efficiency. As a result, streamlining and effective use of administrative staff and training of semi-skilled workers and unskilled workers would be required for the development of the industry.

By the number of years of employment, 50.3 percent or more than half of the total number of employees had worked between three and 10 years. Employees which had worked more than 10 years accounted for 15.3 percent. From the above, it is assumed that the rate of turnover in the electrical machinery industry is relatively low.

b) Composition of work force by level of education

Factory employees at the firms surveyed who were engaged in production were classified by level of education, as summarized in Chart 4-5-5 and Table 4-5-17. University graduates accounted for six percent, polytechnic graduates 10 percent, technical school and high school graduates jointly 60 percent, junior high school graduates 15 percent and elementary school graduates 9 percent. The result indicates that the industry has a relatively high educational level compared with the average educational level of Indonesian industries in which university graduates account for 0.5 percent, polytechnic and academy graduates jointly 1.0 percent, high school graduates 11.6 percent, junior high school graduates 11.4 percent, elementary school graduates 37.1 percent and those with no formal education 38.3 percent, as per the 1987 census.

Sixteen people from six firms received degrees from foreign universities and accounted for more than 20 percent of the total of 74 university graduates. The rate was regarded as very high. The largest number of degrees, seven, came from the U.S. while five came from Japan, three came from West Germany and one came from the Netherlands. The countries where the degree came from was not always the same as those where the employee's firm had a technical agreement. The results of the survey are shown in Table 4-5-18.

Table 4-5-15: Number of Employees by Level of Position and Seniority

Level of Position	1	Seniority (Year) 1~3	3~10	10~	Sub Total
Managerial Staff	0	6	26	6	38
Clerical Staff	5	5	43	16	69
(Factory)					
Supervisor	0	2	14	50	66
Skilled Worker	0	53	117	16	186
Semi-skilled Worker	0	50	55	0	105
Technician	0	31	15	1	47
Unskilled Worker	0	48	23	0	71
Total Employees	5	195	293	89	582

Source: ANX-2~6

Table 4-5-16: Number of Employees by Level of Position and Seniority

Level of Position	1	Seniority (Year) 1~3	3~10	10~
Managerial Staff	0	1.0	4.5	1.0
Clerical Staff	0.9	0.9	7.4	2.7
(Factory)				
Supervisor	0	0.3	2.4	8.6
Skilled Worker	0	9.1	20.1	2.7
Semi-skilled Worker	0	8.6	9.5	0
Technician	0	5.3	2.6	0.2
Unskilled Worker	0	8.2	4.0	0
Total Employees	0.9	33.5	50.3	15.3

Source: ANX-2~6
Note: Each figure is rounded

Table 4-5-17: Breakdown of Factory Workers by Level of Education

Firm	Univ.	Polytech.	High School	J.H. School	Element. School	Others	Total
A	1	0	3	30	12	5	51
B	5	10	40	8	4	0	67
C	4	33	10	4	0	0	51
D	0	0	21	4	0	0	25
E	8	4	94	52	50	0	208
F	1	2	10	10	10	0	33
G	4	9	91	13	13	0	130
H	33	33	264	0	0	0	330
I	18	35	210	70	18	0	351
Total	74	126	743	191	107	5	1,246
(%)	(6)	(10)	(60)	(15)	(9)	(0)	(100%)

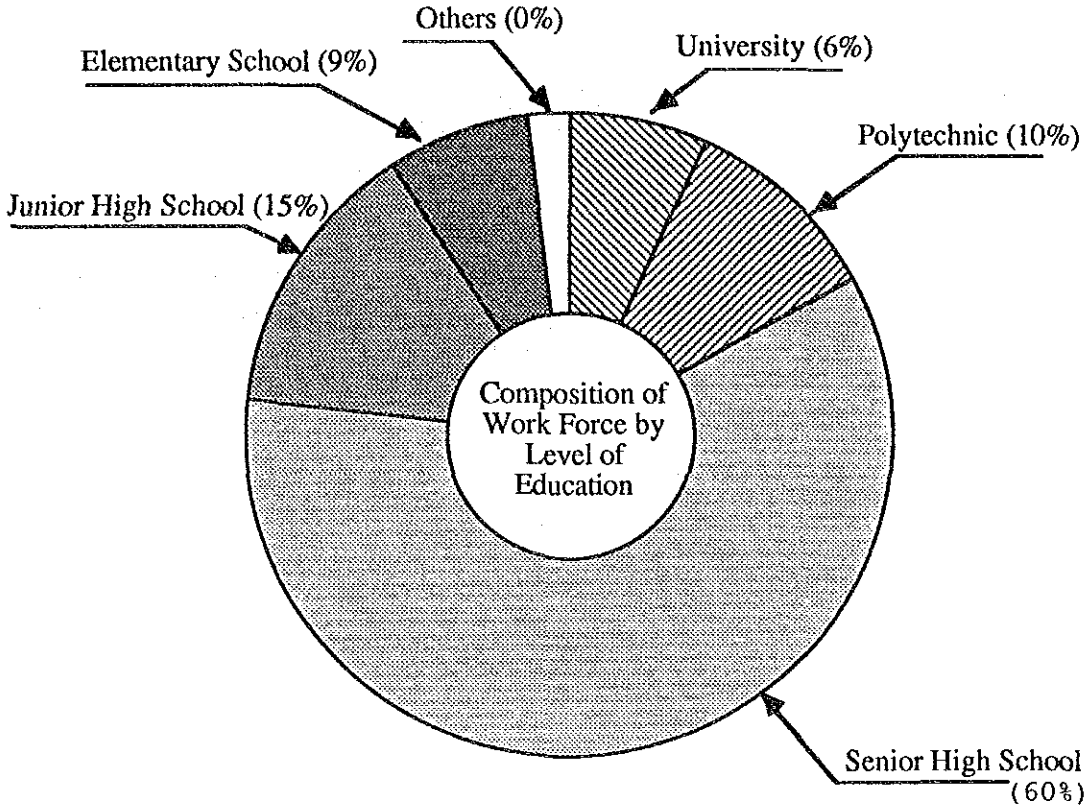
Source: Questionnaire Survey

Table 4-5-18: Degrees Received in Foreign Countries

Country	Degree Doctorate	Master	Bachelor	Total
U.S.A	0	6	1	7
W-Germany	1	2	0	3
Holland	0	1	0	1
France	0	0	0	0
Japan	0	0	5	5
Others	0	0	0	0
Total	1	9	6	16

Source: Questionnaire Survey
Note: Total of Responded 6 Firms

Fig. 4-5-5: Composition of Work Force by Level of Education



Source: Table 4-5-17

[2].Training

Training as human resource development is roughly divided into two categories according to the location of the training. One is in-house training and the other is outside training.

As shown in Table 4-5-19, most of the firms surveyed answered that they had some kind of in-house training in order for their employees to learn technology. Through in-depth interviews conducted by the study team, however, it was revealed that most of the in-house training is designed to give the employees simple technical skills. They often put OJT as a central part of the in-house training, and few have special training programs which include both theory and practice. There is virtually no training of management.

Seven out of nine firms who answered the questionnaire use outside training opportunities. Out of these seven firms, four train their employees at their overseas principal firms, while two do so at their overseas tie-up firms. Dependence on foreign firms for training is noticeable.

On the other hand, as described in Table 4-5-20, many firms expect the Indonesian government to support OJT training carried out by foreign experts. It was determined that the industry strongly requests technology transfer from foreign countries.

Table 4-5-19: Kind of Training by Number of Firms

	Do	Not Do	No Answer
In-house Train.	8	0	8
Outside Training	7	2	7

Source: Questionnaire Survey

Table 4-5-20: Expected Governmental Support by Number of Firms

Governmental Support	Number of Firms
OJT training by foreign experts	3
Subsidy for training	2
Increase technical seminars	2
Expand public training facilities	2
Dispatch of instructors from public facilities	1

Source: Questionnaire Survey

[3]. Engineers Required for the Electrical Machinery Industry

As made clear by the study, although the electrical machinery industry has a relatively high education level compared with other industries, there are not enough qualified engineers to meet the needs of the industry. One of the surveyed firms told the study team that university qualified engineers, whom the firm once hired, did not want to work on production lines in worker clothing but stayed at their desks and requested their own offices and high wages. Overall, they said, the engineers did not contribute to the firm.

Generally speaking, university students in Indonesia receive education emphasizing theory and they are hired by industries as management candidates. They do not receive factory training at universities. At the same time, with the exception of a few, universities are poorly equipped with various electrical education facilities such as high voltage inspection facilities. As a result of the lack of practical education in universities, university graduates sometimes do not understand what is going on at the production site or in many instances do not try to understand it. On the other hand, graduates from technical schools or lower education schools obtain a good deal of experience and knowledge in actual production, but they are often lacking in theory and thus do not have design capability. Most employees who are engaged in production fall into one or the other category and the gap between the two is not bridged at most firms.

TQC or total quality control circle activity is considered to be a very useful tool to improve the quality of products and to increase production efficiency. The activity is made possible through the participation of all of the people who are involved in production. The system works by collecting problems and ideas for improvement from production sites, conveying them to management for consideration and feeding solutions back to the production line. Five out of the 16 firms which were surveyed by the study team had introduced TQC systems, but few of them practice the activity properly. The biggest reason is that engineers with both theory and practice, who should implement the TQC system, have not been fostered.

From the engineering point of view, in the field of electricity, engineers must obtain at least some of the following abilities:

i) The ability to understand specifications and make appropriate decisions
ii) Sufficient knowledge of materials used
iii) The ability to calculate and convert from one to another among electric current, magnetic flux and mechanical power
iv) The ability to design electrical machinery based on national industrial standards
v) The ability to give ideas to improve quality through management of the production process
vi) The ability to draw various plans such as electric circuit diagrams and wiring diagrams
vii) Knowledge of standard values and tolerances of various inspection items and understanding of the relationship between deviation and quality
viii) Knowledge of the details of various kinds of testing and inspections, and the ability to analyze the data

The level of technology is basically related to the workers. At the actual production site, there is a severe shortage of workers who can deal with various situations such as deviation of gauges, shortage of parts, poor quality of raw materials and so on. Training and education of engineers is very important to raise the level of technology and to produce quality goods. Without engineers who are familiar with both production and inspection facilities, heavy investment in modern production facilities would be of no use.

2)Information

[1].Product development information

As shown in Chart 4-5-7, managers in the electrical machinery industry pay less attention to collecting information on product development - it was ranked fourteenth in the top 20 matters concerning management. Introduction of new technology is considered more important by the managers, ranking eleventh. Development of high-value-added products is of greater concern, ranking seventh, but it is still behind such matters as cost reduction and increasing productivity.

Low concern for collecting product development information was observed by the study team in that few firms among those surveyed actually had conducted the activity. Introduction of new technology from other firms, because it takes less time for development and leads directly to new products, has become popular among managers.

Table 4-5-21 summarizes the results of the questionnaire survey regarding the source of product development information. By source of information, government institutions are most popular, having been indicated by five firms. Such institutions as MIDC and LMK-PLN were named by the surveyed firms. Four firms, which are not foreign affiliated firms, get information through technical agreements with other firms. Considering the fact that all the foreign affiliated firms get information from their overseas principal firms, it is said that the introduction of product development information is usually done through technical agreements with foreign firms, regardless of whether the technical agreements are based on joint venture agreements or not.

The results of the questionnaire survey on interest in technical agreements are shown in Table 4-5-22. Six firms out of nine showed interest in technical agreements with foreign firms. The most interesting area is introduction of technology, which includes product development and new technology information. As most favorable countries for technical agreements, Japan is pointed out as number one for either generators, motors or transformers, followed by the U.S., Italy, West Germany and the U.K. Interest in Japanese high technology is very strong among managers of electrical machinery firms in Indonesia. It is significant that Korea and Taiwan are mentioned by one firm each. NIEs, including Korea and Taiwan, are generally good at producing low and medium technology products less expensively. In the future, it is forecast that Indonesia will import technologies not only from advanced countries such as Japan, the U.S. and European countries, but also from NIEs.

Table 4-5-21: Source of Product Development Information

Item	Source of Information (Nbr. of Firms)					
	Tied-up Firms	Customers	Universities	Governmental Institutions	Others	No Reply
Generators	2	0	1	2	1 (Foreign Principal Company)	2
Motors	1	1	0	1	0	2
Transformers	1	1	0	2	2 (Magazines etc.)	3
Total	4	2	1	5	3	7

Source: Questionnaire Survey

Table 4-5-22: Interest in Technical Tie-Ups (No. of Firms)

		Generators	Motors	Transformers	Total
Concerned with Technical Tie-up		3	1	2	6
Not Concerned with Technical Tie-up		1	0	2	3
No Reply		2	2	3	7
Country of Interest	Netherlands	0	0	0	0
	Japan	3	1	2	6
	U.S.A	0	0	2	2
	Italy	1	0	1	2
	France	0	0	1	1
	W.Germany	1	0	1	2
	U.K.	1	0	1	2
	Others	0	0	Korea,Taiwan	2
Purpose of Tie-up	Technology Introduction	4	1	2	7
	OJT by Foreign Exports	2	0	0	2
	Development of Overseas Market	3	1	1	5
	Management Skill	3	1	0	4
	Financial Support	1	0	0	1
	Others	0	0	0	0
Subject		Generators for Vessels, Management, Marketing	Mechanical Engineering, Electrical Engineering	Power Transformer	

Source: Questionnaire Survey

[2].Marketing information

Marketing information includes a wide variety of information varying from that on product, price and sales promotion to that concerning distribution channels. None of the firms surveyed are active in gathering such information. For instance, some firms had not even prepared very basic data such as sales value and volume for the last several years by product item and the name of principal customers. Only a few firms, by introducing simple production control systems run by personal computer, analyzed past sales flow, forecast future demand, controlled the purchase of materials and inventory and made future production plans. Regardless, virtually none of the firms had carried out research on the situation of competitors and competing products or consumers' tastes. As a result, they did not properly respond to competition from cheap imported products on the market.

The significance of marketing information is not only to increase profit. Through the maximization of firms' profits, it also helps improve technology so that it corresponds with customers' requirements and it subsequently helps achieve efficient utilization of limited resources from a macro economic point of view. Even though some of the firms surveyed knew the concept of marketing, most of the firms surveyed did not recognize the significance of marketing information or actual methods of gathering and analyzing the information or its application to real business activities.

The gathering of information on overseas markets is not widely conducted. Most managers in the electrical machinery industry do not pay much attention to overseas market information, with the exception of a few managers who were eager to promote exports and had tried to collect the information through such activities as attending international exhibitions and visiting overseas customers. These kinds of overseas information gathering activities are costly and could only be done by a handful of medium and large-sized firms.

In Indonesia, there is a very limited number of institutions which can supply the industry with overseas market information and the available information is insufficient in both quality and quantity. For the promotion of exports from the electrical machinery industry, easy access to information on overseas markets as well as to the latest technology and new products is essential.

3)Cost Analysis

[1] Trends in cost factors

In this study, several sets of data were obtained on the cost breakdown of two manufacturers of generators, two of motors, and four of transformers. These are shown in Table 4-5-23. As the results of the survey show, material and component cost is the largest cost item with ratios varying from 50 percent to 95 percent. The high costs of materials and components are due to the fact that most of them are not locally-produced but are imported from advanced countries. This prevents Indonesia from making use of its comparatively cheap labor costs and reduces the degree of value added to the final products.

The ratio of material and component cost in the transformer industry is approximately 10 percent smaller than the ratios in the generator or motor industries. One of the reasons is that the transformer industry puts more value added on raw materials such as steel sheet, silicon steel sheet and copper wire to complete the finished products, while the generator or motor industries are closer to a type of assembly industry which creates less value added. This may be evident from the study which found that, except

for firm "H", all of the transformer manufacturers have high ratios of labor cost, amounting to 15 percent or more.

As seen in Table 4-5-23, company "C", which manufactures motors, has an extraordinarily high ratio of material and component cost at 95 percent of the total manufacturing cost. That is because the firm started production very recently and it does not manufacture any parts in-house. It imports all the necessary components from its overseas principal firm and assembles them to make the final products.

Table 4-5-24 compares the average production costs of electrical machinery between Indonesia and Japan and the comparison is depicted in Chart 4-5-6. To comply with Japanese data, data for generators and motors in Indonesia are consolidated. Firm "C" was ignored as it had been established very recently and had not reached regular operation. From the table and the chart, the electrical machinery industry in Indonesia, in comparison with Japan, can be described as follows:

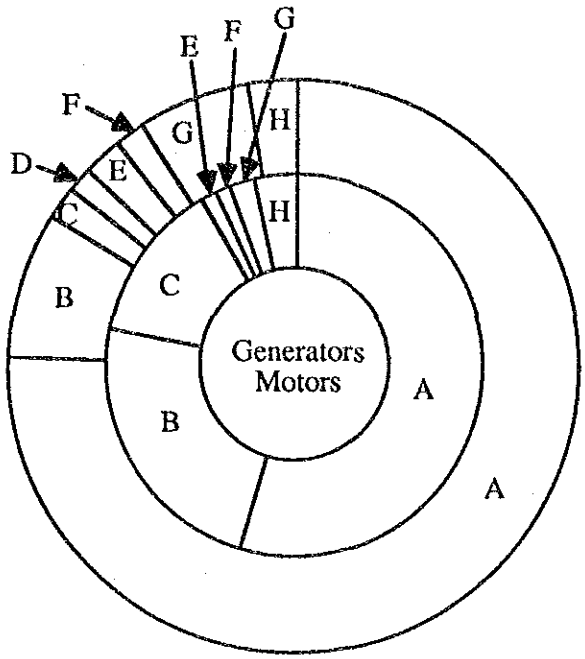
i) The cost of material and components is high. The biggest reason is that many of them are costly imports. Local components, if they are made of imported raw materials, are also expensive.

ii) The ratio of labor cost is small since the average labor cost per person in Indonesia is about 1/10 that of Japan. The cheap labor cost, however, does not affect the price of final products effectively as the size of each firm is small and its production efficiency is low.

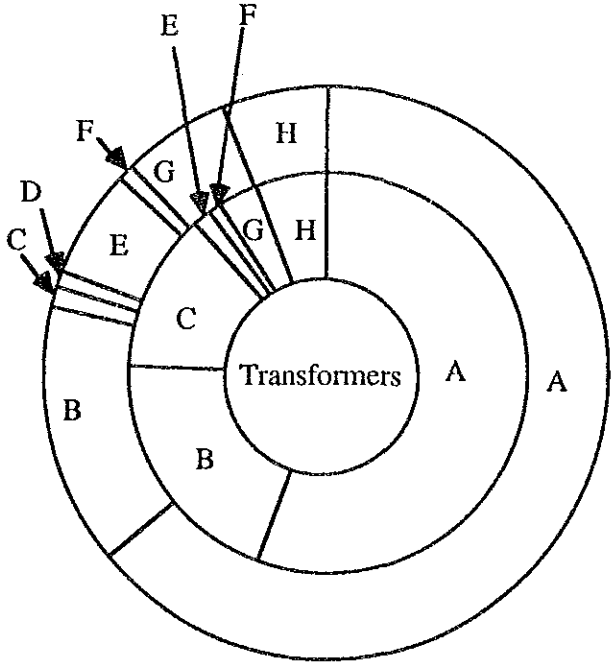
iii) The ratio of sub-contracting is very small. Compared with Japan, the ratio is 1/6 for generators and motors and 1/16 for transformers. This stems from underdevelopment of the supporting industries which would undertake sub-contracting.

iv) Depreciation cost is large. One of the major reasons is that manufacturers use imported production facilities. Another important reason is that they have only one set of facilities to manufacture the products because they produce more parts and components in-house due to the lack of development of supporting industries.

Fig. 4-5-6 : Compoarison of Production Cost between Indonesia and Japan



	Inner Circle: Japan (%)	Outer Circle Indonesia (%)
A. Material	53.7	73.3
B. Labor	23.0	11.7
C. Sub-Contrcting	16.2	2.7
D. Fuel	0.3	0.7
E. Electricity	0.6	2.3
F. Water	0	0.5
G. Depreciation	3.0	8.3
H. Others	3.2	0.5
	100.0	100.0



	Inner Circle: Japan (%)	Outer Circle Indonesia (%)
A. Material	53.2	62.5
B. Labor	20.7	15.5
C. Sub-Contrcting	16.1	1.0
D. Fuel	0.1	1.5
E. Electricity	1.0	4.8
F. Water	0.1	1.3
G. Depreciation	2.6	7.0
H. Others	6.2	6.5
	100.0	100.0

Source: Table 4-5-24

Table 4-5-23 : Breakdown of Manufacturing Costs

Cost Elements (%)	Generators		Motors		Transformers			
	A	B	C	D	E	F	G	H
Material & Compo.	70	80	95	70	70	50	60	70
Labor Cost	15	10	5	10	15	25	15	7
Subcontract Cost	8	0	0	0	1	0	0	3
Fuel	0	1	0	1	0	0	5	1
Electricity	1.5	2.5	0	3	2	5	10	2
Water	0.5	1	0	0	0	0	5	0.2
Depreciation	5	5	0	15	10	5	5	8
Others	0	0.5	0	1	2	15	0	8.8
Total	100%	100	100	100	100	100	100	100

Source: Questionnaire Survey

Table 4-5-24: Comparison of Production Cost of Electric Machinery between Indonesia and Japan

Cost Item (%)	Generators, Motors		Transformers	
	Indonesia	Japan	Indonesia	Japan
Material	73.3	53.7	62.5	53.2
Labor	11.7	23.0	15.5	20.7
Sub-contracting	2.7	16.2	1.0	16.1
Fuel	0.7	0.3	1.5	0.1
Electricity	2.3	0.6	4.8	1.0
Water	0.5	0.0	1.3	0.1
Depreciation	8.3	3.0	7.0	2.6
Others	0.5	3.2	6.5	6.2
Total	100.0%	100.0	100.0	100.0

Source: Questionnaire Survey; Cost Analysis of small and medium size Industries, 1988
Note: Each figure is rounded so that the total does not always equal 100%.

[2]Cost of imported materials and components

As previously discussed, the percentage of imported materials and components cost in the total production cost is very high. Usually, the purchasing cost of imported materials or components is the sum of CIF value, import duty, VAT, importer's handling charge, inland transportation charge, distributor's margin, etc. Import duty varies from 30 percent for CKD components of designated products to 5 percent for standard parts. In addition to the import duty, 10 percent VAT and approximately 20 percent of the total of various charges would be added to produce a 35 to 60 percent increase over the CIF value. In addition, because of low demand for local products, manufacturers cannot pursue economies of scale. As a result, Indonesian manufacturers cannot take advantage of the relatively cheap labor to achieve price competitiveness of the final products.

Import duties and the VAT imposed on some major components used for transformers are shown below. Among them, cooling/insulation oil is the only item with no import duty.

Import Duties and VAT for Selected Imported Materials and Components

Item	CCCN Nbr.	Import Duty	VAT
Silicon Steel	7225.10.000	5%	10%
Copper Strip	7409.11.000	5%	10%
Pressure Relief Device	8481.40.000	10%	10%
Oil Immersed Low Voltage Circuit Breaker	8504.90.900	5%	10%
Commutator	8535.30.100	5%	10%
Lightning Arresters	8535.40.000	20%	10%
Temperature Instruments	9032.10.000	5%	10%
Insulation Paper	8546.90.000	5%	10%
Insulation Varnish	3208.10.290	5%	10%
Bushing	8546.20.100	5%	10%
Cooling/Insulation Oil	2710.00.991	0%	10%

[3]Labor cost

Table 4-5-25 shows the average wage level obtained from one generator, one motor and one transformer manufacturer. There is no noticeable difference in the average wages of unskilled workers among firms "A","B" and "C", but the differences among the three firms are large in terms of technicians, skilled workers and supervisors. The differences become largest for managerial level personnel, where the average wage of firm "B" is more than three times that of firm "C". It may be said that the differences are not caused by the characteristics of the products but by the size of the firms. By number of employees, firm "A" has 80, firm "B" has 400, and firm "C" has 33. That is, in firm "B", managerial personnel have more authority and more subordinates than is the case with firms "A" or "C".

Table 4-5-25: Average Wage of Employees (thousand rupiah)

	A (Generators)	B (Motors)	C (Transformers)
(Administration) Managerial Staff	9,000	12,000	3,600
Clerical Staff, etc.	6,000	3,000	2,400
(Factory) Supervisor	4,800	6,000	2,400
Skilled Worker	3,600	3,000	1,800
Semiskilled Worker	2,400	1,800	1,200
Technician	1,800	3,000	1,800
Unskilled Worker	1,200	1,200	900

[4] Cost reduction activities

In recent years, the inflation rate in Indonesia has been high, and the interest rates of commercial banks have stayed at a high level. Costs of raw materials have been steadily soaring, especially for copper wire and semi-processed silicon steel sheet. The rapid increase in costs was mentioned by many of the firms surveyed. Each firm recognizes the need to streamline the production process but this cannot be done immediately. Seven of the firms surveyed point out improved productivity as a problem to be tackled. Procurement of low cost materials followed, recognized by six firms. Increased production efficiency and increased in-house production were next.

A positive attitude toward the improvement of productivity appears to be widespread and for that purpose long term R&D activities are necessary for the industry. Governmental support for such R&D activities would be requested. The results of the questionnaire survey are shown in Table 4-5-26.

Table 4-5-26: Cost Saving Activities by Number of Firm

	Generators	Motors	Transformers	Total
Improve Productivity	1	1	2	4
Improve Technology Level	2	1	4	7
Procure Lower Cost Materials	2	2	2	6
Direct Purchase of Materials	2	0	2	4
Increase In-house Production of Materials	2	0	1	3
Others	0	0	1	1
No Answer	2	1	3	6

Source: Questionnaires Survey

4)Attitudes of Management

Fig. 4-5-7 shows the results of a questionnaire survey on what points of concern for managers in the electrical machinery industry. In this figure, 15 items of concern to managers were chosen in the order of highest to lowest and a ranking was assigned to the degree of concern. In calculating these, the first item was worth 15 points, the second 14 and so forth. The points received for each item were then summed up for comparison. Based on characteristic points seen in chart 4-5-7, which is based on the results of the interviews, the following can be said:

i) The biggest items of concern right now to electrical machinery manufacturers, or those ranked from first place to third, are related to reduction of costs and improvement of productivity. They are seeking better quality and less expensive materials, parts and components to reduce such costs.

ii) Next on the manufacturers' minds, or those ranked from fourth place to sixth, are issues related to strengthening marketing and developing high-value-added

products. Procurement of local parts and components is ranked next. Most of the managers would like to use more local parts and components if the prices and the delivery could compete with imported ones.

iii) The managers show strong interest in developing high-value-added products, while they show little interest in modernizing production facilities. Although education and training of employees is a key factor in reducing costs, improving productivity and developing high-value-added products, the managers pay less attention to this factor.

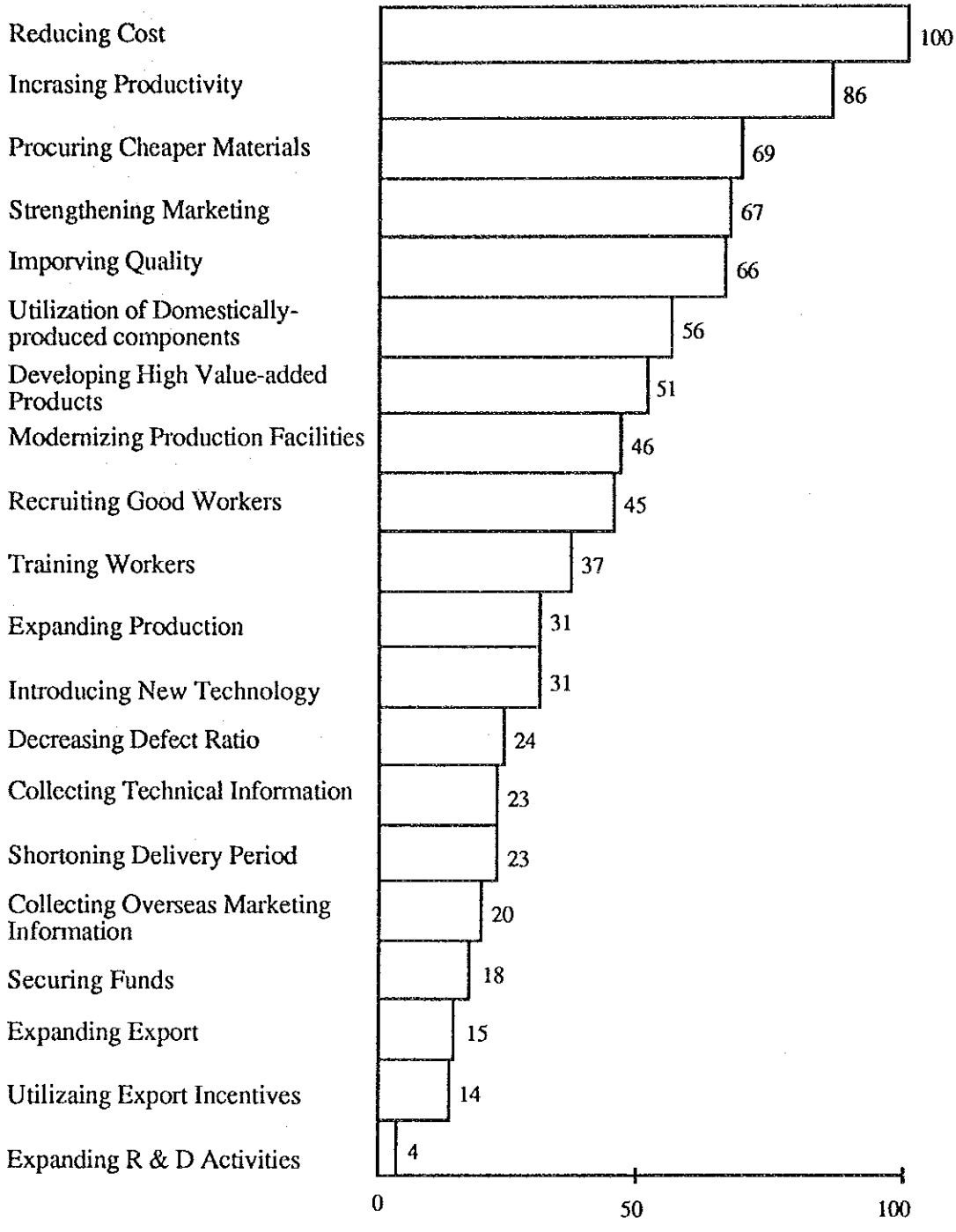
iv) The concern over collecting technical information is low, while the managers show moderate interest in introducing new technology. Further, only one firm is interested in R&D activities and it ranked them very low, in twentieth place or least interesting. Generally, the manufacturers put much higher priority on the improvement of the present operation than on investment in future production. Consequently, they do not show strong concern for R&D activities, which take a long time to lead to new products.

v) Securing of funds is ranked seventeenth among the twenty concerns by managers in the electrical machinery industry. Chosen by only three firms, the concern is considered to be very low. It was made clear through the interview survey that the securing of funds was relatively easy for financially healthy firms such as members of APPI. The real concern for them is not how to secure funds but how to secure low interest funds.

vi) Both collection of overseas marketing information and expansion of exports are ranked low. The immediate concern of the managers is to increase sales in Indonesia. Most managers are not prepared to export because they have limited knowledge in this area.

vii) Concern regarding the utilization of government incentives is very low, ranked nineteenth. There are two possible major reasons. One reason is that there are few incentives which are attractive to the industry and the other is that the procedure for application for such incentives is complex and time consuming. None of the firms are against the basic policy of the government on export incentives, but some firms complained about the operation and procedure.

Fig. 4-5-7. Main Items of Concern by Managers



Source: Questionnaires survey

(3)Supporting Industries and Facilities

1)Supporting Industries

[1]Underdevelopment of supporting industries

Basic and supporting industries in Indonesia, which should support the electrical machinery industry, are still under development and can respond to the requirements of the electrical machinery industry only for a limited number of materials and parts. These include bolts, nuts, nameplates, certain types of enamel wire, medium-sized bearings, low level (class B) insulators, aluminum castings and some iron castings.

Supporting industries, which produce these kinds of parts and components, are roughly divided into two groups: a few medium to large-scale firms and the remaining many small-scale firms. The former are active in introducing the latest technology through technical agreements with overseas manufacturers. As they can easily secure funds, they are equipped with modern production facilities such as CNC machine tools in addition to those for iron castings and aluminum diecastings.

For instance, company A, a Japanese affiliate which has more than 300 employees, is equipped with 25 CNC lathes. The firm imports raw materials, mainly from Japan, and supplies electrical machinery firms with machine processed parts such as end brackets, shafts and frames. Another example is company B, which is specialized in iron casting and has approximately 270 employees. It supplies the electrical machinery industry with various iron casting products such as brackets. They were the first firm in Indonesia to receive a portion of capital from JAIC (Japan Asian Investment Corporation) and have received technical assistance on quality control from JODC. Company C, which has 210 employees, has received JIS approval for its factory and produces enamel wire. Other medium to large-scale firms include PT.Bearindo, which produces various types of bearings, and PT.Carbon & Electric, which produces bushes for generators and motors.

These firms, which have good technology levels and adequate working capital, could be compared to medium to large-scale electrical machinery firms in size. However, most of the other parts and components manufacturers are small in size and continue production of low quality parts and components with obsolete facilities and technology. They have almost no linkage with the electrical machinery industry or have made little contribution to the industry.

Despite the existence in Indonesia of a few firms which manufacture quality parts and components, there are virtually no manufacturers of raw materials who supply raw materials to parts and components manufacturers, except for a few items. For instance, silicon steel sheet, which is one of the most important materials in electrical machinery, carbon steel, which is used for shafts or dies, and special alloys, are all imported.

Development of supporting industries may be one of the key factors in developing industrial power in Indonesia in the future. To achieve this through strengthening the linkage between the electrical machinery industry and supporting industries, it is requested that the government ensures the unification of various gauges, units and standards so that all the related industries can speak a common language.

[2]Present situation of utilization of subcontractors

In-house production of parts and components is costly unless the volume is large enough. Except for some special parts, such as those which require very high technology, assembly manufacturers usually procure parts and components from sub-contractors. Electrical machinery firms, excluding screwdriver type manufacturers,

procure 10 percent to 50 percent of their parts and components from sub-contractors or the market.

The results of the questionnaire survey on the evaluation of subcontractors are shown in Table 4-5-27. It is clear from the table that no firms were satisfied with the delivery conditions of the subcontractors. Concerning the quality of products supplied by the subcontractors, two firms replied that it was good, nine firms fair, and none of the firms indicated poor. However, in the in-depth interviews conducted by the study team, some firms answered that they used imported parts because of the poor quality of local ones.

Besides poor quality, several firms, especially joint venture firms, complained of unstable delivery and frequent delays in delivery by subcontractors. These kinds of problems often upset the firms' production planning and required that they have an excess inventory of parts and components. In light of this situation, the firms would be burdened with high production costs, which may cause finished products to be less competitive against imported ones.

According to the questionnaire survey, 10 firms, or more than 80 percent out of the 12 firms, offer some kind of support. The support is mostly concerned with technical matters such as technical advice and testing and inspections. Financial support is rare. This kind of technical support is considered to be very useful for the development of small-scale industries which lack technology. The results of the questionnaire survey are shown in Tables 4-5-28 and 4-5-29.

Table 4-5-27: Evaluation of Local Subcontractors

	Good	Fair	Poor	No Answer
Quality	2	9	0	5
Quantity (capability to meet requirements)	3	6	2	5
Delivery	0	10	1	5
Technical Level	1	7	1	7
Management	1	7	1	7

Source: Questionnaire Survey

Table 4-5-28: Support for Subcontractors (by Number of Firms)

Item	Support			Kind of Support		
	Do	Not Do	No Reply	Technical	Material supply	Financial
Generators	4	1	1	4	3	1
Motors	3	0	0	1	0	0
Transformers	3	1	3	3	1	0
Total	10	2	4	8	4	1

Source: Questionnaire Survey

Table 4-5-29: Kind of Technical Support

Item	Technical Advice	Training	Testing and Inspection	Others
Generators	2	1	3	0
Motors	3	0	2	0
Transformers	3	2	2	1
Total	8	3	7	1

Source: Questionnaires Survey

2)Supporting Facilities

[1] Technical Support Institutions

Governmental or semi-governmental institutes which give the electrical machinery industries technical support are categorized into three groups based on the controlling body as described below:

a) Central R&D institutes under the authority of BPPI of the Department of Industry:
   (1) Metal Industries Development Center (MIDC)
   (2) Institute for R&D of Industrial Materials and Technical Products (B4T)
b) Central R&D institutions under the authority of the Department of Mining and Energy:
   (1) Electric Power Research Center (LMK-PLN)
c) Other institutions
   (1) Bandung Institute of Technology (ITB)
   (2) Surabaya Institute of Technology (ITS)
   (3) Indonesian Institute of Science (LIPI)

In addition to the above institutes, there are nine regional R&D institutes under the authority of BPPI, as well as LIN under the authority of LIPI, but none of them can give technical support to the electrical machinery industry.

In Indonesia, the number of technical support institutes in the field of electricity is very limited, and, among them, only LMK-PLN is actually conducting pure R&D activities in the field of electricity. MIDC is specializing in technical support in the field of metal processing. Because, as universities, both ITB and ITS are principally educational institutes, most of their facilities are for basic education and research purposes and do not reach a sufficiently high level to support the electrical machinery industry on a wide range of R&D subjects. ITB, in cooperation with PLN, has established a training center (Tim Pelakasana Kerjasama PLN-ITB) for electrical engineers but the center is solely available to PLN for education and training, with a limited range of R&D activities for the industry overall.

As a result, it may be said that B4T and LMK-PLN are the only technical support institutes in Indonesia related to the electrical machinery industry. The two institutes are described as follows:

a) Institute for R&D of Industrial Materials and Technical Products (B4T)

B4T was originally established as a metal testing laboratory in Jakarta in 1909. It moved to Bandung in 1920 to become a materials testing laboratory. After the expansion of its facilities, it became the present B4T in 1980. From its historical background, it mainly provides technical services to industries which produce plant equipment and automotive components, and process industries.

i) Function
Testing and inspection
   -All kinds of material tests (strength, non-destructive, corrosion, microstructure, chemical and physical properties) and calibration testing of measuring equipment are conducted.
   -At the request of industries, B4T conducts tests of materials and is authorized to issues inspection certificates.
Inspection and quality assurance
   B4T conducts mainly non-destructive tests of plant equipment, ships and machinery to certify their quality according to the national regulations and issues

authorized inspection certificates. These inspections are conducted on such products as boilers, heat exchangers, and various pressure vessels.

Training of engineers

B4T conducts training of engineers according to the needs of industries.

The training does not include the field of electrical engineering but includes such fields as:

-Quality control
-Welding in the gas and oil industry
-Non radiation NDT inspection
-Concrete technology
-Microwave inspection based on ASNT level 2

Corrosion and pollution control

-B4T periodically conducts quality tests of waste water with industries to prevent pollution
-B4T conducts research on corrosion and corrosion protection of equipment, sewage pipes and other facilities in the chemical and textile industries.

ii)Organization

Approximately 250 employees are engaged in the administrative division and there are five other divisions : Building materials, Organic chemistry, Inorganic chemistry, Metal, and Technical products. Testing and inspections and R&D on electric machinery are conducted in the electrical testing laboratory of the technical product division.

iii)Testing and inspection facilities

As of August, 1988, the following testing and inspection facilities were equipped for electrical machinery products:

Equipment	Brand	Unit	Year of Purchase
Paper Recorder	Hioki	1	1982
Data Logger & Scanner 160 Channel Cap.	Fluke	1	1982
Oscilloscope	Tektonix	1	1971
Digital Multimeter	Fluke	1	1980
Power Factor Meter	Yokogawa	1	1980
High Voltage Meter	Yokogawa	1	1980
Demitron Thickness Meter	UPA		
Variable Transformer	Matsunaga	1	1971
Discharge Test for Dry Battery	(Lab. Assembly)	1	1977
Lathe Machine	Atlas	3	1951
Scrap Machine	Atlas	1	1951
Drilling Machine	Ryobi	1	1982
Tool Set	Tone	2	1980
Furnace Complete with Temperature Control	Fisher	1	1980
Tensile Testing Machine	Shimadon	1	1983
Universal Testing Machine	Shimadon	1	1983
Planer Impact Tester	Karl Frank	1	1951

(Source: B4T)

iv)Evaluation

As B4T carries out basic testing and inspections concerning industrial materials, it has only basic testing and inspection facilities and is not sufficiently equipped to carry out testing and inspections on electrical machinery. Many obsolete facilities are used in daily work. Modernization of such facilities and introduction of new facilities for advanced testing and inspections of electrical machinery are necessary.

b) Electric Power Research Center (LMK-PLN)

LMK-PLN was first established as a central R&D laboratory of PLN in 1961. It became an independent laboratory called LMK in 1966, but its basic position as a supporting institution to PLN has remained unchanged. Most of its work involves conducting R&D activities for and rendering various technical services to PLN. As a line of technical support to industries, it opens its library to the electrical machinery industry and provides technical consultations over the phone.

i) Function

Evaluation, surveys, studies, research, development and consultation on primary energy resources and possibilities of their utilization for electric power.
Studies, research, development, testing, calibration, guidance and consultation on electrical equipment, power generation and supply systems and fuels, chemistry and other problems of power generation.
Studies and research in preparation for general planning, technical planning and detail planning for development and extension of electric power installations.
Formulation and development of concepts for regulation requirements, standards and other general specifications to guarantee safety and to prevent hazards from the use of electric power.

ii)Organization

No less than 400 employees work in five laboratories and an administration department. Approximately 60 percent of the employees are engineers, with 90 university graduates and 90 polytechnic graduates. Fields of research in the five laboratories are described in Table 4-6-47.

iii)Evaluation

LMK-PLN is principally engaged in providing various technical support to PLN and the government. It provides technical support such as quality control to industries, but the support is not active. It does not conduct testing and inspections on products for the electrical machinery industry. Instead, corresponding to requests from the industry, it provides "witness support" by observing testing and inspections of products and issuing certificates which indicate that the testing and inspections have been properly carried out. It may be said that LMK-PLN does not meet the demands for technical support from the electrical machinery industry.

Table 4-5-30 Organization of LMK-PLN

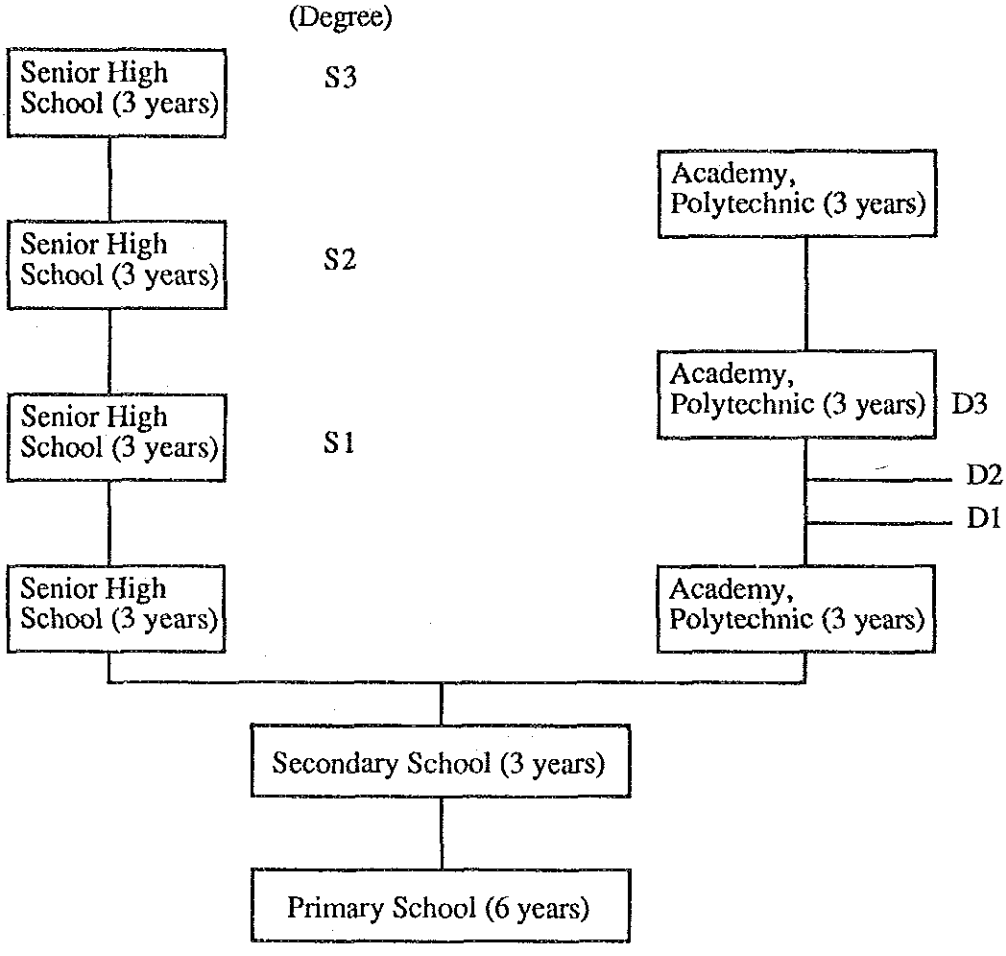
Department/Laboratory	Section	
Electrical	Standards & Meters	Standards Electrical Calibration Electrical Measuring Equipment Photometry
	Installation	Electric Power Installation Telecommunication Protective relays Control
	High Voltage	Lightning research High Voltage research High Voltage Equipment
	Low Voltage Electrical Equipment	Distribution Equipment Cables Switchgear Household Appliances
Hydro Power	Civil Engineering	Hydraulics Geotechnique Hydrology
	Mechanical Engineering	Hydrodynamics Turbine Models Construction
Thermal Power	Power Generators	Steam Turbines Diesel & Gas turbines Nonconventional
	Instrumentation & Materials	Instrumentation & Control Material Testing Vibration & Noise
	Fuels & Chemical	Chemical Analysis Fuels Materials
Survey	Mapping, Geology & General Survey	General Survey Mapping Survey Geological Survey
	Hydrology & Hydrography	Hydrological Survey Hydrographic Survey
	Environmental Research	
Power System Research	System Operation Research	System Operation System Control System Protection
	System Planning Research	System Planning System Reliability Computer Services

Source: LMK-PLN's Catalog

[2]Human Resource Development

The education system in Indonesia is described as follows:

Fig. 4-5-8: Education System in Indonesia



In Indonesia, few people graduate from university (S1) and those who study engineering at university are hired as associate engineers by industries. They are usually treated as management candidates. On the other hand, high school graduates are hired as high ranking technicians and assume positions such as operators of sophisticated machine tools. Polytechnic (D1-D3) graduates are intended to fall between graduates of these two kinds of educational institutions. While theory is more emphasized than practice at universities, at polytechnics more emphasis is put on practice in workshops which is intended to produce middle level engineers. Nineteen polytechnics have been established throughout Indonesia, and among them, Swiss Polytechnic for Mechanics (Politeknik Mekanik Swiss), which belongs to ITB, and the Electronic Engineering Polytechnic Institute (Politeknik Elektronika dan Telecomunikasi), which belongs to ITS, were compared by the study team. The result of the study is summarized as follows:

a) Politeknik Mekanik Swiss

i) Outline of the Institute

This institute was the first polytechnic in Indonesia, established in 1975 with the assistance of the Swiss government. The capacity of the institute is 104 students for each grade, or 312 students in all. Most of the graduates take positions in industry, while approximately 4 percent of them continue study at universities. The institute offers training courses for industries and presently about 160 trainees receive the training.

ii) Outline of the Curriculum

For more than 12 years, the institute has been running a mechanical training workshop. A drawing and design school was added in 1980. A modern tool-making workshop has been in operation since 1983. The institute also has the only foundry school in the country. Seventy percent of the training involves the actual operation of machine tools in workshops and the remaining 30 percent is composed of classroom work. No curriculum concerning electrical engineering is available.

iii) Facilities

More than 100 various machine tools including the latest ones such as CNC milling machines and electrical discharge machines, 165 fully-equipped workbenches and 50 drafting boards with precision drawing machines are provided. As mentioned, the institute has the only foundry facility in the country. Facilities for production or testing and inspections of electrical machinery, however, are very limited.

iv) Support to industries

The policy of the institute is not only to educate students but also to provide industries with various technical services. The following technical services are rendered to industries for a fee:

Technical consulting on foundry
Technical consulting on metal processing
Designing and production of moulds
Designing and production of press dies
Designing and production of metal dies
Precision machining of metals
Rehabilitation of machine tools

In addition to the above, the institute offers industries a 40 hour-a-week training package, which includes such subjects as operation of machine tools and technical drawing.

v) Evaluation

Education is heavily focused on mechanical engineering including such fields as foundry, design and production of dies, production of jigs and tools and precision metal processing. The institute may contribute to the electrical machinery industry in terms of mechanical engineering, but it does not provide the industry with direct technical support in the field of electrical machinery. It has few basic testing and inspection facilities for electrical engineering and it does not have advanced facilities for advanced electrical study.

Generally, a polytechnic is positioned between technical high schools, at which practical training is emphasized, and universities, at which the study of theory is emphasized. This polytechnic, however, because most of its curriculum comprises practical work in workshops, may be regarded as a technical training center for high level technicians rather than middle level engineers.

b) The Electronic Engineering Polytechnic Institute (Politeknik Elektronika dan Telekomunikasi)

i) Outline of the institute

This institute was established in 1988 in cooperation with the Japanese government as the nation's first polytechnic covering the fields of electronics and telecommunications. The number of seats available per year is 120 in two departments: the Department of Electronic Engineering and the Department of Communication Engineering. It received its first students in August 1988 and in August 1990 the number of students is supposed to reach the capacity of 360. While at other polytechnics approximately 60 percent of the curriculum involves work in workshops to acquire technical training, at this polytechnic, approximately 60 percent of the curriculum is carried out in classrooms where theory rather than practice is emphasized. The remaining 40 percent of the curriculum involves work in workshops. In classrooms, subjects other than engineering, such as industrial management, are taught.

ii) Outline of the curriculum

The curriculum is broadly divided into three levels of education: general subjects, basic science and engineering and engineering subjects. Engineering subjects include the following:

Department of Electronic Engineering
(Theory:practice=62%:38%)

-Quality control
-Electric circuits
-Electricity and magnetism
-Electronic circuits
-Digital electronics
-Microprocessor and interface
-Automatic control
-Electric power system
-Computer language II
-Computer-aided problem solving
-Signal processing
-Applied electronics
-Opto-electronics
-Maintenance and repair
-Mechanical workshop
-Electronic workshop
-Practice I, II, III

Department of Communication Engineering
(theory:practice=63%:37%)

-Quality control
-Electric circuits
-Electricity and magnetism
-Electronic devices
-Electronic circuits
-Digital electronics
-Microprocessor and interface
-Automatic control
-Electric power system
-Computer language II
-Computer-aided problem solving
-Signal processing

-Communication circuits and system
-Applied communication
-Radio wave transmission and microwave
-Radio wave measurement and instrumentation
-Network and switching
-Optical communication
-Maintenance and repair
-Mechanical workshop
-Electronic workshop
-Practice I, II, III
-Project

In addition to the education carried out in school, training at industries is scheduled.

iii) Facilities

The institute is equipped with the best of facilities and equipment covering all fields of electronics and telecommunications. These facilities include a series of basic measurement instruments and modern broadcasting and telecommunication facilities which are the same as those actually used at broadcasting or telecommunication firms. In addition to other modern facilities such as personal computers, OHP's, and video projectors, the school is equipped with a studio for production of video films and a radio anechoic room, which is considered to be the only such facility in the country.

iv) Support to industries

Because it was established recently, at present this institution is operating solely to educate students and it does not provide industries with any technical assistance. In the future, it intends to give industries a wide variety of technical services as public service is one of the duties to be carried out by governmental institutions.

v)Evaluation

In contrast to other polytechnics, this institute trains middle level engineers through an intensive curriculum which puts more emphasis on theory and tries to bridge the gap between high schools and universities. It is also significant that the institute teaches management as one of the key subjects. In the fields of electronics and telecommunications, demand for middle level engineers would increase as the industries grew and this institute would contribute to the industries by supplying well-educated engineers.

The institute is equipped with sufficient state-of-the-art facilities and equipment. It is considered to be the best institute among all the institutions in Indonesia, including universities and governmental laboratories.

Although it has no programs to support industries at present, it will contribute a great deal to industries in the future. The institute, however, may not give sufficient support to the electrical machinery industry since the fields covered are different from those existing in the industry.

4.6.Proposal of Comprehensive Promotion Programs for Electrical Machinery Industry

(1) Perspective of Comprehensive Programs

1) The Indonesia electrical machinery industry has been promoted under import substitution policies in line with the comprehensive schedule for deletion programs implemented starting from the period of Repelita IV. However, the prices of products of domestic manufacturers and their nonprice competitiveness are still not strong and parts and finished goods continue to be imported in large amounts at the present time.

2) The object of this survey is to provide proposals of comprehensive programs for the development of the industry into an export industry, but for electrical machinery, in view of the rising domestic demand, it is important for the products of domestic manufacturers to be able to secure competitiveness sufficient to counter imports in some way and thus to increase their domestic sales.

In the case of electrical machinery, unlike general consumer goods, the nonprice factors (performance and quality) are more important than the price factors.

Securing competitiveness sufficient to counter imports means simultaneously to have competitiveness as export products as well.

Fortunately, the tariff rate assessed on imported parts is expected to be reduced starting in 1990. Therefore, the price competitiveness of finished products for the domestic market and exports can be expected to increase, so the improvement of technical capabilities will become the more important issue.

3) Strengthening of Linkage Industries

Electrical machinery relies not only on technology of the electrical field alone. Rather, it is essential that sufficient technical competitiveness be secured in the fields of metalworking and machining and that the overall foundation of the metal machinery industry be strengthened.

This improvement of the technical capabilities of such linkage industries is an important factor for the strengthening of the competitiveness of electrical machinery with regard to parts, components, and materials for the same as well.

4) Parts Industries

Looking at the start of production in Indonesia from the viewpoints of joint ventures and technical tieups, generators are being produced under license from other countries. Production under foreign license accounts for the mainstream of production both for motors and transformers. Further, Indonesia relies on imports for much of its key raw materials, parts, and components and prices have been rising. This is clear from the high ratio of parts in the elements of prime costs. There is no price competitiveness with respect to internal demand or export use. It is important to strengthen domestic production of materials, parts, and components. As one method for this, it is desirable to positively attract foreign manufacturers.

5) Promotion of Medium Sized Local Companies

Many of the electrical machinery manufacturers in Indonesia which are engaged in production or assembly based on technical license agreements with foreign companies were established with the purpose of a market orientation (production and sale for domestic demand.

These large companies are able to move on to exports along with the changes in the elements of comparative advantages in Indonesia, while selling to meet domestic demand, but such expectations lies in the future. Considering the magnitude of the domestic demand of Indonesia and the future development potential, investment in expansion of market-located type production would be attractive. Despite the existence of government measures for domestic production (import substitution), Indonesia is attractive for the potential size and future possibilities of the market.

Therefore, the companies which should be targeted for promotion as export companies are the medium sized firms. The promotion and development of companies free from technical licenses or restrictions on markets of sale is one method which should be considered in promotion the development of the electrical machinery industry as an export industry.

6) R&D

A tendency of overdependence on foreign technology is apparent in both foreign affiliated firms and local companies, with insufficient autonomous development of products being performed. This is due in part to the lack of manpower able to perform R&D and simultaneously to the insufficient system of support provided by official organizations.

7) Export Promotion

Field of products: Judging from the export records and production records of electrical machinery, the products in which Indonesia is judged to be strongly competitive at the present are voltmeters and transformers, while those in which it is judged to be extremely weak in competitiveness are rectifiers and generator sets. Motors, generators, welding machines, and panels fall between the two. Generators and motors are also becoming competitive in terms of volumes and some have been exported. Therefore, the export promotion activities have to include strategic promotional measures which positive promote products in the order of their potential.

Information: Industrial circles concerned in Indonesia does not have the enough ability to collect overseas technical information and overseas market information except in the case of specific large joint ventures. Therefore, it is necessary to push forward with the provision of information to the industry as a whole.

Price competitiveness: To strengthen the price competitiveness of export products, measures are necessary for reducing the cost of parts including slashing of the import tariffs.

Contributions of industrial organizations: Industrial organizations is expected to deal positively with export activities in cooperation with the government. It is also important that they participate in overseas trade fairs, dispatch missions to develop markets, and run surveys of overseas markets.

(2) Current Problems

The main technical and business operational problems faced by the Indonesian electrical machinery industry, as revealed by the current survey, may be summarized as follows:

1) Problems in Standards, Testing, and Inspection

[1] Testing and Inspection Equipment

Electrical machinery becomes a finished product only after satisfying the requirements for electrical characteristics in the final preshipment testing and inspection. Compared with mechanical testing equipment, there is a remarkable shortage of electrical testing equipment. In particular, there is almost no high voltage testing and inspection equipment in either private companies or public research institutions. The insufficient testing and inspection result in shipment of inferior products in many cases. These products suffer from oil leakage, poor insulation, etc. and have caused a loss of customer confidence in some cases.

[2] Establishment of Industrial Standards

There are three domestic standards: the SLI, SPLN, and SII, but none of these are complete and the system of standards is complicated. There have been much delays in the establishment of a unified system of standards (SNI) by the National Standards Commission and it is difficult for companies to standardize with each other. There have been delays in the unification of the systems of units (gauges, units), the underpinnings of technology. Various types of units are being used at the same time. Due to the different interpretations of the same values, there are many cases of nonintegralness of production between assembly companies and subcontractors. Even in the market the situation is the same. Bolts and nuts of different units are sold without differentiation.

[3] Research and Development Organizations

There is no central research institute specialized for electrical machinery under the Ministry of Industry. B4T just performs simple tests and has insufficient equipment. On the other hand, LMK-PLN engages mainly in research on commission from PLN and does not provide much support at all to private companies. The national universities have insufficient equipment and manpower and are not set up to provide support to business at all.

2) Problems in Quality Control and R&D

[4] Quality Control

There are few companies completely equipped with measurement equipment and jigs, the basis for quality control. Only a very small number of companies perform calibration of their measurement equipment. There are many companies which do not exercise suitable control over hazardous objects such as flammable oils, in addition to problems in quality.

[5] Quality of Domestic Parts and Components

There is a large variation in levels of quality and many parts and components which do not satisfy ratings. Insulators not meeting ratings are shipped out due to insufficient inspection and have caused a loss in confidence by customers in Indonesian parts as a whole.

[6] R&D Activities

Indonesia relies too much on technology from abroad and does not develop products on its own. The first reason for this is a shortage of manpower for taking on R&D activities. The second reason is the lack of public organizations for providing side support to R&D activities. This is particularly apparent in the fields of generators and electric motors.

[7] QC Activities

There is insufficient understanding of QC activities and specific experimental methods are not known. Further, QC activities are only effective when everyone involved in the production participates, but the central core of people for this have not been developed. There are not enough medium level technicians bridging the gap between the upper level technicians and skilled workers.

3) Problems in Basic Industries

[8] Technical Level in Metalworking

Of particular importance in metalworking in the main manufacturing processes in the electrical machinery industry are forging, heat treatment, and platework and welding. In Indonesia, very few companies have forging or heat treatment facilities. Almost all companies have imported worked components and parts. In platework and welding, there is insufficient inspection before shipment of products. There is almost no nondestructive inspection performed using X-rays etc. at the present time.

[9] Subcontracting Expenses in Cost Factors

Companies rely on imports for many of their raw materials and parts. Further, due to the lack of development of subcontractors and systems for outside orders of parts, the companies manufacture parts and components in-house. It is impossible to achieve the economy of scale, leading to a rise in the costs of the final products.

[10] Basic Industries

The subcontracting industries, raw material industries, and other basic industries are still in their infancy. It is impossible to make good quality products without good quality raw materials and parts. The development of basic industries for providing the underlying support of the electrical machinery industry is one of the most important factors in determining future industrial potential. Despite this, sufficient support is not provided by public organizations.

4) Problems in Information

[11] Technical and Product Development Information

Since there are almost no public organizations, including universities, providing technical information, Technical and product development information is generally obtained through technical tieups. There is very little independent development of products. This excessive reliance on overseas technology has effects on the sales channels of the final products as well and inhibits freedom of exports.

[12] Marketing Information

There are almost no companies positively collecting marketing information and using it for sales activities for domestic and overseas markets. For true exports, not reverse exports by joint ventures, the collection and analysis of overseas information are essential, but there are few organizations providing such information and what is available is not satisfactory either in terms of quality or volume.

5) Problems in Manpower

[13] Education and Training for Technicians, Skilled Workers, and Ordinary Workers

There are only a very few companies which offer systemized in-house education and training programs. Almost no companies make use of external education and training organizations. On the other hand, as the educational support hoped for by companies from the government, there is a strong demand for on-the-job-training by foreign experts.

[14] Manpower Development Organizations

University education stresses theory. On the other hand, education at the vocational schools aim at the training of technicians with practical skills. There is a large gap between the two and Indonesia has been slow to establish organizations for training intermediate level technicians such as polytechnics. There are polytechnics in the field of electronics, but the aim here is not the training of electrical engineers. Further, there are insufficient organizations for retraining the technicians and skilled workers working in companies.

[15] Insufficient Export Mind

There is low interest on the part of the managers in acquiring overseas market information or expanding exports. With the exception of a handful of companies, there is no participation in international trade fairs or visits by overseas clients as the companies have their hands full with domestic sales activities. The joint ventures rely on their parent companies completely for development of overseas markets and do not engage in autonomous efforts much at all.

(3) Measures for Promotion of Indonesian Electrical Machinery Industry

The measures to be take regarding current problems and examples of the detailed contents of the same are shown in Fig. 4-6-1. The measures are derived from the technical peculiarities of the electrical machinery industry in Indonesia and the characteristics of the market. Interesting features of the contents are as follows:

1) Reinforcement of Technical Assistance

To raise the technical capabilities of the electrical machinery industry, first of all it is necessary to strive to promote the metalworking industry, which supports the industry. In particular, reinforcement is sought for metalworking training organizations in the fields of forging and heat treatment, which Indonesia has been slow to establish the necessary technology. Simultaneously, it is necessary to establish national standards and push forward with standardization of the system of gauges and units to enable design and manufacture under uniform standards.

2) Improvement of Quality Through Reinforcement of Testing and Inspection

Electrical machinery do not become final products merely be satisfying electrical specifications. Particularly notable among testing equipment for its absence was the high voltage testing and inspection apparatuses considered essential for large sized transformers etc. These large sized testing apparatuses do not necessarily have to be installed in each and every company. It is sufficient if a public testing and inspection organization would have them. To improve the quality of products, it is essential that testing and inspection capabilities be strengthened and that there be no lack of company-wide QC activities. In particular, it is considered necessary to provide support for small and medium sized enterprises in QC activities.

3) Augmentation of R&D Activities

There is a very low level of R&D being performed in the electrical machinery industry. Positive R&D activities are essential for the establishment of autonomous, independent technology and the transfer and application of foreign technology. Public organizations must provide side support to such corporate R&D activities through research under cooperation between industry and academia and the collection and supply of advanced technology.

4) Promotion of Basic Industries

The basic industries, including the metalworking industry, subcontracting industries, and raw material industries are still underdeveloped. This weakens the competitiveness of Indonesia's electrical machinery industry. It is urgently requested to provide technical guidance to the individual companies in the raw material industries and subcontracting industries and to strengthen and augment research and development organizations engaged in basic research.

5) Strengthening of Manpower Development

In the Indonesian electrical machinery industry, there is a shortage of medium level technicians of a polytechnic level or higher. Augmentation of the educational organizations

is an urgent task. It would also be effective to establish a system for overseas study aimed at superior technicians with the object of acquiring advanced technology overseas. On the other hand, from the management viewpoint, the majority of the small and medium sized enterprises use premodern management techniques. It is necessary to provide education in management and marketing aimed at the managers of small and medium sized enterprises and to promote the introduction of modern management methods.

6) Strengthening of Export Activities

Organizations for supporting the export activities of companies will be augmented and overseas market information, including technical matters, will be collected and supplied by the same. Further, in accordance with need, a mission for investigating the overseas markets will be dispatched and support will be given to participation of companies in foreign trade fairs.

(4) Recommendations to Promotional Program

For the Indonesian electrical machinery industry to obtain international competitiveness, it is urgent and most important to raise its level of technology. Based on this, a study was made, from the aspect of reinforcement of the competitiveness in production, of the problems faced by and countermeasures for the Indonesian electrical machinery industry discussed in the previous section and proposal was made of a program for building up an electrical machinery industry. The Main targets for technology are shown in 1).

The strengthening in competitiveness in production brought about by eliminating the bottlenecks in technology would raise the price competitiveness in overseas markets, but first Indonesia should try to promote exports from the most competitive fields. By focusing on fields targeted for export promotion along with the capacities of the electrical machinery industry, the export strategy in specific sectors may be strengthened. The main targets for exports are shown in 2)

1) Strengthening of Competitiveness in Production

It is essential to modernize the electrical machinery industry and give it export competitiveness by raising technical capabilities. Further, rationalization is sought in factory operations, including production, for realization of internationally competitive prices. From this, it is clear that the simultaneous improvement of technical capabilities and managerial capabilities is the key to promotion of the electrical machinery industry. In particular, of great importance in building the foundation for the electric machinery industry of Indonesia are (1) standardization of products, (2) augmentation of R&D and technology promoting activities, and (3) training of electrical and mechanical engineers.

On the other hand, in Indonesia, there are extremely large gaps in technology and gaps in information between some major electrical machinery companies and the small and medium sized part manufacturers. In the small and medium sized companies, almost no R&D is being performed relating to new product development. It is urgent to improve the quality of the electrical machinery products and parts and improve productivity by providing technical assistance to private companies, including small and medium sized ones, and strengthening the linkage between the assembly industry and supporting industries.

Organizations for training technicians should work with industry in R&D activities and thereby contribute to the electrical machinery industry. In particular, the APPI, the industrial organization in the electrical machinery manufacturing industry, is expected to take the lead in strengthening the organization of the industry and strongly push forward with development of human resources in cooperation with scholars, engineers, and others in the Society of Electrical Machinery. The training of medium level technicians would have as a secondary effect making investment from foreign countries to Indonesia more attractive.

2) Establishment of Export Strategy and Strengthening of Activities

[1] Promotion of Exports of General Use Machines

Exports should be positively promoted while dealing with domestic demand, aiming at full use of the current production capacity of the local manufacturers. In particular, focus should be on production of general use DC machines (both power generating and motors) and general use AC machines, based on the 1 to 650 kVA oil-filled transformers, 1 to 20 HP class motors, etc. in which the Indonesian electrical machinery industry is considered to be relatively competitive internationally. Demand is anticipated from the advanced industrialized nations. In particular, these machines are no longer being produced by large manufacturers in Japan. Indonesia may expect not only exports, but also domestic demand for machines for assembly into automobiles and home electric appliances in Indonesia and for welding machines and drives for various types of other machines. At the present time, the motors, generators, and other electrical machinery used for such products are mostly imported, so this would lead to import substitution.

[2] Promotion of Exports of Parts and Semifinished Goods

In parallel with exports of finished products, exports of parts and semifinished products will be encouraged. Exports of parts and semifinished goods would publicize the technical capabilities of the manufacturers. Among the companies surveyed, there are those which are importing silicon steel sheet coils, working the same into transformer parts by the latest machinery, then successfully reexporting the same. The cutting work itself of automatic cutting machines raises the added value and leads to exports. In this way, it would help promote the export of parts and semifinished products if the manufacturers were to have fields of part manufacture in which their excelled and were competitive. The developable fields among parts and semifinished products currently being produced in Indonesia include castings, forgings, die castings, moldings, punchings, shaft cutting and polishing, frames and other housing, carbon brushes, bushings, etc.

On the other hand, while there are reportedly insufficient medium level sized companies engaged in precision metalworking in Indonesia, it is possible for existing manufacturers to handle, to a certain technical level, cores, rotor conductors, shafts, terminals, fans, valves, servo meters, tap chargers, gauges, and other general use metalworked parts.

[3] Positive Strengthening of Sales Activities

To tackle exports, one first of all must endeavor to sustain and expand exports to markets which have previously imported Indonesian electrical machinery products and

parts. It would be difficult to sell products being locally produced now to the advanced countries of the world, in particular the U.S., Canada, Japan, Australia, the U.K., West Germany, France, Italy, the Benelux countries, Denmark, and other technically advanced nations. Indonesia should work, however, to expand sales of "dry transformers" to the markets of Japan, Singapore, Australia, Hong Kong, Taiwan, Bangladesh, and the Netherlands. In addition, for example, it should work to sustain and expand exports of parts of motors to Singapore and to sustain and expand exports of A.C. and D.C. motors to Australia.

To expand exports in this way, it will be necessary to have strategic promotional measures aimed at possible products and markets.

3) Promotion of Investment into Part Industries

DC generators are comprised of such key components as armature coils, commutators, field coils, field cores, brushes, and insulators. Three-phase AC generators are mainly comprised of stator coils, field coils, armature coils, poles, and insulators, while motors are mainly comprised of yokes (cores) and pole cores or stator cores and armature (cores and coils) or pole cores or rotator cores, brushes (only in case of DC motors), and other parts. Transformers are standardly comprised of cores, coils, and oil for insulation and cooling.

Among these parts, typical ones not now being manufactured by Indonesia include flat copper wire, armatures, and high voltage insulators. In addition, Indonesia relies on imports for most of its insulating oil, insulating paper, varnish and other insulators, copper wire, and bearings. Investment will be promoted aimed at the introduction of select technology from overseas regarding these parts and components. Medium sized companies specializing in the related parts which would be willing to provide technical cooperation will be sought from not only the advanced industrialized nations, but also the various NIEs.

4) Proposal of Programs

Here, the recommendations for comprehensive programs explained in the previous sector will be summarized. The following ten programs are recommended as specific measures.

Program 1: Standardization of Products

(Object)

To quickly establish or unify the underdeveloped SNI standard and systems of gauges and units to smooth technical communication among companies. Toward this end, the current equipment of B4T will be strengthened and renovated and testing and inspection performed based on the SNI standard. A quality certification marks will be issued for parts and components meeting the standard and the distribution of inferior parts suppressed by the same. Further, certification of superiority will be issued for superior companies and products.

(Content)

- o Establishment of SNI standard by employment of experts
- o Renovation and augmentation of testing and inspection equipment of B4T enabling inspection based on the SNI standard

- o Renovation and augmentation of testing and inspection equipment of B4T for parts and components
- o Education and training of technicians by B4T and private companies by hiring of experts in testing and inspection
- o Making obligatory acquisition of reports on inspection of quality performed at the B4T for products
- o Issuance of certification of superiority for superior companies and superior products

Program 2: Activities for Promoting R&D and Electrical Machinery Technology

(Object)

To raise the overall level of R&D activities in Indonesia, the R&D sector of national research institutes will be strengthened, information will be supplied, and support given to R&D activities of private companies through cooperative research activities between industry and academia.

(Content)

- o Education and training of technicians of research institutes and private companies through hiring of experts
- o Augmentation of R&D sector of existing research facilities and promotion of technical transfers to the private sector
- o Collection and supply of the latest overseas technology
- o Promotion of R&D activities through cooperation between industry and academia, primarily the national universities

Program 3: Support Activities for the Basic Industries of Raw Materials and Parts

(Object)

To provide support to the technically underdeveloped materials and part industries and promote subcontractors with technical capabilities. On the other hand, to provide side support to joint technical development between the electrical machinery industry and the subcontracting industries to strengthen the linkage between industries.

(Content)

- o The national research institutes will be augmented and support give to research and development activities for the basic industries of the electrical machinery industry, i.e., materials and parts.
- o Roving guidance will be provided to the materials and part industries through hiring of experts

Program 4: Promotion of Electrical Machinery Technicians in Supporting Facilities

(Object)

To reeducate technicians and skilled workers working in factories, including managers, in electrical theory, the latest technology, management, quality control, and the latest technology and a certification of rank is given and remuneration improved to persons who have reached predetermined technical levels.

(Content)

- o Association with Electrical Machinery Training Center to provide step by step education and training, including basic business management, for higher level technicians (engineers and assistant engineers), medium level technicians, managers, etc.
- o Certification of rank of technicians reaching predetermined levels of technology in accordance with degree of technical skill

Program 5: Strengthening and Augmentation of Technician Training Organization

(Object)

The following technicians are considered as urgently necessary due to the current state of the industry:

- — Persons able to apply technology introduced from abroad in Indonesia
- — Persons able to engage in independent technical development and product development
- — Persons falling between skilled technicians and engineers and assisting in conversations between the two
- — Persons able to understand business and serving as key elements for company-wide quality control systems

The technicians aimed at by the technician training organizations must understand the theory and practice of technology and management. Therefore, the content of the education of the training organizations should be about 40 percent practical training and about 60 percent theory of design, drafting, etc. and management. Sufficient education should also be given to quality control, a problem in Indonesia.

(Content)

- o Augmentation of education in universities for training technicians stressing practice more
- o Augmentation of reeducation system in universities etc. for technicians (in particular skilled workers) from companies
- o Establishment of technician training organizations as joint activities of the industry
- o Augmentation of electrical machinery related polytechnics stressing both theory and practice
- o Strengthening and augmentation of existing vocational training facilities, raising of level of sophistication of content of training, and education on management and quality control

Program 6: Exchange of Personnel with Overseas Research Institutes and Companies

(Object)

To diagnose companies, hold technical seminars, etc. by having technical experts employed from overseas make rounds of companies, with the costs for this being borne by the government. A scholarship system would be established and superior students and technicians sent to overseas universities and research institutes for study so as to acquire

advanced technology and work to transfer technology.

(Content)

- o Establishment of system of assistance for hiring technical experts from overseas research institutes and companies
- o Establishment of scholarship system for study or training in overseas universities, research institutes, and companies

Program 7: Introduction of National Tests for Certification of Electrical Engineers

(Object)

To introduce national tests for certification of qualifications of technicians so as to improve the remuneration given to technicians, for example, setting three ranks of qualifications, advanced, intermediate, and beginner, and setting down by law the minimum salaries for each rank and, simultaneously, guaranteeing persons passing the national tests priority employment in companies.

(Content)

- o Introduction of national tests for certification of qualifications of electrical engineers so as to promote technical education and improve remuneration of technicians

Program 8: Establishment of Export Targets and Strengthening of Activities

(Object)

Products and parts believed to have potential international competitiveness will be focused on as export targets and production resources will be input for the development of the same on a priority basis. Those export destinations which offer large potential demand will be selected and aggressive sales promotional activities conducted.

- o Conduct of marketing survey on main target markets for exports
- o Strengthening activities of NAFED in collection, analysis and dissemination of information relevant to export promotion of the industry concerned
- o Evaluation of technical competitiveness of products and parts by roving visits of experts to companies
- o Dispatch of mission for investigation of overseas markets

Program 9: Promotion of Investment in Part Industries

(Object)

Foreign capital will be introduced with the aim mainly of transferring technology for important parts having a major effect on the quality of the electrical machinery of Indonesia. The products covered may include various types of insulators (high voltage insulators, insulating oil and paper, varnish, flat copper wire, bearings, etc.

(Content)

- o Positive promotion of entry of superior overseas manufacturers by BKPM
- o Incentives for investment in specific fields of parts

Program 10: Stimulation of Electrical Machinery Industry

(Object)

The APPI and the like are just in the position try to stimulate the industry in an organized manner to promote exports of Indonesian electrical machinery. In parallel with this, the industry will be stimulated by a Society of Electrical Electricity and a joint industrial-academic system will be established.

(Content)

- o Technical and business guidance by experts
- o Collection and dissemination of domestic and foreign technical and market information
- o Strengthening of cooperation with research and development organizations
- o Promotion of exchanges between APPI and Society of Electrical Engineers

(5) Priority Programs

The promotional programs proposed in the preceding section are all important for the development of Indonesia's electrical machinery industry and desirably should be implemented in a comprehensive, concentrated fashion. However, in actuality, the programs will be implemented with limited resources and manpower. In this case, it would be desirable to start preferentially with programs for which there are existing implementing organizations, which could easily be implemented, and for which there is a high degree of urgency. In consideration of this, the following four priority programs have bee selected in the order of the greatest direct impact of the effects of the programs on the electrical machinery industry:

Priority program 1:	Activities for promotion of export investment
Priority program 2:	Technical assistance to individual companies by experts
Priority program 3:	Strengthening and augmentation of technical assistance activities in public organizations
Priority program 4:	Assistance for activities of organizations in electrical machinery industry

The final objective of these programs is to promote the development of the Indonesian electrical machinery industry as an export industry, but for this it is first required to resolve problems in the technical area one by one and improve technical capabilities. The above priority program 3 "strengthening and augmentation of technical assistance activities in public organizations" aims at strengthening the basic technical capabilities with a long term perspective and is comprised of a number of basic programs of great importance in the technical area, i.e., is a comprehensive program of technology. The results will appear indirectly in the future. As opposed to this, priority program 2 "technical assistance to individual companies by experts" is a relatively short term program and should be implemented quickly in view of the current state of the electrical machinery industry of Indonesia. Its results will be direct. Priority program 4 "assistance for activities of organizations in electrical machinery industry" is a medium to long term program and calls for supporting the activities of industrial organizations to raise the level of technology and management in the industry as a whole. In particular, the industrial organization of manufacturers of electrical machinery, the APPI, should take the lead and stimulate and strengthen the organization of the industry and should launch positive initiatives for human

resource development and export activities as well. By strongly implementing the above priority programs, the electrical machinery industry can be promoted and established as an export industry. This is is proposed by priority program 1 "activities for promotion of export investment".

Priority Program 1: Activities for promotion of export investment

[1] Aim of program

(a) The electrical machinery industry of Indonesia is still in the early stages of export, but several products of great promise have appeared. See ((4)-2). Therefore, a more detailed survey will be made of individual industries and markets and strategic targets set. After this, Indonesia must move to implementation of specific activities. This will require organization of the industry and much more positive activities by the same.

(b) Investment by foreign companies will be promoted for the part industries, which are forming bottlenecks in the strengthening of price and nonprice competitiveness.

[2] Content of program

(a) The activities of the MOI and NAFED in this industrial field will be strengthened. This will require cooperation from overseas economic cooperation agencies in funding and knowhow. The activities would include overseas market surveys, establishment of targets, dispatch of sales missions, participation in trade fairs, etc. The industrial organizations will give total support to the above activities of the government by stimulating exchanges with corresponding organizations in other countries and obtaining their cooperation for smoother activities.

(b) Investment promotion missions to promote the part and component fields will be dispatched and received at the earliest opportunities.

Priority Program 2: Technical assistance to individual companies by experts

[1] Aim of Program

In Indonesia, the subcontracting industries, material industries, and other basic industries for supporting the electrical machinery industry from below are still in the infant stage and have not reached a level able to meet the requirements for quality, price, and delivery of the assembly industries. Good quality products cannot be made without good quality materials and parts, therefore development of the Indonesian electrical machinery industry requires the development of subcontracting industries able to produce parts and components with sufficient international competitiveness in both quality and price to make products for the overseas markets. The main objects of the program proposed are as follows:

(a) To individually visit medium sized part manufacturers for factory diagnosis so as to provide guidance in production technology and management and, by this, to strengthen the linkage between the electrical machinery industry and the part industries.

(b) To develop champion companies with international competitiveness in both quality and price by providing sustained guidance to specific companies and to tie these into exports

of a product level.

[2] Content of Program

The staff of the Ministry of Industry will take the lead and provide roving guidance to local medium sized companies in cooperation with the technical staff of the MIDC, B4T, etc. under the Ministry of Industry's Industrial Research and Development Agency (BPPI). In the roving guidance, a wide range of guidance in technology and management will be provided in the long term to a few superior companies so as to develop champion companies.

The content of the guidance will be mainly for the improvement of production technology,but will not be limited to acquisition of mere skills, but will stress such other aspects as product planning, design, quality control, and TQC activities. In addition to production technology, guidance will be provided in management and marketing and support will be given to the in-house training of personnel. Products with relatively short and medium term potential competitiveness will be selected and guidance provided in price and nonprice aspects until sufficient competitiveness for the overseas markets is achieved. Cooperation of experienced experts from international organizations will be obtained for such support activities.

The experts will provide one to two weeks guidance for each visit and will repeat this two to four times. This guidance will be provided to the same factories for three successive years so as to develop several champion export companies.

The main implementing organization will be the Ministry of Industry, but in accordance with need full support will be given by the ITB, ITS, and other national universities and the LMK-PLN and other organizations.

(3) Assistance from International Organizations

(Dispatch of experts)	A team will be formed comprised of two experts for providing guidance in production technology and one expert in management diagnosis and marketing. Of the two experts in production technology, one desirably will be an electrical engineer and the other a metalworking engineer.
(Term of dispatch)	Three months to three years

Priority program 3: Strengthening and augmentation of technical assistance activities in public organizations

[1] Aim of Program

The public organizations currently providing technical assistance to the electrical machinery industry are the central research institutes under the Ministry of Industry's Industrial Research and Development Agency (BPPI), i.e., the B4T and MIDC. The former deals with industrial materials as a whole, while the latter deals with metalworking machines, so these do not deal purely with electrical machines. As a result, there are insufficient facilities for electrical tests and inspections. In particular, there are no testing and inspection facilities for high voltages, so these organizations cannot meet the needs of

private companies. Aside from these research institutes of the Ministry of Industry, there is the Central Research Institute for Electrical Power (LMK-PLN) under the Ministry of Mining and Energy, which was established with the aim of providing technical support to the PLN and therefore is not set up so as to be able to provide sufficient technical support to private companies.

This program was proposed in view of this circumstance and has as its final objectives the standardization of products, the augmentation of R&D and activities for disseminating technology, and, through the same, the training of engineers in electrical machinery. Further, the program does not stop with technical assistance, but provides support to the export activities of private companies through the collection of market information.

This research institute will provide technical assistances to private companies, including medium and small businesses, so as to improve the quality of the electrical machinery products and parts and improve production capabilities and will strengthen the linkage between assembly industries and supporting industries.

[2] Content of Program

To promote standardization of products, first it will be necessary to quickly bring the various standards for electrical machinery products (SNI, SLI, SII, SPLN) under the SNI. The testing and inspection equipment of the B4T (Research Institute for Development of Industrial Materials and Industrial Products) under the Ministry of Industry's Industrial Research and Development Agency (BPPI) will be strengthened and augmented, and testing and inspection will be performed based on the SNI unified standards. Further, the confidence of clients will be obtained by making it obligatory for manufacturers of electrical machinery and parts and components obtain reports on quality inspections.

In addition to the basic electrical testing and inspection apparatuses, provision will be made of testing and inspection facilities for high voltage power in accordance with the production of electrical machinery for power generation purposes, a field in which large demand is foreseen in the future in Indonesia. The testing and inspection apparatuses for metalworking machines will be replaced as required. Further, to provide support to research and development activities, experts will be engaged to educate and train the B4T staff and engineers actually engaged in R&D activities in companies.

[3] Testing and Inspection Equipment for Which Reinforcement and Augmentation Are Considered Necessary

The Ministry of Industry's Industrial Research and Development Agency (BPPI) surveyed the existing facilities at nine central research institutes, including the B4T, in 1987 to select equipment which it considered had to be reinforced or replaced. This survey, however, only evaluated the basic testing and inspection equipment and did not consider high voltage testing facilities and equipment for high power transformers or the facilities and equipment for completion tests for large sized generators and motors. A representative list of the testing and inspection equipment considered necessary for such large sized electrical machinery is provided below:

(a) Testing and Inspection Equipment for High Power Transformers

Testing and inspection equipment	Content/Specifications
Impulse Voltage Generators	5000KV, 250KWS; 1200KV
Sphere Gap	Diameter: 50cm; 150cm
Testing Transformers	1000KV, 1000KVA; 250KV 50KVA
Coupling Capacitors	2000PF, 2000KV; 2000PF, 1000KV
Sine-wave Generators	1~1000KVA
Drive Cycle Generators	3~300KW
Measuring Equipment	N.S.B.O., synchroscopes, long recorders, etc.
Dielectric Breakdown Testing Apparatuses	
Wet Test Equipment	

(b) Testing and Inspection Equipment for Large Sized Generators and Motors

Testing and inspection equipment	Content/Specifications
For tests of completed products	
-DC generators	850KW; 500KW
-AC generators	2500KW
-Three-phase transformers	2200KV
-Induction regulators	1900KVA; 2400KVA
-Reactors	2500KVA
For inspection of parts	Balancing machines and various withstand voltage testers
For testing materials	Metal structure microscopes
For nondestructive inspections	X ray, magnetic, and supersonic inspection equipment
Others	Synchroscopes, electromagnetic oscilloscopes, vibration meters, noise meters, digital strain measurement equipment, magnetic flux meters, wattmeters, voltmeters, frequency meters, rotation meters, etc.

Program 4: Assistance for activities of organizations in electrical machinery industry

[1] Aim of Program

The main industrial organization in the Indonesian electrical machinery industry is the APPI, which is comprised mainly of assembly companies. While the APPI is comprised of 63 large sized companies in the electrical machinery industry of Indonesia, there are also many small sized companies which find it difficult to acquire technical information on their own or to access overseas markets. Therefore, the activities of the APPI will be increased to collect and supply such information and therefore benefit industry as a whole.

Next, the APPI should take the lead and cooperate with a Society of Electricity

principally scholars and engineers, to provide technical guidance to companies. These activities will contribute to raising the technical and managerial level of the electrical machinery industry as a whole. The activities of the APPI, which is comprised of assembly companies with strong ties with the subcontracting and materials industries, can be expected to promote those basic industries as well. Support to the basic industries would lead to a stronger linkage among industries and would raise the international competitiveness of Indonesian electrical machinery products. Further, the APPI will serve as the main organization for personnel training and provide various forms of cooperation including overseas study and retraining of engineers.

[2] Content of Program

The APPI will take the lead and engage in the following activities:

(a) Engagement of experts for roving guidance to companies
(b) Engagement of experts for holding management and technical seminars
(c) Collection and supply of overseas market information and technical information
(d) Assistance in export activities (dispatch of missions, participation in overseas exhibitions, export seminars, etc.)
(e) Deepening of exchanges with overseas industrial organizations to promote technical transfers etc. from overseas companies to member companies
(f) Establishment of system for study at overseas universities and research institutes
(g) Managerial and technical consulting for subcontracting companies
(h) Activities contributing to exchanges among assemblers, part manufacturers, material manufacturers, and users

To support such activities, cooperation will be obtained from experienced experts from international organizations as needed and full support will be obtained from the national universities, BPPI, BKPM, NAFED, and other organizations.

Fig. 4-6-1: Problems in Electrical Machinery Industry and Process of Priority Programs

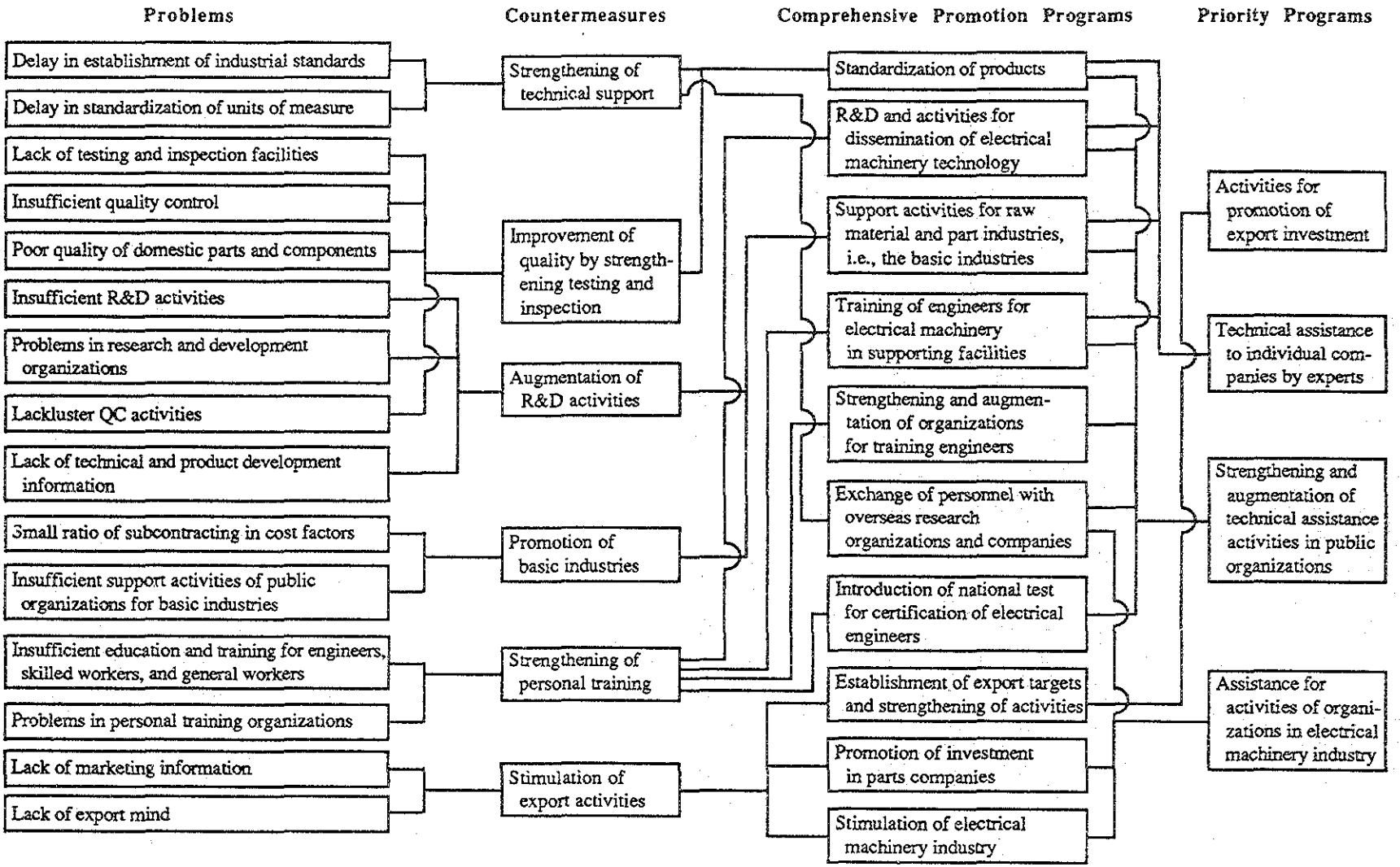
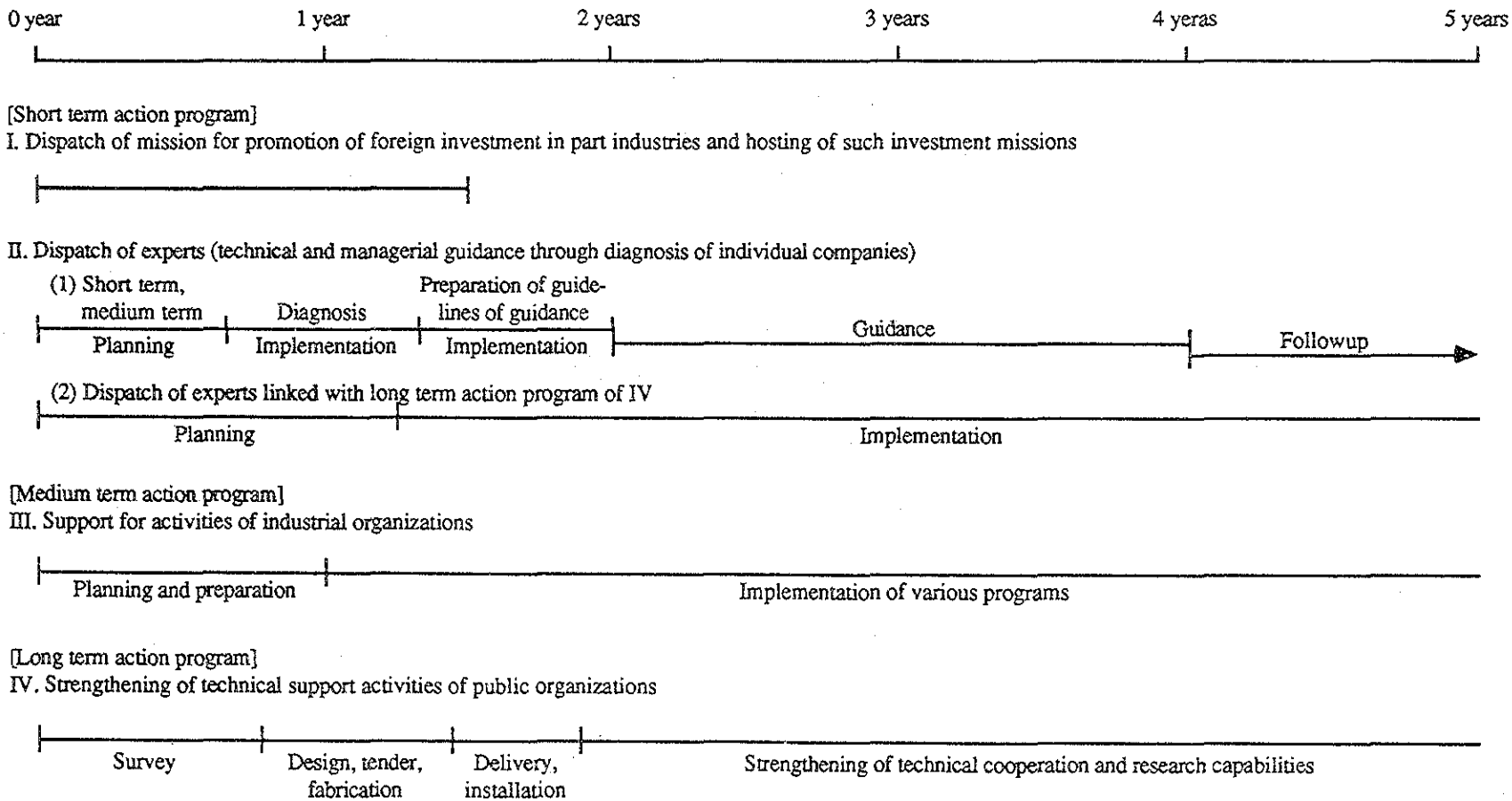


Fig. 4-6-2: Draft Schedule for Programs for Promotion of Electrical Machinery Industry



4.7 Information for Promotion of Investments and Technical Tie-ups in Electrical Machinery Industry

(1) List of Japanese Companies Interested in Investment

[1]Mitsubishi Heavy Industries, Ltd.

Mailing Address	: 2-5-1, Marunouchi, Chiyoda-ku, Tokyo 100
Person in Charge	: Manager, Administration Sec., Int'l Operations Dept. Presidential Administration Office
Tel. No.	: 03-212-3111
Cable Address	: Hishiju Tokyo
Facsimile No.	: 03-284-1285
Telex No.	: J22443

[2]Nippo Co., Ltd.

Mailing Address	: 16, Higashi-Yasudo-cho, Seto-shi, Aichi 489
Person in Charge	: Sales Dept.
Tel. No.	: 0561-85-5111
Cable Address	: Nippo Seto Aichi
Facsimile No.	: 0561-82-2155
Telex No.	: 04496001 NIPPO

[3]Sanwa-Daiei Electric Construction Co., Ltd.

Mailing Address	: 3-6-5, Higashioi, Shinagawa-ku, Tokyo 140
Person in Charge	: Marketing Div.
Tel. No.	: 03-761-7161
Facsimile No.	: 03-767-8400
Telex No.	: 2425003 SDDK J

[4]Yonden Engineering Co., Inc.

Mailing Address	: 3-1-4, Kamino-cho, Takamatsu-shi, Kagawa 761
Person in Charge	: Overseas Dept.
Tel. No.	: 0878-67-1711
Cable Address	: Yonden-Eng
Facsimile No.	: 0878-55-5045
Telex no.	: 5822790 YDEG

(2) List of Indonesian Companies Interested in Joint Ventures or Technical Tie-ups

[1]Cv. Guntur
Mailing Address : Bambe, Driyorejo, Gresik, Surabaya
Tel. No. : 46209-471643
Facsimile No. : 031-514668
Main Production : Generator
Domain of Interest : Joint Venture with Japan

[2]Pt. Teco Multiguna Elektro
Mailing Address : J1, Mayor Oking 2, 7KM, Citeureup
Main Production : Electric Motor
Domain of Interest : OEM production with Taiwan

[3]Pt. Bambang Djaja
Mailing Address : J1, Rungkut Industri 3/56, Surabaya
Tel. No. : 819688
Facsimile No. : 813850
Main Production : Power Transformer
Domain of Interest : Joint Venture with U.S.A.

[4]Pt. Carbon & Electric
Mailing Address : J1, Raya Rungkut 30, Surabaya
Tel. No. : 810981
Facsimile No. : 031-810981
Main Production : Carbon Brushes
Domain of Interest : Investment from Japan

(3) Information on Companies in Above Lists

Company Name	Mitsubishi Heavy Industries, Ltd.
Mailing Address	2-5-1, Marunouchi, Chiyoda-ku, Tokyo 100
Person in Charge	Manager, Administration Sec., Int'l Operations Dept, Presidential Administration Office
Tel. No.	03-212-3111
Cable Address	HISHIJU TOKYO
Facsimile No.	03-284-1285
Telex No.	J22443
No. of Employees	45363
Paid-up Capital	$1,629,000,000 (M$200,367)
Exportation Ratio (%)	20%
Stock Exchange	Tokyo, 1st Sec.
Line of Business	Manufacturing
Overseas Investment Plan	Under Consideration
Planned Project	Machinery, Heavy Electric Machinery, Transport Equipment
Country of Interest	Indonesia, Korea (Republic of), Malaysia, U.S.A., Thailand

Company Name	Nippo Co., Ltd.
Mailing Address	16, Higashi-Yasudo-cho, Seto-shi, Aichi 489
Person in Charge	Takaaki Kato, Sales Dept.
Tel. No.	0561-85-5111
Cable Address	NIPPO SETO AICHI
Facsimile No.	0561-85-2155
Telex No.	04496001 NIPPO
No. of Employees	35
Paid-up Capital	$243,000 (M¥30)
Year of Establishment	1929.5.1
Annual Sales	$20,325,000 (M¥2,500)
Exportation Ratio (%)	10%
Stock Exchange	Nonpublic
Line of Business	Non-Manufacturing
Overseas Investment Plan	Not Decided
Planned Project	Heavy Electric Machinery
Country of Interest	Thailand, Malaysia, Indonesia

Company Name	Sanwa-Daiei Electric Construction Co., Ltd.
Mailing Address	3-6-5, Higashioi, Shinagawa-ku, Tokyo 140
Person in Charge	Minoru Komine, Marketing Div.
Tel. No.	03-761-7161
Cable Address	—
Facsimile No.	03-767-8400
Telex No.	2425003 SDDK J
No. of Employees	860
Paid-up Capital	$7,170,000 (M¥882)
Year of Establishment	1947.9
Annual Sales	$252,032,000 (M¥31,000)
Exportation Ratio (%)	10%
Stock Exchange	Tokyo, 2nd Sec.
Line of Business	Non-Manufacturing

Overseas Investment Plan	Under Consideration
Planned Project	Construction, Heavy Electric Machinery, Telecommunication Equipment
Country of Interest	Thailand, Indonesia, Pakistan, Latin America, Africa

Company Name	Yonden Engineering Co., Inc.
Mailing Address	3-1-4, Kamino-cho, Takamatsu -shi, Kagawa 761
Person in Charge	Hiromichi Akamatsu, Overseas Dept.
Tel. No.	0878-66-1711
Cable Address	YONDEN-ENG
Facsimile No.	0878-66-5045
Telex No.	5822790 YDEG
No. of Employees	830
Paid-up Capital	$1,951,000 (M¥240)
Year of Establishment	1970.6
Annual Sales	$166,894,000 (M¥20,528)
Exportation Ratio (%)	10%
Stock Exchange	Nonpublic
Line of Business	Non-Manufacturing
Overseas Investment Plan	Not Decided
Planned Project	Construction, Machinery, Heavy Electric Machinery
Country of Interest	Thailand, Indonesia, Philippines, China (People's Republic of), Middle East

COMPANY PROFILE

CV. GUNTUR

1. APPI Member No.	:044
2. Status	:Private Company(BRO)
3. Address	
Office	:J1. Slompretan Mo.16 Surabaya
Tel.No.	:031-270191,270196
Fax.	:031-24828
Factory	:j1. Kolonel Sugiono 14 Malang
Tel.No.	:0341-23555, 41020
4. Ownership	:Private, under PT. Rutan Machinery Trading Co.
5. Founded	:1942
6. Technical Approval	:Taiyo Electric Mfg(until 1993)
7. Total Investment	:Rp.600,000,000.-
8. Started Operation	:1983
9. Management	
President Director	:
Director	:E.B.Santosa
10. Man Power	:88
11. Brand Name	:Taiyo/Guntur
12. Trade Mark Licence	:Public sector 30%, Private sector 70%

PRODUCT PROFILE

Range of Product

:Single phase generator, Three phase generator, Welder,
:Marine Generator, Marine switchboard, Land used generating,
Marine used generating.

Production Capacity:

Generator 2KVA-1150KVA:2225 units/year
Welding Generator up to 500A:3000 units/year
Marine Switchboard:2500 units/year

COMPANY PROFILE

PT. TECO MULTIGUNA ELEKTRO

1. APPI Member No.	:050
2. Status	:Domestic Capital Investment
3. Address	
Office	:J1.P.Jayakarta 68 Block Block B No.2, Jakarta Pusat
Tel.No.	:6393006(4 lines)-6596984
Telex No.	:63880 Tecom 1A
Fax. No.	:6597674
Factory	:J1.Mayor Oking 2,7 KM, Desa Gunung Putri,Citeurcup, Bogor, Jawa Barat
Tel.No.	:9/(9)83401-83405
Fax.No.	:219-82843
4. Ownership	:PMA(Taiwan 20%, Indonesia 80%)
5. Founded	:1981
6. Technical Approval	:Teco of Taiwan
7. Total Investment	:Rp.1,000,000,000.-
8. Started Operation	:1982
9. Management	
Factory Manager	:Chen Cheng Po
Director	:Husin
10. Man Power	:254
11. Brand Name	:Teco
12. Trade Mark Licence	:Public sector 20%, Private sector 80%

PRODUCT PROFILE

Range of Product

:Three phase Squirrel Cage & Slip Ring Induction Motor
:Flange Mounted & Single phase motors,
AC & DC Brake motors, ED & Ringcone Variable speed motors,
Geared Motor & Reducers, Exhaust Fans, Air Curtains

Production Capacity: 20,000 units/year

COMPANY PROFILE

PT. BAMBANG DJAJA

1. APPI Member No. :061
2. Status :Domestic Capital Investment
3. Address
   Office & Factory :J1.Rungkut Industri IIIi/56, Surabaya
   Tel.No. :819688
   Fax. No. :813850
4. Ownership :PMDN, Only Indonesian Capital.
5. Founded :February 12, 1975
6. Technical Approval :Tatung, Taiwan (1982~1987)
7. Total Investment :US$ 5 million (until 1989)
   Scheduled Investment :US$ 1.5 million with U.S.Westinghouse
8. Started Operation :1984
9. Management
   President Director :Djoko Soewignjo
   Managing Director :L.S.Pelupessy
   Deputy Managing Director :Arthur Pelupessy
10. Man Powe :250
11. Brand Name :Bambang Djaja
12. Trade Mark Licence :PLN & Private sector
13. Annual Sales :US$ 6 million

PRODUCT PROFILE

Range of Product
:Oil immersed transformers up to 30 KV/10 MVA

Production Capacity:
:Distribution Transformer: single phase 7,000 units/year
three phase 4,000 units/year

COMPANY PROFILE

PT. CARBON & ELECTRIC

1. APPI Member No. :non-member
2. Status :Private, National Capital, non-PMDN
3. Address
   Office & Factory :J1.Raya Rungkut No.30, P.O.Box 8 Sbsg. Surabaya
   Tel.No. :810981
   Fax. No. :031-810981
4. Ownership :National Capital, but non-PMDN
5. Founded :1963
6. Technical Approval :Tookai Electrics & Hitachi
7. Total Investment :Rp.750 million
   Scheduled Investment :Rp.200 million for new machinery
8. Started Operation :1963
9. Management
   President Director
   Director :A.P.Malada
10. Man Power :52
    Training :OJT
11. Brand Name :Carbon & Electric
12. Trade Mark Licence :Nil
13. Main Customer :State-owned Companies, such as Petrokimia Gresik, Pertamina, Sugar Factory, Crumb Factory, etc.50%
    :Mainly for Big Business, 50%

PRODUCT PROFILE

Range of Product
:Carbon brushes for all types of electrical machines
:Carbon Sliding Contacts,
Rollers and Holders for variable voltage transformers,
Carbon Bearings, Synthetic Carbon Components,

Production Capacity
:40,000pcs/year

ANX-1. Matters of Interest in Management

Order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Unknown order	Total no. of companies	Weighted total	Weighted points
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	8			
1)Procurement of funds	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	3	18	[17]
2)Employment of workers	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	5	45	[9]
3)Education of workers	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	4	37	[10]
4)Improvement of quality of products	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2	6	66	[5]
5)Improvement of productivity	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	2	7	86	[2]
6)Reduction of costs	1	0	2	2	1	0	0	1	0	0	0	0	0	0	0	2	9	100	[1]
7)Shortening of delivery times	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2	23	[14]
8)Improvement of yields	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	24	[13]
9)Modernization of production facilities	0	0	0	2	0	0	1	0	0	0	1	0	0	0	0	1	5	46	[8]
10)Procurement of good quality, inexpensive materials	0	1	0	1	0	1	0	1	0	1	0	0	1	0	0	2	8	69	[3]

Order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Unknown order	Total no. of companies	Weighted total	Weighted points
11)Use of domestic parts	0	0	2	0	0	0	1	0	0	0	1	0	0	0	0	2	6	56	[6]
12)Introduction of new technology	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	3	31	[11]
13)Stimulation of R&D activities	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	4	[20]
14)Development of high added value products	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	5	51	[7]
15)Expansion of production	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	5	31	[11]
16)Strengthening of marketing	1	0	0	0	2	1	0	0	0	0	0	1	0	0	0	2	7	67	[4]
17)Expansion of exports	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	3	15	[18]
18)Acquisition of overseas market information	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	3	20	[18]
19)Acquisition of technical information	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	3	23	[14]
20)Use of government incentives	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	3	14	[19]

Source: Survey Questionnaires

ANX-2: Labor Management

Case 1:Generator Manufacturer A

	Breakdown of employees			Years of employment			
				under 1 year	1-3 year	3-10 year	over 10 year
Management staff		6				6	
Administrative staff		19				19	
Factory employees	Male	Female	Total				
Section head	2		2			2	
Skilled workers	18		18		3	15	
Semiskilled workers	2		2			2	
Group head	3		3			3	
Unskilled workers							
Total factory employees	25		25				
Total employees			50		3	47	

Source: Questionnaire survey

ANX-3: Labor Management

Case 2: Generator Manufacturer B

Breakdown of employees				Years of employment			
				under 1 year	1-3 year	3-10 year	over 10 year
Management staff		8				8	
Administrative staff		4				4	
Factory employees	Male	Female	Total				
Section head	6		6				
Skilled workers	12		12			6	
Semiskilled workers	18		18			12	
Group head	24		24		24	18	
Unskilled workers	8		8		8		
Total factory employees	68		68				
Total employees			80		32	48	

Source: Questionnaire survey

ANX-4: Labor Management

Case 3: Generator Manufacturer C

	Breakdown of employees			Years of employment			
				under 1 year	1-3 year	3-10 year	over 10 year
Management staff		3					3
Administrative staff		16					16
Factory employees	Male	Female	Total				
Section head	42	2	44				44
Skilled workers	4		4				4
Semiskilled workers							
Group head	1		1				1
Unskilled workers							
Total factory employees	47	2	49				
Total employees			68				68

Source: Questionnaire survey

ANX-5: Labor Management

Case 4: Motor Manufacturer D

	Breakdown of employees			Years of employment			
				under 1 year	1-3 year	3-10 year	over 10 year
Management staff	Management		8		2	6	
	Staff		12		4	6	2
Administrative staff		30		5	5	20	
Factory employees	Male	Female	Total				
Section head	10		10		2	6	2
Skilled workers	150		150		50	90	10
Semiskilled workers	75		75		50	25	
Group head	15		15		7	8	
Unskilled workers	40	10	50		40	10	
Total factory employees	290	10	300				
Total employees			350	5	160	171	14

Source: Questionnaire survey

ANX-6: Labor Management

Case 5: Transformer Manufacturer E

	Breakdown of employees			Years of employment			
				under 1 year	1-3 year	3-10 year	over 10 year
Management staff	1						1
Administrative staff							
Factory employees	Male	Female	Total				
Section head	4		4				4
Skilled workers	2		2				2
Semiskilled workers	10		10			10	
Group head	4		4			4	
Unskilled workers	13		13			13	
Total factory employees	33		33				
Total employees			34			27	7

Source: Questionnaire survey

ANX-7. Overseas Market Information

Order of importance	Weighted points	Overseas market information considered necessary (no. of companies)					
		Demand projections	Import projections	Import channels	Consumer preferences	Business practices	Import regulations
1	6	5	0	1	0	0	1
2	5	1	3	1	0	0	1
3	4	0	2	2	0	1	0
4	3	1	0	0	2	0	2
5	2	0	0	0	1	2	1
6	1	0	0	0	2	1	0
Order unknown	3.5	1	1	2	0	0	0
Total no. of companies		8	6	6	5	4	5
Weighted total		41.5	26.5	26	10	9	19
Overall order		[1]	[2]	[3]	[5]	[6]	[4]

Source: Questionnaire survey