3-3-3 Promising Aluminium Products and Markets

(1) Promising Markets by Product

[1] Rolled, extruded, and plate worked products

In order to evaluate promising aluminium products and markets for them, the demand for aluminium products in Japan and the U.S. has been reviewed. In 1989, the breakdown of demand for aluminium in Japan, shown in Figure 3-2-2, reveals that rolled and related products accounted for 59.2 percent, diecasting 18.4 percent, casting 10.5 percent, electric cables and wires 2.1 percent and other products 9.8 percent. From the data, it can be stated that rolled and related products account for the largest share of the aluminium industry in Japan. In the U.S., as shown in Table 3-2-17, the share of rolled and related products is much higher, with these products together accounting for nearly 90 percent of the total aluminium market. Among the various products, plate worked products accounted for 60 percent of demand, foil for 7 percent, bars and extrusions 19 percent, pipes 2 percent, and diecasting 11 percent. In Japan, the market shows increasing demand in all product fields. Among them, production of plate worked products and foil has shown a very high increase in recent years. Meanwhile, in the U.S., the total demand for aluminium has remained constant.

Table 3-3-68 shows the shipment of rolled products in Japan by product. The products include: plates (thickness: below 6.0mm), plates (thickness: below 0.5mm), coils (thickness: 0.5mm and above), coils (thickness: below 0.5mm), and extruded products. These five products together account for 83.7 percent of all rolled products and more than 50 percent of all aluminium products. Shipment of these products including foil is shown in Table 3-3-69.

Table 3-3-68: Shipment of Rolled and Extruded Products in Japan (1984)

Products		Shipment (Ton)	Ratio (%)
Rolled			
	Plates (over 6.0mm)	18,431	1.2
	Plates (below 6.0mm)	104,749	6.8
	Plates (below 0.5mm)	80,386	5.2
	Disks	39,544	2.6
	Coils (over 0.5mm)	75,649	4.9
	Coils (below 0.5mm)	271,644	17.7
	Sub Total	590,403	(38.4)
Extruded			
	Tubes and Pipes (extruded)	16,368	1.1
	Tubes and Pipes (drawn)	31,067	2.0
	Tubes and Pipes	2,397	0.2
	Bars and Rods (extruded)	17,910	1.2
	Bars and Rods (drawn)	15,446	1.0
	Profiles	755,163	49.0
	Cable and wire	17,270	1.1
	Sub Total	855,621	(55.6)
Foil		92,257	6.0
Total		1,538,281	100.0%

Source: Aluminium Rolling and Extrusion Handbook 1985, Japan Aluminium Federation

Table 3-3-69: Shipment of Selected Aluminium Products in Japan by User Industry

Unit: Ton

User Industries	Plates ~6.0mm	Plates ~0.5mm	Coils 0.5mm~	Coils ~0.5mm	Profiles	Foil
Food Industry	126	65,242	1,440	74,761	102	27,703
Tobacco Industry	2	-	-	-	113	4,668
Chemical Industry	1,009	6	146	100	464	5,119
Metal Products						
Daily Necessities	2,792	469	3,181	292	924	19,679
Foil	-	1	26,118	102,536	-	-
Other Metal Products	11,936	8,084	6,089	32,419	20,857	1,370
Electrical Machinery						
Consumer Electronics	6,385	667	5,336	31,651	6,243	28,641
Other Electric Products	9,277	664	10,432	9,444	20,118	
Transportation Equipment	20,974	199	9,946	9,605	43,836	
Precision Machinery	809	90	942	63	3,250	978
Other Machinery	3,056	85	1,018	528	13,398	
Construction Use	24,436	3,484	8,041	8,353	629,974	2,573
Others	23,947	1,395	2,960	1,892	17,884	1,526
Total Domestic Demand	104,749	80,386	75,649	271,644	755,163	92,257

Source: Aluminium Rolling and Extrusion Handbook 1985, Japan Aluminium Federation

From the above table, it can be seen that there is a large demand for plates (thickness: below 6.0mm) in the areas of transportation equipment, construction and other products, and medium demand in the fields of other metal products, consumer electronics and other electric appliances. In the same way, user industries are reviewed based on demand for each product, and the industries which show medium demand are marked with a circle "*", while the industries with large demand have an asterisk "**." The result of the review is shown in Table 3-3-70.

Table 3-3-70: Promising User Industries by Product

User Industries	Plates ~6.0mm	Plates ~0.5mm	Coils 0.5mm~	Coils ~0.5mm	Profiles	Foil
Food Industry		**		**		**
Tobacco Industry						*
Chemical Industry						*
Metal Products						
Daily Necessities						**
Foil			**	**		
Other Metal Products	*	*	*	**	**	
Electrical Machinery						
Consumer Electronics	*		*	**	*	**
Other Electric Products	*		*	*	**	**
Transportation Equipment	**		*	*	**	
Precision Machinery						
Other Machinery					*	
Construction Use	**		*	*	**	
Others	**				*	

In addition to the user industries shown in the above table, there is medium demand for circle plates in consumer products and other metal products, extruded bars in transportation equipment, and drawn bars in transportation equipment.

These are the user industries of aluminium products in Japan. Although the markets of Japan and Indonesia are quite different, it may be useful to consider promising areas for Indonesian products in the future. Each demand segment is further broken down into specific product items as described in Table 3-3-71. Promising areas are marked with a circle "*" and the most promising markets are marked with "**".

Table 3-3-71: Breakdown of Rolled and Extruded Aluminium Products in Japanese Market

	Demand Field	Sample Products
Food Industry	Body Materials	Aluminium cans for beer, soft drinks, coffee
	End Tab Materials	End tab materials for aluminium beverage cans
	Packaging, etc.	Bottle caps, Crown caps, Small beer barrels, Beer brewing tanks, Other packaging materials
Chemical Industry		Oil storage tanks, LNG/LPG tanks, Various packages for chemicals
Metal Products	Daily Necessities	Pots and pans, Kettles, Dishes, Ashtrays, Ladles
	Foil	Kitchen Foil
	Other Metal Products	Furniture, Kitchen equipment, Gas stoves, Gas ranges, Athletic equipment, Music instruments, Toys, Golf clubs, Construction materials, Nameplates, Impact products, Metal currency, Stationary goods
Electrical Machinery	Consumer Electronics Products	Refrigerators, Air conditioners, Electric fans, Irons, Microwave ovens, Dishwashers, Washing machines
	Other Electrical products Appliances and Equipment	TVs, Radios, Tape recorders, Video recorders, Motors, Headphones, Microphones, Telephones, ICs, Telecommunications exchangers, Facsimiles machines, Antennas, Busbars
Transportation Equipment	Automobiles	Bodies, Frames, Air conditioners, Fins, Wheels
	Ships, Aircraft, Railways, etc.	LNG Ships, Fishing boats, Leisure boats, Aircraft bodies, Rail cars, Containers, Bicycles, Wheel chairs
Precision Machinery		Microscopes, Binoculars, Cameras, VTR cameras, Tripods, Watches, Inspection apparatus, Measuring instruments
General Machinery		Engines, Construction machinery, Heat exchangers, Copy machines, Printing machines, Sprinklers, Tractors
Construction Use	Sashes, Doors	Sashes for home use, Curtain walls for buildings
	Exterior, Interior Materials, etc.	Ceilings, Partitions, Curtain rails, Siding, Venetian blinds Balconies, Light posts, Guard Rails, Fences

Source: Aluminium Rolling and Extrusion Handbook 1985, Japan Aluminium Federation

[2] Diecasting products

There is a wide variety of diecasting products and other casting products from mass-produced industrial products such as transportation components, electrical parts and construction equipment to hand-made fine arts.

The die casting in the foreign affiliates is sophisticated in level and excellent in quality, factory control, etc., but even these companies are at an intermediate level when compared with companies in Japan. The majority of the Japanese affiliates are producing automobile and motorcycle parts, with some making components for electrical equipment in-house. Foreign affiliates other than Japanese ones are also mostly producing parts for transport machinery. In the future, it is considered that production of die cast products will soar not only for parts for automobiles and motorcycles, but also for parts for electrical equipment and electronics.

A look at the usage of aluminium alloy die castings in Japan shows that in 1989, automobiles accounted for 70.7 percent, motorcycles for 3.7 percent, industrial machinery and equipment for 6.7 percent, electrical equipment and communications equipment for 6.7 percent, daily use items for 2.1 percent, precision equipment for 1.8 percent, industrial vehicles and bicycles for 0.7 percent, and other products for 4.6 percent. In Indonesia, it is expected that there will be growth in parts for electrical equipment and communications equipment in the future. In the short term, these parts will replace the imports now being used by the foreign affiliates, but in the medium and long term exports could be expected along with the greater international division of labor of these companies. In such a case, the targeted overseas markets would be Japan, the U.S. and other advanced western nations, the Asian NIE's, and the ASEAN nations.

On the other hand, aluminium automobile wheels produced by the low pressure die casting method are judged to already be a high level of quality and sophisticated technical expertise. Considerable volumes are already being exported to Japan and the western markets, and exports to these countries are projected as continuing to rise. In the future, due to the nature of the product, the entire world could become a potential market.

Some of the aluminium diecasting products produced in Japan are shown by user industry in Table 3-3-72.

Table 3-3-72: Breakdown of Aluminium Diecasting Products In Japanese Market

User Industry	Sample Products
Industrial Machinery	Boilers, Engines, Tractors, Machine tools, Spinning machines, Food processing machines, Printing machines, Packaging machines, Pumps, Compressors, Shredding machines equipment, Power transmission devices, Office equipment Chemical equipment, Refrigerators, Vending machines, Agricultural machinery, Sewing machines, Furnaces Casting machines, Book-binding machinery, Bulldozers
Electric Machinery, Communication Apparatus	Electric rotating machines, Electric stationary machines, Consumer electrical appliances, Lights, Vacuumstubes, Semiconductors, Radios, TVs, Testing and inspection equipment, Communication equipment
Automobiles	Bodies and chassis for 3/4 wheel automobiles, Two wheel Automobiles, Engines
Precision Machinery	Precision measuring apparatus, Optical instruments
Industrial Vehicles, Bicycles	Industrial transportation vehicles, Bicycles
Railways	Parts of railway, tramway locomotives, or rolling-stock
Daily Necessities	Furniture, Kitchen untensils, Daily necessitie
Others	Radiators, Fire extinguishers, Parts for ships, Arms and ammunition, Toys

Source: Material Process Yearbook 1989, The Material Process Technology Center

(2) Promising Aluminium Products

As mentioned in paragraph 3-3-3 (1), aluminium plate and extruded products are widely used in the advanced countries. A large demand exists in the fields of construction, civil engineering, components for electrical equipment, and general machinery. Diecasting products, on the other hand, are widely used as parts for transportation equipment. Considering the state of demand in these countries, the following products may be expected to enjoy large demand in the future in Indonesia and in overseas markets. In this section, the promising aluminium products are discussed by usage.

[1] Aluminium products for construction use

Aluminium products for construction use have many advantages over conventional materials and thus the usage in advanced countries has increased very rapidly. Some of the advantages are light weight, resistance to corrosion, heat resistance, easy processability, good reflection of light and heat, and good in prevention of microwaves.

Promising aluminium products for construction work in the Indonesian market are plate roofing and Venetial blinds. There is already an 800 ton monthly market for plate roofing in Indonesia and demand is remaining steady. On the other hand, about 500 tons of Venetial blinds are produced a year. These are mostly made from aluminium plate imported from Japan which are then processed and sold in Indonesia. The thin plate material is made of a special aluminium alloy which is not now being produced in Indonesia. Along with improvements in rolling technology in the future, however, this will probably be replaced by domestic plate.

Window and door frames, doors, and other building materials made of extruded products are already being produced in Indonesia by foreign affiliated (Japanese) joint ventures and being imported into the Japanese market. Such products requiring a relatively greater degree of manual labor represent fields where Indonesia has potential competitiveness due to its relatively low labor costs, even compared with the other ASEAN nations. Domestic extrusion companies could advance into these fields by improving their die and surface treatment technologies and developing products meeting the needs of the overseas markets. On the other hand, in the short term, it would be effective to attract overseas building material manufacturers and make Indonesia into a center for OEM production, which would also promote transfers of technology to domestic manufacturers. The most promising markets would be, first, Japan, followed by the western nations.

Specific aluminium products, suitable materials, and promising markets ae summarized in the following table. Promising markets are marked with a circle "*". Among them, the most promising markets are marked with " ** "

Table 3-3-73: Promising Aluminium Products and Markets for Construction Use

Products	Applicable Materials		Potential Markets		
	Materials	Shape	Indonesia	Japan	ASEAN
Roofing	1050, 1100, 5052	Plates	**		*
Partitions	6063	Profiles		*	
Ventilation Tubes, Handrails, Lights	1080, 5052, 6063	Plates, Profiles	*	*	
Doors	1050, 1100, 5052, 6063	Plates, Profiles	*	**	
Venetian Blinds	5083	Plates	**		*
Curtain Boxes, Curtain Rails	5052, 6063	Plates, Profiles	*	*	
Lattices, Gate Doors	5052, 6063	Plates, Profiles		*	
Sashes	6063	Profiles	*	**	
Fences	5052, 6063, 5056	Plates, Profiles		*	
Verandas, Balconies	5052, 6063	Profiles		*	

[2] Aluminium products for civil engineering use

Aluminium products for civil engineering use include road signs, guard rails, light posts, sound dampening walls, scaffolding plates, etc. Among these, road signs, guard rails, and light posts are materials used for public works, so large demand in Indonesia could be expected if the government and local autonomous bodies were to make positive use of such aluminium products.

In Japan and other advanced countries, wide use is made of aluminium sound dampening walls and scaffolding plates. In general, labor costs account for a high percentage of the total production cost of these products. Production of internationally competitive products, thus, is possible utilizing relatively the cheap labor in Indonesia. Promising markets would be NIEs such as Korea, Taiwan, Hong Kong, and Singapore, as well as Japan and European countries.

Specific products, suitable materials and promising markets are summarized in the following table.

Table 3-3-74: Promising Aluminium Products and Markets for Civil Engineering Use

Products	Applicable Materials		Potential Markets		
	Materials	Shape	Indonesia	Japan	ASEAN
Road Signs	5052, 6063	Plates, Profiles	*		*
Guard Rails	6061, 6063	Profiles	*		
Light Posts	5052, 6063	Tubes, Pipes	*		*
Sound Dampening Walls	1100, 5052, 6063	Plates, Profiles		*	
Scaffolding Plates	5052, 6063	Plates, Profiles		*	*

[3] Aluminium products for use in electrical appliance

As more electrical appliance assemblers set up their factories in Indonesia, it is inevitable that they will attempt to purchase as many domestically produced parts as possible.

In general, high quality aluminium materials are required for use for components of electrical equipment and Indonesia has still not reached the level of technology enabling it to manufacture the same. In the future, integrated production from the materials to the final products would be desirable, but until the Indonesian rolling companies are set up to supply the high quality materials meeting these needs, it is important to start with processing imported materials and to work to build up technical capabilities.

The most promising market would be the domestic Indonesian one. Product fields would include general decorative plate and shapes, condenser cases, semiconductor heat radiating plates, fins, etc. Busbars and cable sheaths would be other products for which demand could be expected.

Indonesia is also expected to become a base for supply of various parts to electric machinery manufacturers located in Asian countries. Potential importing countries in include Singapore, Malaysia, Thailand and Taiwan.

Specific products, suitable materials and potential in the Indonesian market are summarized in the following table.

Table 3-3-75: Promising Aluminium Products and Potential in the Indonesian Market for Electrical Appliance Components

Products	Applicable Materials		Potential Markets	
	Materials	Shape	Indonesia	ASEAN
General Decorations	1050, 1070, 6063	Plates, Profiles	**	*
Condensor Cases	1050	Plates	**	*
Switch Plates	1100, 5052	Plates		
Light Bulb Caps	1100, 3004	Plates		
Radiators for ICs	1050, 6063	Profiles, Plates	**	*
TV Antennas	1100, 3003, 6063	Tubes, Pipes		
TV Cabinets	5052	Plates		
Motor Frames	1050, 6063	Plates, Profiles		*
Busbars	1060, 6063	Plates, Profiles	*	
Cable Sheaths	1050	Tubes, Pipes, Plates	*	
Ventilation Fans	1100, 3003, 5052	Plates		
Pots for Rice Cookers	1100, 3003, 3004	Plates		*
Fins	1100, 1200, 1050	Plates	**	
Drums for Copying Machines	1050, 3003, 6063	Tubes, Pipes		

[4] Aluminium products for general equipment use

Most of the aluminium products for general equipment use require medium levels of technology, thus Indonesian products are considered to have international competitiveness if the products are in labor intensive areas.

Name plates and printing plates are other major applications of pure aluminium plate. If Indonesian rolling companies were to be able to manufacture plate with a high degree of flatness and a surface luster, then they should be able to take over the markets of imported plate. High quality plate can be immediately used for materials for sinks, bathtubs, etc., so large demand could be expected in the fields of household equipment as well. In the short term, such products would substitute for imports, but development of new products could be expected to lead to exports as well to Asian and Middle and Near Eastern countries.

Other countries make use of large amounts of aluminium materials for automobile coolant containers, truck flatbeds, frames, etc. These are being produced in some factories in Indonesia as well, but in the future it is projected that there will be a rapid rise in use of aluminium materials in automobiles due to their light weight, from the viewpoints of improvement of fuel economy and aesthetics. While exports of stand alone aluminium products to the overseas markets might be difficult for the time being, exports of products as assembled in automobiles would be possible.

Specific products, suitable materials and potential in the Indonesian market are summarized in the following table.

Table 3-3-76: Promising Aluminium Products and Potential in the Indonesian Market for Electrical Products

Products	Applicable Materials		Potential Markets	
	Materials	Shape	Indonesia	ASEAN
Watch Dials	1050, 1100	Plates		
Kitchen Sinks	1100, 5052	Plates	*	*
Bathtubs, Smokestacks	1100, 3003, 5052	Plates	*	
Whiteboards	5052, 6063	Plates, Profiles		
Picture Frames	6063	Profiles	*	
Rackets	6061, 6063	Profiles	**	
Nameplates	1050, 1070, 1080	Plates	**	*
Printing Patterns	1050, 1100, 3003	Plates	**	
Truck Flatbeds, Frames	5052, 5083, 6063	Plates, Profiles	*	*

[5] Aluminium products for packaging use

Aluminium products for packaging use include packaging and also caps, aluminium cans, LPG containers, etc.

The biggest use for aluminium plate in the U.S. and other advanced overseas nations is as the body material and caps of aluminium cans. In the area of body materials for beer cans, 99 percent of the total cans produced in the U.S. and 97 percent of those produced in Japan are made of aluminium. Aluminium cans are considered to have the following advantages in comparison with other materials:

(a) Compared to glass bottles
- Stronger (not fragile)
- Light, resulting in lower transportation costs
- Easy to handle empties
- Can be chilled more quickly

(b) Compared to tinplate cans
- Maintains contents longer
- Light, resulting in lower transportation costs
- Better quality printing
- Easy surface treatment
- Can be chilled more quickly

(c) Compared to PET bottles
- Can recycle empty cans
- Maintains taste longer
- Better sealability
- Can be chilled more quickly

(Source: Aluminium Rolling and Extrusion Handbook 1990, Japan Aluminium Federation)

The production of aluminium cans is considered to require a sophisticated level of production technology, and the latest machinery and equipment. The rolling facilities in Indonesia have not been of a satisfactory level quality-wise, but one domestic company has recently introduced state-of-the-art production facilities and the relevant technology from a foreign company. The company is scheduled to start production of two-piece cans in 1991 at a monthly rate of 300 tons. Domestic demand is still small, so for the time

being the production level may also remain small. If demand for about 3,000 to 5,000 tons of aluminium cans were to develop, then further investments would follow.

The use for aluminium cans are, however, principally limited to beer and carbonated drinks, and they are inferior to steel cans price-wise. Therefore, rapid increase in demand for aluminium cans in the country is not projected.

As for packaging itself, as the quality of the aluminium foil produced and the volume of domestic production rises, gradually domestic products will replace imported ones.

From the above, the promising future aluminium products for packaging use would be caps and aluminium foil packages. The market would be limited to the domestic Indonesian market/

Specific products, suitable materials and potential in the Indonesian market are summarized in the following table.

Table 3-3-77: Promising Aluminium Products and Potential in the Indonesian Market

Products	Applicable Materials		Potential Markets	
	Materials	Shape	Indonesia	ASEAN
Aluminium Caps	1100, 1200, 3003, 5052	Plates	**	*
Aluminium Cans	3004, 5052, 5082, 5182	Plates	*	
LP-Gas Containers	5052, 5083	Plates		
Foil Packages	1030	Foil	**	*

[6] Aluminium household utensils

Almost all aluminium household utensils made in Indonesia at the present use poor quality plate made by pull-over rolling and are shipped out with just buffing as the final finish. Such products lack almost any competitiveness in the international markets, though not in the domestic market, where the stress is less on quality and more on price.

In the future, Indonesian household utensil companies should exert effort into higher value added products as export commodities, for example, Teflon coated frying pans and anodic oxide film coated, colored pots and kettles. The development of such products would require adaptation in accordance with the consumer needs in design, color, etc. in the target markets, but this would be difficult for local companies due to their limited amounts of information. First, as a short term strategy, it would be effective to engage in OEM production for overseas companies so as to work to acquire the technical and design expertise.

The targeted overseas markets should be Japan, the U.S., and other advanced western nations and R. Korea, Taiwan, Hong Kong, Singapore, and other Asian NIE's. Note that two companies are now producing Teflon coated utensils in Indonesia. It is exporting most of its production to Japan and is succeeding in its endeavors.

[7] Aluminium parts for automobiles

Improvement of fuel consumption and reduction of weight are two of the major problems automobile manufacturers are tackling today throughout the world.

Development of fuel efficient engines as well as thinner steel for use in bodies is being carried out and, as the next step, automakers are seeking to replace the present materials, most of which are steel or iron casting, with new ones. Corresponding to such movements, further use of plastic and aluminium materials to automobiles is being attempted. Recently, aluminium plate was first applied to body sheets of mass-produced automobiles in Japan. While aluminium makes up only about 5 percent of the total weight of an average automobile, in this case, about 30 percent of the total weight, which is 1,350 kgs, was made up of aluminium parts.

So far, in the automobile industries of the advanced countries, the parts and components have been made of aluminium. As the rate of domestic production of automobiles increases in Indonesia, the demand for these parts made of aluminium is expected to increase.

At the same time, as international horizontal production by overseas automobile manufactures progresses, production and export of automobile parts that need medium technologies and less expensive labor is expected to increase. As indicated by the success of export of aluminium wheels, export of aluminium rolled parts has large potential.

Table 3-3-78: Aluminium Parts for Automobiles

Product Categories	Applicable Alloys	Product Samples
Rolling and Extrusion	Pure Aluminium	Step Sheets, Trim
	Al-Cu family	Rivets, Doors, Body Sheets
	Al-Mn family	Interior and Exterior Decorations for Trucks
	Al-Si family	Radiators, Air Conditioners
	Al-Mg family	Interior and Exterior Decorations for Trucks and Buses
	Al-Mg-Si family	Frames and Floors for Trucks
	Al-Zn-Mg, Al-Zn family	Truck Frames, Bumpers
Diecasting and Other Castings	Casting	Manifolds, Crank Cases, Pistons, Wheels
	Diecasting	Crank Cases, Gear Cases, Wheels
Forging	Free Forging	Reinforcement Materials
	Closed Die Forging	Pistons, Wheels, Reinforcement Materials

Source: Aluminium Rolling and Extrusion Handbook 1990, Japan Aluminium Federation

In the future, the following parts are expected to be produced of aluminium:

Table 3-3-79: Potential Use of Aluminium in Automobile Parts

Product Categories	Degree of Potential for Aluminium Parts High	Moderate
Bodies	Hoods, Trunk Lids, Fenders, Sunroofs	Roofs, Doors
Bumpers		Reinforcement Frame Extension and Impact
Engines	Engine Blocks, Rocker Arms, Oil Filter Bodies	Connecting Rods, Accelerators, Air Cleaners, Generator Brackets, Engine Mount Brackets
Steering	Steering Wheels	
Drive Trains	Shift Forks, Clutch Pedals	
Front and Rear Suspensions	Lower Arms, Upper Arms	Stabilizer Brackets, Steering Knuckles
Brakes	Brake Pedals (Bracket), Calibers	
Others		Brackets, Fuel Tank Doors, Sheet Frames, Sheet Belt Rails, Jacks

Source: Aluminium Rolling and Extrusion Handbook 1990, Japan Aluminium Federation

(3) Competitiveness of Aluminium Products

Aluminium products are light, strong, resistant to corrosion, easily worked, electrically conductive, nonmagnetic, heat conductive, light and heat reflecting, nontoxic, beautiful when surface finished, and easily recyclable. Diverse products are being made making use of these advantageous features. However, there have been remarkable technical innovations made in other metals and plastics as well and there is thus competition in many product areas.

The unit weight manufacturing costs of aluminium and competing materials, as analyzed by the U.S. Commodities Research Unit (CRU) Co. in March 1980, are as shown in Table 3-3-80.

Table 3-3-80: Comparison of Manufacturing Costs of Aluminium and Competing Materials

Aluminium and competing materials	Cost in U.S. (US$/m^3,1979)	Projected cost index based on 1979 as 100			
		1985		1990	
		U.S.	Japan	U.S.	Japan
Aluminium plate	0.58	117	116	130	130
Steel plate	0.36	114	116	127	130
Aluminium alloy for casting	0.41	118	117	133	132
Zinc for casting	0.68	110	115	118	127
Pip iron	0.16	115	116	127	131
Aluminium rods	0.44	118	118	133	133
Steel rods	2.38	116	115	125	125
6.6 nylon	0.98	115	112	144	142
Hard PVC compound	0.17	120	118	133	128

Source: Report of CRU Co. "Long Term Projection on Competitive Position of Aluminium", February/March 1980)

As indicated by the above table, plastic (hard PVC compound) is superior to metals in a simple cost comparison. Plastic, however, is low in strength, so large amounts have to be used. Further, it is inferior in heat resistance, so is limited in applications, so a simple comparison cannot be made. A low cost of material does not in itself lead to superiority. From the long term projections of CRU and the trends in the world markets, the competitiveness of aluminium products in various product fields is considered to be as follows.

[1] Aluminium products for construction use

First, in building materials, aluminium products have a solid superiority overall due to their light weight, diverse surface treatment, and excellent workability. However, in particular in the U.S., the world's largest market, there has been remarkable growth in use of PVC and it is projected as becoming the biggest competing material in the fields of house siding and window frames. Aluminium products will continue to be superior in store fronts and curtain walls. In Japan's case, a high percent of window and door related parts are already made of aluminium and it is not considered that any new material will appear in the near future to take the place of aluminium.

[2] Aluminium products for packaging use

The biggest aluminium product in the field of packaging is aluminium beverage cans. In particular, the appearance of DI cans for beer has led to a rapid shift away from the conventional glass bottles and steel cans to aluminium cans. Taking the U.S. as an example, the rate of use of aluminium for beer cans rose from the 52.8 percent of 1975 to 99.9 percent in 1988, with almost all beer cans now being made of aluminium. Even looking at beverage cans as a whole, including soft drink cans, the rate of use of aluminium rose from the 38.3 percent of 1975 to 96.0 percent in 1988. A similar trend may be seen in other countries as well. For example, the use of aluminium for beer cans in Japan reached 97.0 percent in 1989. Plastic cans and steel cans using high tension steel are being developed, but aluminium cans should continue to hold a superior position due to their ease of printing, heat conductivity, light blocking nature, light weight, etc. On the other hand, no major future growth can be expected in aluminium foil. Demand for foil is expected to be eaten away by plastic film and metallized paper.

[3] Aluminium products for transportation equipment

Looking at use of aluminium in the transportation field, use for automobiles and motorcycles is the greatest at the present. The aluminium used for the chassises of automobiles are mostly die castings and aluminium castings. A main product is engine blocks made by aluminium castings, but many parts, including parts for engine blocks, are already being made of aluminium, so no major increase in the amount of aluminium used is expected in this field in the future. Growth may be expected in the future for aluminium body parts made with the aim of reducing weight. In addition, use of aluminium products is expected in the fields of truck flatbeds, carts, van bodies, trailers, containers, and new urban transport vehicles. The transportation market is expected to become the most important market for the aluminium industry in the future.

[4] Aluminium products for general equipment use

Other fields of aluminium products include electrical equipment, durable consumer goods, and machine parts. Leading aluminium products used in the field of electrical equipment include the foil used for the material of condensers, plate used for heat radiating plates, and electrical conductors. Among these, demand is growing for electrical wire to take the place of copper wire. In particular, large global demand is expected due to the electrification plans of the developing countries. On the other hand, the aluminium used for durable consumer goods and machine parts is facing increasing severe competition from nylon, ABS resin, engineering plastics, etc., so its overall share is expected to fall.

3-3-4 Interest of Indonesian Companies in Joint Ventures, Technical Tieups, and Technical Cooperation

A look will now be taken, through the results of the questionnaire survey, at the interest of Indonesian aluminium product manufacturing copmanies in joint ventures and technical tieups. As mentioned earlier, only one of the seven aluminium rollings manufacturing companies responded to the questionnaire and note should be taken that it is impossible to obtain a grasp of the intentions of the aluminium plate companies.

Joint Ventures

Six companies were interested in joint ventures with foreign companies. By product, this breaks down into two companies for extrusions, one for die castings, one for impact tubes and cans, and one for manufacture of alloys.

As to companies of which country joint ventures were desired with, Japan was mentioned most often (multiple responses possible), by five out of the six companies, followed by the U.S. by three companies, the Asian NIE's by three, the EC by two, and ASEAN by one.

As to what was hoped for from the joint venture partner, transfer of technology was mentioned most often, by 10 companies, followed by overseas markets by weight, management knowhow by three, and financial assistance by three.

Technical Tieups

Thirteen of the 24 companies responding to the questionnaire were interested in technical tieups. By product, this breaks down into two companies for extrusions, two for die castings, two for utensils, three for impact tubes and cans, one for permanent mold casting, one for low pressure die casting, and two for wires.

As to companies of which country technical tieups were desired with, Japan was mentioned by five out of the 13 companies, followed by the Asian NIE's by companies, the EC by two, and the U.S. by two.

Table 3-3-81 : Desires for Joint Ventures, Technical Tieups, and Technical Cooperation

	Joint ventures	Technical tieups	Technical cooperation
Extrusions	2	2	3
Sheet	0	0	0
Die castings	1	2	3
Utensils	0	2	2
Impact tubes and cans	2	3	3
Mold castings	0	1	1
Low pressure due castings	0	1	1
Wire	0	2	0
Alloy	1	0	1
Total	6	13	14

Source: Local questionnaire survey

Table 3-3-82 :Desired Partner Countries for Joint Ventures, Technical Tieups, and Technical Cooperation

	Joint ventures	Technical tieups	Technical cooperation
Japan	5	5	11
U.S.	3	2	3
Asian NIE's	3	3	8
EC	2	2	4
ASEAN	1	0	1

Source: Local questionnaire survey

Technical Cooperation

Fourteen out of 24 companies responded that there was a need for technical cooperation.

By product, this breaks down into three each for extrusions, die castings, and impact tubes and cans, two for utensils, and one each for low pressure die castings, permanent mold casting, and alloys.

The partner country for such technical cooperation mentioned most often, by 11 companies, was Japan, followed by the Asian NIE's by eight, the EC by four, and the U.S. by three.

3-3-5 Profiles of Representative Companies

1) Extrusions - Company A

[1] Summary

This is a top company which produces internationally first rate products with the latest facilities and under strict quality control and exports 80 percent of its production. It was established in September 1986 with the status of a PMA and its factory is located in Tangerang. It employs 476 workers (including 12 foreign nationals).

The facilities are all of Japanese make and include a 5 MT melting furnace, a 5 MT holding furnace, a 6' and 8' x 6000 m casting facility, a 1000 MT soaking furnace, and a total of two extrusion machines: one of 1800 MT and one of 2200 MT.

The company produces 1000 MT/month of billets, 600 MT/month of aluminium extruded shapes, and 500 MT/month of aluminium surface treated materials. Eighty percent of the products is exported (to Japan, Singapore, Hong Kong, and Taiwan) and 20 percent is sold domestically.

[2] Features and Problems

All the manufacturing facilities, inspection facilities, and other facilities are the same as those used in the parent company in Japan. The products meet the standards of the parent company and are given composite surface coatings. The key portions of the processes are performed under the guidance and checking of foreign nationals. Also, 10 workers are sent to Japan every six months for education and training there. Everything from the counter meters for checking the components of the melt to the machinery for checking the alumite coatings is performed by inspections of quality and inspection machinery the same as in Japan. Automatic machinery has been introduced for even the cutting of frames and attachment of screws and other parts so as to eliminate variations in work. The company is also tackling QC activities, but at the present time is only at the stage of a safety campaign.

2) Extrusions and Plate - Company B

[1] Summary

This is a member company of an aluminium manufacturing corporate group located in Surabaya and manufactures rolled plate and extruded products. It is working to raise the quality of its products through guidance from foreign engineers and introduction of foreign technology.

The plate rolling facilities were obtained through a package purchase of used machinery from Hong Kong and include two melting furnaces, one hot rolling machine, and three cold rolling machines. Seventy percent of the products is sold within the same group and the remaining 30 percent to the outside. The company produces 500 M/month, which breaks down into 70 percent frames, 20 percent sheets, and 10 percent coil.

The extrusion facilities include one 5.5 MT melting furnace, a West German extrusion machine of 1800 MT, a Taiwanese one of 1600 MT. and two Taiwanese ones of 350 MT. The dies are fabricated in-house using two electrodischarge machines. The company produces 500 MT/month.

[2] Features and Problems

The company is using used facilities of over 30 years' age while touching them up. The plate is supplied to utensil manufacturing companies in the same group.

The extrusion division is receiving guidance from foreign engineers. The surface treatment is being performed by a PPG coating system introduced from the U.S. The company plans to increase production from 700 MT to 1000 MT by the introduction of an American made extrusion machine (2500 MT). It is also considering introducing a fully automatic line for the surface treatment.

3) Rolled Plate - Company C

[1] Summary

This company is the largest local firm in this field and was established in 1980.

The production facilities include two 20 MT melting furnaces and one 15 MT holding furnace, one 20 MT melting furnace and one 15 MT holding furnace, and, from December 1990, a scheduled one 20 MT melting furnace. The company also has two slab heating furnaces, one hot rolling machine, one cold rolling machine (both of British make), one intermediate rolling machine for utensils, one finishing rolling machine for roofing plate, one finishing rolling machine for foil, and four annealing furnace circle plate.

The company produces 100 MT/month of general plate, 500 MT/month of circle, 600 MT/month of embossed roofing plate, and 300 MT/month of foil. It exports 5 percent of its production and sells 95 percent domestically.

[2] Features and Problems

With the current used rolling facilities, a production of 2000 MT/month is the limit and the quality too is inferior compared with in the advanced countries. Therefore, the company plans to introduce used facilities made by Hunter so as to achieve an annual production of 50,000 tons. Quality wise too, there may be expected to be considerable improvement. Four foreign experts are providing guidance.

4) Foil - Company C

[1] Summary

The company is the only foil manufacturer in Indonesia and is the same Surabayan company C as described for rolled plate. Judging from the capabilities of its machinery, the quality of foil of less than 10 microns thickness is not good.

All of the production facilities are used machinery and include three made in Germany, four in the U.K., and one in the U.S. There are eight annealing furnaces of the electric heater type.

The company states it is producing 5000 MT a year, but is believed to be producing about 3000 MT.

[2] Features and Problems

The quality of the original coil is poor, so the quality of the finish of foil of less than 10 microns thickness, produced by double rolling, is not very good. When looking at actual rolling, there was center and edge buckles. There were no facilities for lamination etc. If the quality of the original plate is improved and the rolling technology upgraded, the quality of foil of less than 10 microns thickness would be improved and production increased.

5) Utensils - Company D

[1] Summary

This is the largest company making utensils. It produces Teflon coated products under a technical tieup with Du Pont and exports to Japan. Established in 1972, it employs 3150 workers. The production capacity is 610 MT/month, of which 15 percent is exported. The Teflon coating division produces 185 MT/month and employs 900 workers. Ninety percent of its production is destined for export. Japan accounts for an 18 percent share of this.

[2] Features and Problems

The reject rate of the export oriented products is 30 percent, but the rejects are sold domestically, so there is no substantial loss. Every export product is inspected. The products for Japan are made under OEM agreements with supermarkets.

6) Impact Tubes and Cans - Company E

[1] Summary

Established in 1982, this company manufactures aluminium impact cans and employs 150 workers. It holds an 80 percent share of the domestic market. It engages in vertical production from the metal to the printing using mostly West German machinery.

The facilities include one 4.5 MT melting furnace, one continuous casting machine, one 9 mm x 125 mm rolling machine, three Japanese made slab punching presses (40t, 80t, 150t), one annealing furnace, four canmaking machines (300t to 500t), and four printing machines.

The company produces 30,000 cans a month, which converts to 150 MT/month of aluminium materials. It exports 10 percent of this (to Taiwan and Singapore) and ships the remaining 90 percent to the domestic market.

[2] Features and Problems

The company is receiving technical guidance in manufacturing technology from West Germany and Switzerland. Domestic inspection organizations are used for the checking of the purity of the materials. For the in-house standards, the company uses the DIN standards of West Germany. There are limits to the improvement of the quality of the products since the processes up to the manufacture of the aluminium slabs are old-fashioned.

7) Die Castings - Company F

[1] Summary

This is a local company established in 1984 and specializing in die casting. It employs 150 workers and produces die cast parts as a subcontractor for a Japanese affiliated motorcycle manufacturer Company A and electrical machinery manufacturer Company B. It is receiving technical guidance from the Japanese affiliated firms, but suffers from many problems in facilities, level of technology, etc. and has a high reject rate.

The facilities include three Taiwanese and Hong Kong made die casting machines

(200t, 180t, and 150t). The dies are made in-house when simple and are imported from Taiwan when complicated. The company produces 100,000 to 120,000 motorcycle brake shoes and 100,000 to 125,000 speaker parts a month.

[2] Features and Problems

There are many problems in the process control and quality control and technical guidance is required.

First, the aluminium and zinc manufacturing equipment are installed close to each other, posing the risk of intermixture of materials. The products and materials are piled up on the ground and the products are stored and handled roughly. The die casting machines lack thermometers and no temperature control is performed. The dies are stored unsuitably. Inspections are performed visually and all deburring is performed by hand hammering.

8) Low Pressure Castings - Company G

[1] Summary

This company has formed a technical tieup with a Japanese Company T. It is engaged in low pressure die casting of aluminium wheels and is shipping its products to a Japanese affiliated automobile manufacturer. Established in 1988, it employs 145 workers.

The facilities include two low pressure die casting machines with another two scheduled to have been introduced in December to expand production. The dies are fabricated by the Japanese Company T. The lifetime is 200,000 shots. Production is 20,000 units a month, which converts to 50t/month of aluminium. The company was scheduled to shift to 30,000 units a month starting in 1991.

[2] Features and Problems

The factory could not be inspected. The reject rate is 15 percent, with the main problems being porosity, leaks, remaining black film, etc. The company uses as in-house standards the Japanese automobile manufacturer's standards, which are tougher than JIS. Work standards are prepared for all machinery.

3-4 Review of Aluminium Industry Promotion Policy

3-4-1 Administrative Organization

The administrative organization relating to aluminium industry is comprised of the Asahan Development Agency (ingots), the Ministry of Industry (semifinshed products and finished products), the Investment Coordinating Board (investment permits), and the National Agency for Export Development (export promotion). Research and development are the province of the Institute for Development of Metal and Machinery Industry (IDMMI), and inspection and testing that of the Institute for Research and Development of Material and Technical Product Indutry (IRDMTP) Both the IDMMI and IRDMTP are under the jurisdiction of the Ministry of Industry and are located in Bandung.

In the Ministry of Industry, the Directorate of Basic Metal Industries of the Directorate General of Machine Industry, Basic Metals, and Electronics has jurisdiction over semifinished products (alloys, plate, extrusions, die castings), while the Director of Electrical Equipment and Metal Industries of the Directorate General of Multifarious Industries has jurisdiction over final products (utensils, containers, etc.) The directorates are comprised of four sections which take charge of planning, production, licenses and permits, and the business environment.

The research organizations of the Ministry of Industry are under the overall control of the Research and Development Agency on Industries (BPPI), which has nine central institutes and nine local institutes. Among these, the above-mentioned IDMMI and IRDMTP are related to the metal industries. Both these institutes have the basic facilities and apparatuses relating to metals and industrial materials, but have almost nothing relating to aluminium. Further, they are working to build up technical expertise and knowhow relating to aluminium through joint research with private companies but have not yet reached satisfactory levels.

3-4-2 Position in Industrialization Policy

In relation to aluminium products, REPELITA V set development targets for the basic materials sector and various industries' sector. Production of aluminium ingots at the end of REPELITA IV stood at 189,512 tons and is projected as reaching 225,000 tons by the end of REPELITA V. The main development programs in this field are as follows:

- Establishment of plants for producing aluminium slabs, aluminium billets, and aluminium castings.
- Establishment of an aluminium die casting producing plant with an annual production capacity of more than 1000 tons.
- Establishment of an aluminium forging plant with an annual production capacity of over 1000 tons.
- Establishment of an aluminium pigment powder plant with an annual production capacity of over 500 tons.

In multifarious industries' sector, in the basic industrial product industry, figures for production and export of metal household goods, including ones made of aluminium, at the end of REPELITA IV and projections of the same for the end of REPELITA V are as follows:

Table 3-4-1: Production and Exports of Metal Household Goods

	End of REPELITA IV	End of REPELITA V
Production (1000 tons)	30.6	52
Exports (US$1000)	11,164.5	56,909

Source: REPELITA V Industry Sector

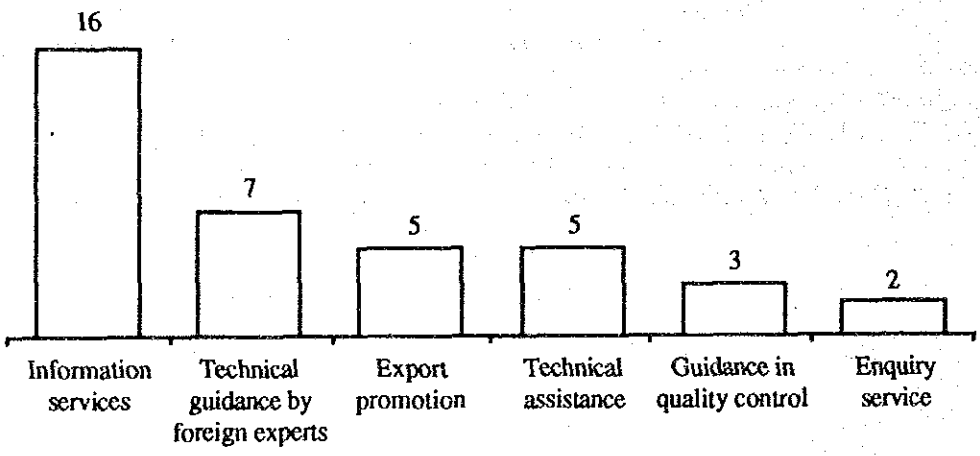
3-4-3 Trade Promotion Policies Relating to Aluminium Product Industry

A look at Negative List of Investment shows that investment is not banned for aluminium products. This industry is open to both foreign and domestic investment. According to the BKPM, four PMA projects and seven PMDN projects were approved from 1985 to October 1990 for the aluminium industry.

There are no trade policies specifically covering aluminium products.

According to the questionnaire survey in Indonesia, what is desired most from the government is information services - requested by 16 out of the 24 responding companies. The lack of information on overseas markets was pointed to most frequently as a factor inhibiting exports, and the acquisition of overseas market information was mentioned most frequently as a requirement for expansion of exports. There is an extremely strong need for overseas market information and overseas technical information in the aluminium product industry. Seven companies indicated a desire for technical guidance by foreign experts and five for export promotion and technical assistance and guidance.

Fig. 3-4-1: Expectations to Government



Source: Questionnaire survey

3-4-4 Financial Policy

According to the field survey, many companies are in need of funds for investment in facilities or the introduction of pollution prevention measures. The Government of Indonesia has endeavored to develop a financial sector and long term capital market. However, demand for long term capital is increasing rapidly and as a result the difficulties in raising long term funds and high interest rates constitute the main financial problems faced by private companies in the sub-sector. In consideration of the current financial situation and problems, the introduction of two-step loans to private companies in the sub-sector and official incentives for investment in facility modernization are recommended in this report. This recommendation is presented in detail in Part I Review of Policies Related to Industrial Sub-Sector Development.

3-4-5 Infrastructure

Brisk production and investment activities since 1989 have brought about economic recovery. However, this has produced a gap between demand and supply of basic infrastructure including electricity, telephone lines, land for industrial use and office space, etc. In the field survey of the downstream aluminium industry, the high cost of electricity is pointed out as a cause of high production costs. One company in Medan complained about insufficient electricity supply, but otherwise there was no mention of infrastructure during the field survey. It is recommended that infrastructure be supplied in order to meet the demand caused by the rapid expansion of production which is expected to continue in the future.

3-5 Issues in Promotion of Aluminium Product Industry

The issues in the promotion of the aluminium product industry of Indonesia, judging from the problems in technology and corporate management uncovered by the current survey, are as follows, classified into the three manufacturing methods of (1) rolling, extrusion, and plate work, (2) die casting and other casting, and (3) aluminium manufacture as a whole.

(1) Rolling, Extrusion, and Plate Work

1) Modernization of rolling facilities

Wide use is being made of the pull-over rolling system, which has already disappeared from the advanced nations, for manufacturing aluminium plate. This system has the advantages of a small initial investment and the ability to handle small run production, but basically is poor in productivity and poor in the quality of the plate which is produced, so almost all of its production is used for utensils. On the other hand, even the coil rolling systems in operation in Indonesia are almost all old-fashioned and cannot handle production of wide plate and thin foil. Unlike on the domestic market, competition on the international market requires that the international level of quality be achieved. For this, renovation of the existing ageing facilities would be desirable.

2) Surface treatment

Most of the local companies are giving anodizing surface finishes just by chemical treatment and are not controlling the thickness. Today, in Japan and other advanced countries, wide use is being made of tough, beautiful composite films made by anodizing treatment plus plastic coatings. Composite film treatment requires stricter control over the treatment liquid, the liquid temperature, the treatment time, etc. At the same time, it is necessary to improve the quality of the extruded material itself. Therefore, companies have to tackle a host of problems including the quality of the materials and the precision of the dies.

3) Quality of billets

The billets made in-house by the local companies are insufficient in terms of composition, deoxidation, and degassing treatment. Further, suitable control of the temperature is not exercised in the homogenizing treatment. Therefore, little use is being made of billets produced in-house for products where high levels of quality are demanded and instead make use of imported billets. The quality of the billet is a factor having a major influence on the state of the surface of the shape which is extruded and the final result of the subsequent oxide film treatment. For production of high quality billets, it would be effect to modernize the melting, casting, and homogenizing treatment facilities and also obtain guidance from foreign advisors.

(2) Die Casting and Other Casting

1) Die casting machines

[1] Automation of manufacturing process

Much of the manufacturing process is being performed by manual labor with little effort made at automation. In particular, there is remarkably little automation of the startup, charging, extraction of products, spray cleaning of dies, and plunger lubrication. Quick mechanization is required.

[2] System of control over maintenance

The matters to be controlled and their frequency are not clarified or performed. Further, satisfactory maintenance is not being performed to prevent accidents. It is necessary to determine matters to be inspected daily, weekly, monthly, tri-monthly, semiannually, and annually and to prepare manuals based on the same.

[3] Layout of manufacturing facilities

The layout of facilities in local companies is not suitable. Cold chamber machines using aluminium alloy and hot chamber machines using zinc alloys are placed next to each other. Casting facilities using different materials should be placed in different buildings so as to prevent mixup of materials.

2) Dies

[1] Design technology

There is insufficient knowledge and technology about products and die schems, so while simple dies can be made, complicated ones cannot. The basics of design, casting theory, and the performance of die casting machines must be sufficiently understood and learned.

[2] Die lifetime

Due to the insufficient facilities for the heat treatment and surface treatment of dies, the lifetime of dies is short, which obstructs productivity. The heat treatment and surface treatment facilities must be modernized. Such facilities, however, do not necessarily have to be installed by each company. It is possible, for example, for a public organization to install the latest facilities so as to cope with private demand.

[3] Maintenance of dies

The technology for maintaining dies is underdeveloped and no suitable measures are taken until the dies are damaged. Preventive measures before die damage are extremely important. It is necessary to establish a control system for periodic inspection.

3) Alloys

[1] Quality of alloys

The quality of the alloys supplied by local companies is not very reliable. Suitable control is not exercised in the melting or refining methods of the alloys. Further, the compositions of the alloys are not correctly measured. It would be desirable to introduce the latest inspection equipment for accurately determining compositions or to have a public organization perform the testing and inspection.

[2] Methods of storing and managing alloys

The methods used for storing and managing alloys are unsuitable. Satisfactory consideration is not being given with regard to corrosion, dirt, etc. Alloys should be stored on suitable special shelves or in special containers and care taken so that no mixup occurs with other materials.

(3) Aluminium manufacture as a whole

1) Quality control

[1] Separation of good and defective products

Products are not being clearly indicated as good or defective and defective products tend to get mixed up with good ones. It is important to completely differentiate containers for good and defective products.

[2] Inspection

Overall, there are very few inspection processes in the manufacturing process. Further, many companies were seen which left the inspection to the operators of the machinery and equipment. It is dangerous to overly rely on the operators for inspection. Total inspection is desirable from the viewpoint of quality assurance, but this is not practical in that it would take too many manhours. The best procedure is to determine a limiting sample with the customer and perform statistical control by sampling inspections etc.

[3] Handling of products

The method of handling products and the method of storing good products are rough, especially in the local companies. Avoidance should be made of removing casting burrs from products directly on the ground and piling up products on the ground before shipment.

[4] Quality control activities

There is a basic lack of understanding of quality control activities and few companies which are engaged in specific activities of that nature. In addition to the lack of basic knowledge on quality control activities, there is the problem that employees are not being trained to serve as the core personnel for these activities. It is necessary to tackle the

training of manpower from a long term perspective and important to establish a system of support by public organizations.

2) R&D

Companies overly rely on technology introduced from other countries and are not independently developing products. R&D does not necessarily mean research and development of frontline technology. It includes domestic application of technology already spread overseas and improvements in production processes. It is this that is sought of the present day Indonesian industry. Companies must work to train manpower and support must be provided to R&D activities of private companies by public organizations.

3) Standards and testing and inspection organizations

[1] Establishment of industrial standards

Indonesia has been slow in establishing domestic industrial standards. Different standards are used by several ministries and various overseas standards are used in a patchwork fashion. Industrial standards are the basics of manufacture and are a common language of technology used among companies, so it is necessary to promote their quick establishment.

[2] Strengthening and augmentation of testing and inspection organizations

Almost no private companies are fully equipped with testing and inspection facilities. Public testing and inspection organizations are generally equipped, but not fully equipped and many of their facilities are antiquidated. It would be desirable to improve the facilities at the public organizations and have those organizations undertake testing and inspection on commission or to provide support to private companies through calibration of the testing and inspection facilities which private companies have etc.

4) Information

[1] Technical and product development information

There are few public organizations which provide technical information. Also, the information which is supplied is not sufficient in content. In general, foreign affiliates are able to easily obtain technical and product development information from their overseas parents, but local companies lack effective means for obtaining information. It would be desirable to improve the functions of public organizations to promote the collection of technical and product development information and propagation of it to private companies.

[2] Marketing information

Very few companies positively collect marketing information and use in for domestic sales activities or export activities. The collection and analysis of overseas market information are essential for local companies to engage in export promotion activities on their own, but individual companies would find it difficult both in terms of manpower and money to do these. It is hoped that industrial organizations or public organizations would take on such activities and function to collect information.

5) Education and training

With the exception of some foreign affiliates, there are almost no companies which

are providing systematic education and training to their engineers, skilled workers, and general employees. Support from some public organization would be desirable. For the medium and long term, improvement of educational and training facilities would be desirable, but in the short term, it would be desirable to hire experts from advanced foreign nations and have them rove companies to provide on-the-job training. Further, not only education and training in technical matters, but also education in management and control for managers and retraining of engineers and skilled workers working in companies would be important.

3-6 Recommendation on Industrial Promotion Program for Aluminium Products

3-6-1 Basic Perspective

(1) Comprehensive Viewpoint

1) Basic Understanding of Current Situation

[1] Demand for aluminium increases in proportion to the stage of economic development. Demand for iron slows down in growth as the heavy machinery and chemical industries are completed. Aluminium, however, continues increasing in demand even in the more advanced stages of economic development since its superior properties enable the development of diverse products and since it is used to replace other metal materials, wood, etc. The World Bank projects an average annual growth rate for total consumption of aluminium by the year 2000 of 1.0 percent for the U.S., 2.0 percent for Japan, and 1.8 percent for the four major countries of Western Europe.

[2] The Indonesian aluminium industry may be evaluated as being in the initial stage of development judging from its scale, product composition, and technical level. The consumption of primary aluminium ingot is one-fifth that of R. Korea and between that of Thailand and Malaysia. In the advanced nations, about 20 percent of the sheet used is for utensils, but in Indonesia it is estimated that the figure is about 70 percent. Technology wise, with the exception of a few companies, the majority of production is in low quality products for the domestic market. The level of the production technology is not high.

[3] Along with the recovery of domestic demand which started in 1987, the aluminium product industry has displayed increased activity. Some products are even being exported. Many companies are engaged in full production. There are also many companies which are planning expansion of their facilities. The demand for aluminium in Indonesia in the year 2000 will depend on that country's economic growth, but is estimated to increase from the current 70,000 tons to over 109,000 tons if average annaul 4.9 percent growth is continued and if 6.5 percent to over 152,000 tons. The composition of products should also change along with the development of new products and the creation of new demand.

[4] Since the adjustment of currencies after the 1985 Plaza Agreement and the devaluation of the rupiah in September 1986, exports of utensils, window and door frames, etc. from Indonesia have been increasing. The superiority in currency position added to that of labor costs and the ability to produce exportable products through export-oriented investment by foreign capital and guidance by foreign experts are factors behind the increase in exports.

[5] To increase exports of aluminium products, it is necessary to strengthen competitiveness in nonprice factors such as quality and marketing in addition to the current advantage in price. At the present time, most aluminium product making companies sell mainly to the domestic market. The demands for quality in the domestic market are lower than in the export markets. With the domestic market oriented products and production system as they are, exports would be difficult.

[6] There is no problem with the quality of the raw material, i.e., the aluminium ingots. Therefore, for production of high quality products, what is necessary is the improvement of the technology and quality control in the various manufacturing steps from the melting of the alloy to the preshipment inspection of the final products. The main problems are the poor quality of the alloy, the ageing of facilities, the lack of testing and inspection facilities, the insufficient surface treatment, and the insufficient precision of the dies.

[7] The measures for strengthening nonprice competitiveness should basically be implemented by the private companies themselves. The role of the government should be to establish the business environment enabling private companies to realize exports and solution of problems common to the Indonesian aluminium industry and difficult to solve by private companies alone.

[8] To resolve problems which private Indonesian companies would find it difficult to solve on their own, primarily in manufacturing technology, but also including marketing, assistance and cooperation from outside of the companies are necessary. In terms of outside assistance, cooperation from private foreign companies (joint venture investments and technical tieups) and assistance from public Indonesian organizations may be considered. There are limits to what the public Indonesian organizations can do in regard to the aluminium industry in terms of its functions and manpower, so cooperation from overseas economic cooperation organizations is necessary.

Fig. 3-6-1: Problems in Aluminium Product Industry

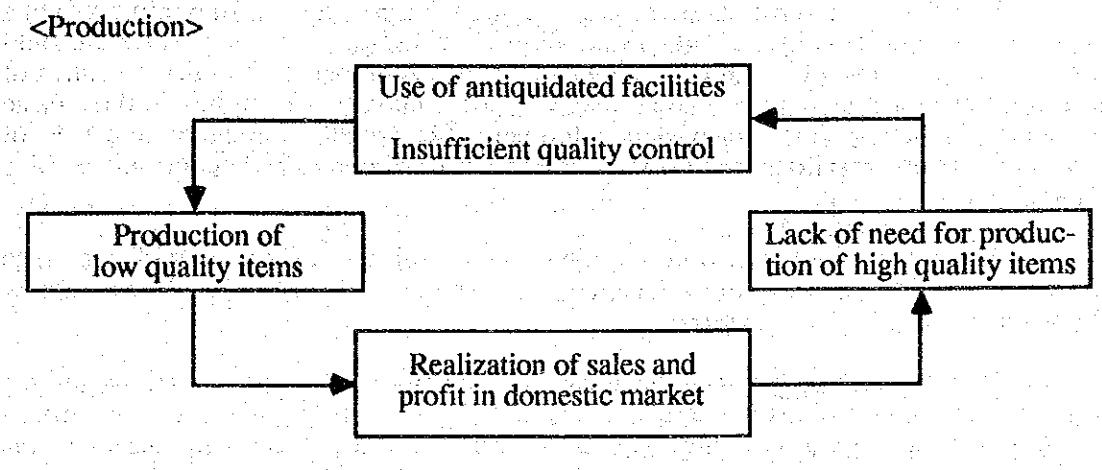
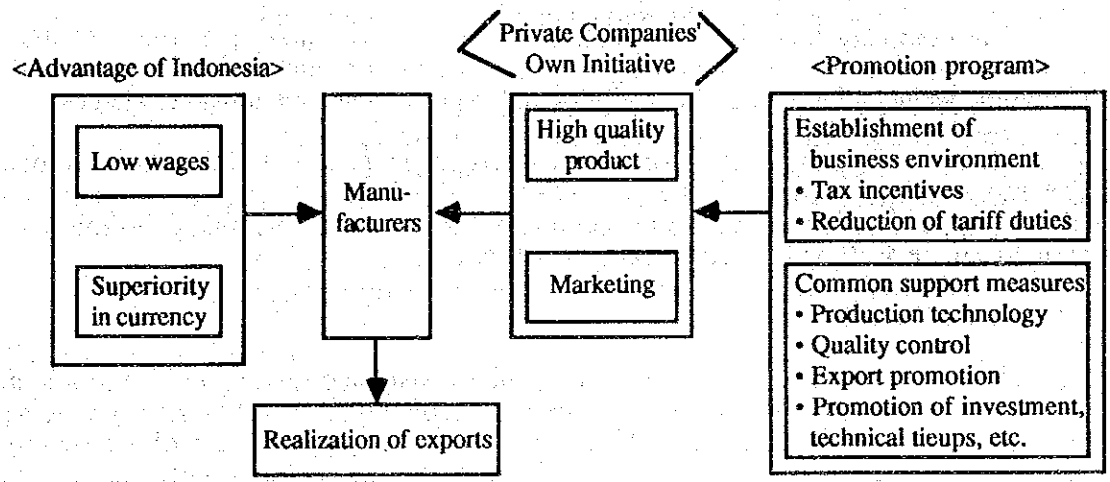


Fig. 3-6-2: Scenario for Export of Aluminium Downstream Products



(2) Basic Concepts in Formulation of Promotional Measures

To assist in the formulation of promotional measures for the aluminium product industry, the problems in the Indonesian aluminium industry as clarified by the field survey, the measures which should be taken by private companies, and the measures of assistance provided by public organizations have been classified according to three basic concepts [1] factors for industrial development, [2] private companies and role of governmental organizations, and [3] state of reserves of resources and opportunities. (See Table 3-6-1.)

The most important will be the measures by private companies with regard to technology and human resources. Details of the same are given in "(3) Viewpoints by Products and Types of Companies".

The relationships between the assistance by governmental organizations and the program recommendations are shown in Table 3-6-2. Recommendations on institutions and policies are shown as policy recommendations and are developed further in the "Policy Review". Programs related to the Ministry of Industry were extracted from among the assistance measures by public organizations and recommendations made on specific programs by considering the importance, urgency, effect, and ease of implementation of the same.

1) Factors for Industrial Development

The company factors are capital, technology, and human resources. Capital usually includes production facilities, but here the factors are classified as capital, technology, as including production facilities and management, and human resources.

The noncompany factors are considered to be raw materials, the markets, infrastructure, supporting industries, institutions, and policies. Diemaking is considered to be a supporting industry for aluminium, but dies are mostly made in-house or imported, so are dealt with among company factors.

[1] Company Factors

* Capital: In the field survey, few companies considered funding to be a problem. Nevertheless, a large amount of funds will be necessary for replacing ageing facilities, the biggest factor behind the production of low quality products. The Indonesian financial market is being deregulated and domestic funds are being mobilized, but problems of a lack of medium and long term funds and high interest rates remain. To raise the funds for investment in modernization of facilities, measures such as joint ventures with foreign companies and use of two-step loans for low interest financing may be considered. Details on the financial policies are given in the "Policy Review".

* Technology: Along with such "hard" facets of technology such as production facilities and manufacturing technology, "soft" aspects of technology such as production planning, quality control, new product development, and marketing are important.

In the field of production technology,there are problems such as the use of ageing facilities, the insufficient automation, the low level of production technology, insufficient surface treatment, the low quality of the billets and die-casting alloys, insufficient die precision and durability, insufficient quality control and standardization in management

technology, and lack of new product development activity.

The problems in technology are the biggest factors obstructing the development of the aluminium product industry of Indonesia as an export industry. The current state of the industry, its problems, and measures against the same are discussed in detail by product and type of company in "(3) Viewpoints by Product and by Type of Company".

* Human Resources: Human resources may be divided into managers (entrepreneurs), engineers and skilled workers, and general workers. Entrepreneurs are essential as promoters of industrialization. Also, a labor force with a certain level of education, level of skills, and observance of work order is essential for industrial production activities.

According to the field survey, many of the local companies are family operated and have not yet reached the stage of modern management. There is no problem with the quantity of general workers, but almost none of the local companies provide systematic education and training to their engineers and factory workers. There is also a conspicuous lack of middle level engineers. Development of human resources takes time, but it is necessary to improve the quality and increase the quantity of workers by on-the-job training and other in-house and outside training in the short term and augmenting education and training facilities in the medium and long term.

According to the foreign affiliate company A, quality of the Indonesian workers is not different from that of the workers of the advanced countries and just lack experience. It mentioned as an example showing the high level of technical expertise possible the export of extrusion dies. The company provides both in-house training and training in its parent company and has achieved good results through its positive education and training programs.

[2] Noncompany Factors

* Raw Materials: The raw materials, i.e., ingots, can be procured domestically, but are also being imported. The import duty was lowered to zero percent in November 1990. The price is based on the LME price both in the case of domestically procured materials and imports.

* Markets: The market may be divided into the domestic market and overseas market. The domestic market is protected by tariffs, with prohibitively high tariffs being assessed on some plate. A look at the ratio of domestic production and domestic demand shows that Indonesia has substantially achieved import substitution in plate, extrusions, and utensils, but is now at the stage where it must improve the quality of its products through corporate competition so as to enable development of the industry as an export industry and should reevaluate its protectionist policies. The domestic market has been growing along with the recovery of business since 1987, but is still small in size compared with the advanced nations. There is an orientation toward low price products, with low quality products therefore being the main market.

Exports have been soaring since the devaluation of the rupiah in 1986.

There are two types of markets: markets to which foreign affiliates and companies engaging in OEM production export high quality products, such as Japan, and markets to which local companies export primarily medium grade products, such as the Middle and Near East and Africa. The lack of information on overseas markets was most often pointed to as a problem in the field survey. For the domestic market, it is necessary to create new demand, while for the overseas markets, it is necessary to strategically promote exports targeting at specific markets.

* Infrastructure: Demand supply gap of electricity, telephone lines, industrial use land, and office space is considered problems by many companies. In the case of the aluminium product industry, the field survey found high electrical power rates mentioned particularly often. In Medan, the shortage of electrical power was a problem, but in other areas there was no problem with the infrastructure at present. Along with the rapid growth of production activities, however, the gap between supply and demand in the infrastructure will become a problem. It is therefore necessary to move forward with the improvement of the infrastructure.

* Institutions and Policies: The institutions and policies having a bearing on industrial promotion are considered to be the financial policies, tax system, tariff policies, export promotion measures, investment policies, environmental protection policies, and industrial policies.

These institutions and policies do not cover specific industries such as the aluminium industry. High tariffs are assessed, however, on some aluminium plate. In terms of institutions and policies, in the tariff policies, it is recommended to reduce the tariff on aluminium plate in steps and, in the tax system, it is recommended to introduce tax incentives for capital investment. Along with the increase in use of aluminium, it will be necessary to establish a recycling system for the reclamation of aluminium and the use of recycled aluminium. In terms of the industrial policies, at the corporate level, mention was made of the lack of testing and inspection facilities and the lack of R&D activities. The facilities at the public institutions are also insufficient and there are limits in equipment and manpower for R&D for the aluminium industry.

2) Assistance from Private Companies and Public Organizations

Private companies should be the main players in the development of the aluminium product industry. The governmental organizations should play a supporting role and work to improve the business environment and resolve problems faced by the private companies. at the present stage of development, however, private companies [1] do not recognize even the existence of problems, [2] when recognizing the existence of problems, do not know how to deal with them, and [3] even when understanding the problems and how to deal with them, cannot take the measures to deal with them due to lack of funds, facilities, manpower, and experience. Therefore, the governmental organizations must provide positive guidance and support. At the present time, the governmental organizations in Indonesia lack sufficient facilities, manpower, and experience in the aluminium industry and therefore cooperation from private foreign

companies and overseas economic cooperation organizations is necessary.

The measures to deal with the problems in production technology in private companies are discussed in "(3) Viewpoints by Products and Type of Companies", the support by the public organizations in the broad sense is discussed in 3-6-2 "Policy Recommendations", and the programs are discussed in "Recommendations on Programs".

3) Reserves of Resources and Opportunities

Indonesia is blessed with rich resources. Indonesia's resources for the aluminium product industry is an inexpensive labor force. A look at the aluminium products which Indonesia has succeeded in exporting shows that there are many products produced with labor intensive processes, such as stepladders and high grade utensils.

The opportunities which should be used by the Indonesian aluminium industry are [1] the lower labor costs compared with neighboring nations and [2] the advantageous position in the exchange rates. Export-oriented investment from Japan and the Asian NIE's is increasing. Since the devaluation of the rupiah in September 1986, exports of finished products have been soaring due to the utilization of these opportunities.

These opportunities should be made full use of in the aluminium product industry as well.

(3) Viewpoints by Products and Types of Companies

Table 3-6-3 shows the features and problems of production technology etc. and the measures which should be taken by private companies, arranged according to products and types of companies. The products examined are extrusions, plate, foil, utensils, impact tubes and cans whose companies were visited, and low pressure die castings. The standards for classification of types of companies are discussed in 3-3-2. "Current State and Problems of Corporate Management and Production Technology".

The main problems in the manufacturing processes of main products are discussed below:

1) Extrusions

There are problems in extrusions in [1] the soaking treatment of billets, [2] dies, [3] extruding, and [4] the surface treatment of the final products. If billets are not subjected to a soaking treatment as in [1], the predetermined characteristics cannot be obtained in the extrusion material and the quality of the final product is affected. The precision of the dies is poor, as in [2], so the dimensions of the finished products are inaccurate. Also, the surface treatment of the dies is insufficient, so the lifetime is short. As mentioned in [3], the extrusion machines are ageing and the precision of work is poor. As to [4], in the surface treatment, the anodizing film is thin and there are no testing machines for measuring the film thickness. Further, composite films cannot be formed due to the limitations in equipment and technology.

The A rank companies are first rate internationally in terms of the level of technology and quality of products and are even exporting to Japan. They suffer from none of the above problems. The B and C class face the above problems. The B rank companies are working to improve their quality through guidance from foreign engineers. The C rank companies are supplying low quality, low price products to the domestic market and are not working to improve their factory control or quality control.

2) Plate

The problems in plate are [1] the melting, [2] the rolling, and [3] the preshipment inspection. When melting slabs as in [1], the components of the melt are analyzed not by testing machines, but by human judgement. Regarding [2], the material is rolled manually and so the plate surface is easily scratched. Regarding [3], the preshipment inspection is performed visually and considerable damage is overlooked.

The A rank companies are engaged in various types of process control under the guidance of foreign experts. The B class and C class companies work with ageing equipment and insufficient process control, but produce plate for in-house production of utensils, so face no particular problems. The C class companies produce poor quality products using the manual pull-over system and suffer from low productivity.

3) Plate Products

The biggest problem in plate products (foil, utensils, and plate roofing) is the quality of the raw material, i.e., the plate. Domestically produced plate is inferior in quality compared with imports, but a high tariff is assessed on the high quality imported plate, so use of the same is difficult.

Looking at foil, the purity and precision of the aluminium coil are insufficient, so pinholes are formed when the foil is rolled.

Looking at utensils, the quality of the aluminium plate and coil is poor and the handling of the same is rough. Therefore, good surface treatment cannot be performed.

In plate roofing, the precision of the raw material, i.e., the embossed aluminium coil, is insufficient.

In impact tubes and cans, the purity of the slabs is low and the control over the component is unsuitable, which have a deleterious effect on the final product.

4) Die Castings

The problems in die castings are [1] the dies and [2] the alloys. In [1] dies, Indonesia is immature when it comes to the design technology and lacks sufficient knowhow, so cannot design or produce complicated dies. Heat treatment and surface treatment also cannot be performed, so there are problems such as a short lifetime of the dies. Regarding [2], locally made alloys are shipped out without sufficient inspection, so their composition is unclear and their reliability is poor. The supply is also small.

Die castings are most made in-house by foreign affiliates making motorcycle and home electrical appliances. There is one local specialized manufacturer. There is an extremely large gap between the foreign affiliates and local firms in terms of the level of technology, quality control, the quality of the finished products, and indeed in all other points.

Table 3-6-3 shows the measures for dealing with these problems as arranged by product and by types of companies. These measures should primarily be taken by private companies. The support which should be given to private companies by public organizations is shown in 3-6-2 "Policy Recommendations" and 3-6-3 "Recommendations on Programs".

Table 3-6-1: Measures by Products and Ranks of Companies Characteristics and Issues (Extruded Shapes)

	A	B	C
Manufacturing processes and level of technology	One company 1. Capacity of extrusion machines: 1,800 tons and 2,200 tons. 2. All lines comprised of latest Japanese equipment. 3. Guidance provided by Japanese engineers and training provided to employees in Japan as well. 4. Use of Japanese work standards for all processes. 5. Fabrication of dies at same level of technology as in Japan. 6. Export of 80 percent of products to Japan. Quality also first rank even by world standards.	Three companies 1. Capacity of extrusion machines: 1,800 tons. 2. Experience with guidance from foreign engineers. 3. Dies fabricated by latest machine tools from Japan. Heat treatment is insufficient, however, resulting in short lifetime. . 4. Use of some imported billets. 5. Insufficient analysis of composition of billets made in-house and insufficient deoxidation and degasification. Temperature control during homogenizing treatment also insufficient. 6. In surface treatment, anodizing films are thin and insufficient attention is given to work standards, checks of the film thickness, and adjustment of color. Composite film treatment cannot be formed. 7. Overall process control is insufficient, so resultant quality is unstable. 8. Extrusion machines are antiquated. 9. Manufacture of aluminum frames for domestic buildings.	Four companies 1. Specialization in materials for display showcases used in domestic market and small extruded materials of a maximum diameter of 5 inches for use as building parts. 2. Products need only be roughly shaped to a certain extent. Low price is demanded over quality. 3. Introduction of Taiwanese made melting and casting facilities and extrusion machines. Facilities are antiquated. 4. Adjustment of composition of billets is done completely by experience and intuition, with no control exercised by analytical equipment for each lot. 5. In surface treatment, anodizing films are thin and insufficient attention is given to checks of the film thickness and adjustment of color. Composite film treatment cannot be formed. 6. Dies are insufficient in terms of precision, durability, and design.
Factory control and quality control	1. Start from complete emphasis on work safety and steady improvement thereafter. 2. Understanding and resolution of problems through comparison with Japanese model factory. 3. Use in Indonesian factories of procedures based on quality control in Japan. Inspection facilities for various processes the same as in Japan. 4. Thorough preparation of work manuals and manuals on inspection processes.	1. Proceeding with advice from overseas engineers. 2. Machinery and equipment are ageing and there are limits to the mechanization and automation being performed.	1. Products are merely shaped right. There is insufficient factory control and quality control.
Product development	Developing products designed for Indonesian market		
Development of human resources	Periodic dispatch of certain number of workers to factory in Japan and effort made to teach up-to-date quality control and level of technology.	Guidance and training from foreign engineers.	

Measures (Extruded Shapes)

	A	B	C
Manufacturing processes and level of technology	1. Export of 80 percent of products to Japan. Quality also first rank even by world standards. Factory control of same level as in Japan. Company able to resolve problems and perform marketing in-house. Need not be covered by promotional measures. 2. Investment by foreign capital is desirable from viewpoints of increasing exports, developing domestic demand, and raising level of technology and disseminating same.	1. Process control and quality control performed under guidance of overseas engineers. Working to raise level of production technology and stabilize quality. Should be covered by promotional measures. 2. Machinery and equipment are of old types over 20 years old. There are limits to mechanization and automation. 3. Therefore, there are problems in precision of products. 4. Modernization and automation of manufacturing facilities and assistance in same. 5. Raising of level of die design and fabrication technology and maintenance. 6. Modernization of billet manufacturing facilities and improvement of technology thereof. 7. Handling of increased demand for shapes of high strength alloys of 2000 series and corrosion resistant of 5000 series. 8. Acquisition and application of overseas technical information. 9. Acquisition and use of overseas marketing information.	The level of interest in quality, dimensional precision, etc. of products is in whether Indonesian standards are met. There is no hope for improvement of quality in so far as there is no competition among companies. Need not be covered by promotional measures.
Factory control and quality control		Guidance in quality control and strengthening of product inspection.	
Product development	Content of OEM production will be made more sophisticated and quantity increased in accordance with level of technology and control.	OEM production of storm doors, fences, verandas, and other standard products.	
Development of human resources	Continuation of training and guidance by Japanese parent company.	Training of middle level engineers by education and training of engineers.	

Characteristics and Issues (Aluminium Plate)

<table>
<tr><th></th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Manufacturing processes and level of technology</td><td>One company
1. Can produce aluminium plate of widths of up to 1,240 mm. Monthly production is reaching 2000 tons.
2. By application, company is producing not only general utensils, but also plate for Teflon coating, building materials, and foil.
3. There are plans to increase monthly production to 4000 tons.
4. Level of technology close to that of R. Korea and Taiwan.
5. Refurbishing of used equipment of the U.S. and other advanced countries.</td><td>Two companies
1. Plate width is less than 600 mm.
2. Use is made of old fashioned equipment of 20 years' age. No improvements have been made in that time.
3. Applications are for utensils for domestic market.
4. Probably would fall into difficult straits if tariff protection were removed or type of products in demand changed.</td><td>4 products
1. Production by rudimentary rolling technique of manual pull-over.
2. Application is for in-house production of utensils.
3. Low productivity, plate size of less than 1000 mm longitudinally and laterally, and numerous problems in precision, flatness, surface finish, and other aspects of quality.</td></tr>
<tr><td>Factory control and quality control</td><td>1. Limited types of products produced (three types)
2. Anticipatory production
3. Relatively good process control through introduction of testing machinery, automation, etc.</td><td>1. Limited types of products produced (one type, for utensils, only)
2. Anticipatory production
3. Control of melt by instinct, rolling by hand, visual inspection of products, and other insufficient process control and quality control methods.</td><td>1. Limited types of products produced (one type, for utensils, only)
2. Anticipatory production
3. No testing and inspection facilities at all, large amount of manual work, etc. for completely unsatisfactory process control and quality control.</td></tr>
<tr><td></td><td>Quality Control
Process | Main control items | Current state
Melting | Control of composition | Analysis for each lot
Melt filter | Facilities exist
Casting | Control of temperature of cooling water/melt | System exists
Slab cutting | Dimensional precision | Facilities exist
Surface grinding | Removal of defective surface defects | Facilities exist
Heating/ soaking | Soaking treatment and uniform preheating | System exists</td><td>Process | Main control items | Current state
Melting | Control of composition | Work based on experience
Melt filter | No facilities
Casting | Control of temperature of cooling water/melt | No system
Slab cutting | Dimensional precision | No facilities
Surface grinding | Removal of defective surface defects | No facilities
Heating/ soaking | Soaking treatment and uniform preheating | Partial system
Rolling | Rolling by machine | Yes</td><td>Process | Main control items | Current state
Melting | Control of composition | Work based on experience
Melt filter | No facilities
Casting | Control of temperature of cooling water/melt | No system
Rolling | Rolling by machine | No
Automatic control of shape and thickness of rolled plate | No
Finishing | Thickness of products | Yes
Annealing | Control of temperature by program | Yes</td></tr>
</table>

	A	B	C
	Rolling: Rolling by machine Yes; Automatic control of shape and thickness of rolled plate Yes Finishing: Thickness of products Yes Annealing: Control of temperature by program Yes; Injection of atmospheric gas Yes More advanced inspection required for export products.	Automatic control of shape and thickness of rolled plate No Finishing: Thickness of products Yes Annealing: Control of temperature by program Yes; Injection of atmospheric gas No	Injection of atmospheric gas No
Product development	There are no competing companies domestically and products are protected by high import tariffs. There is no need to aggressively take up risk of new product development since sufficient profit margin can be enjoyed with current domestic demand.	In view of level of technology, antiquated facilities, and pressure to meet current domestic demand for utensil use plate, cannot be expected to develop new products.	Since the products are rolled by the manual pull-over system, development of new products would be impossible in terms of quality and precision.
Development of human resources	Guidance from foreign engineers.		

Measures (Aluminium Plate)

	A	B	C
Manufacturing processes and level of technology	1. Acquisition and application of overseas technical information. 2. Technical tieup with foreign companies and guidance by foreign experts for raising level of technology, developing new products, and training engineers.	1. Modernization and automation of facilities and assistance for same. 2. Modernization of slab manufacturing equipment and improvement of technology for same. 3. Improvement of surface treatment technology. 4. Acquisition and application of overseas technical information. 5. Guidance by foreign engineers for implementation of above 2 to 4.	In future, it will become necessary to changeover to coil rolling.
Factory control and quality control	1. Upgrading of types and quality so as to gradually change over from current imports to window blind materials etc. to domestic products. 2. Export to advanced countries requires higher level of inspection in all processes.	1. Introduction of inspection facilities in all processes and inspection using the same. 2. Guidance for the above.	
Product development	1. Expansion of applications from utensils, roofing plate, and foil to electrical equipment parts, vehicular members, and packaging materials and development of new demand by same. 2. Currently there are no domestic competitors and tariff protection is enjoyed, so production is profitable even with current demand. 3. Surplus supply directed for exports.	1. Possible expansion of application from utensils, roofing plate, and foil to electrical equipment parts, vehicular members, and packaging. 2. Positive development of new products and creation of new demand through government guidance.	
Development of human resources	Education and training of engineers	Education and training of engineers.	

Features and Issues (Plate Products (Aluminium Foil))

	B
Manufacturing processes and level of technology	One company 1. Company produces foil using eight used foil rolling machines. 2. Tariff protection is enjoyed, so supply of original foil of over 7 microns thickness is monopolized. 3. Cannot roll foil of less than 7 microns thickness or produce laminate foil. 4. Insufficient deoxidation and dehydrogenation of raw material aluminium coil, so there are problems in purity and precision of aluminium coil. 5. The degree of cleanliness of the melt, the shape during rolling, and the prevention of strain are insufficient due to the rolling machines being used ones. 6. Due to use of cold rolling machines provided with automatic fine control (AFC) units recently introduced, some improvement in these respects can be expected.
Product development	1. Along with the improvement of the quality of the foil, production of foil of less than 7 microns may become possible. 2. Exports of added value products produced through labor intensive processes such as foil trays and gas range mats are possible. 3. If it becomes possible to produce foil with accurate thickness and sufficient flatness, production of foil laminates with paper and vinyl will also become possible.
Development of human resources	1. Guidance and education by overseas engineers.

Measures (Plate Products (Aluminium Foil))

	B
Manufacturing processes and level of technology	1. Necessity of dealing with [1] strain in shape of plate and [2] defects in material, the causes of foil breakage. 2. [1] may be dealt with by use of a system (AFC) for automatic control of the shape during rolling. 3. [2] may be dealt with by cleaning of the melt during casting, removal of roller scratches and slitter defects during rolling, and keeping all processes clean so as to prevent the intrusion of foreign matter. 4. Introduction of technology for production of foil of less than 7 microns thickness.
Product development	1. Production of foil trays, gas range mats, and other foil products. 2. Production of laminates of foil with paper and vinyl.
Development of human resources	Receipt of guidance in development and education of human resources through technical tieups with companies of advanced countries.
Others	Promotion of investment by competing manufacturers so as to prevent problems caused by one company monopoly.

Features and Issues (Plate Products (Utensils))

	A	B	C
Manufacturing processes and level of technology	Two companies 1. Production of cheap products for domestic market and simultaneously production and export of Teflon coated products, alumite products, and other high class utensils. In particular, OEM production for Japanese supermarkets. 2. Various types of presses for utensils and alumite processing facilities or Teflon coating facilities owned. Technical staff available able to operate these in companies. 3. Poor quality of raw material aluminium plate. When used for production of high class products for export, yield is low.	Three companies 1. Two companies use plate manufactured on their own by pull-over system. 2. The presses are old types or else Chinese or Taiwanese makes. 3. The quality of the raw material aluminium plate is poor and alumite finishing is not possible.	Two companies 1. Small amount supplied to local market. 2. Use made of plate made by companies themselves by pull-over system or plate supplied from domestic manufacturers. 3. The quality of the raw material aluminium plate is poor and alumite finishing is not possible.
Factory control and quality control	1. For OEM production for Japanese supermarkets, total inspection is performed for final products so as to try to stabilize quality.	The quality of the raw material plate is poor, so production of high quality products is difficult.	The quality of the raw material plate is poor, so production of high quality products is difficult.
Product development	Production of new products by OEM etc. possible.	Development of new products is difficult considering state of currently owned facilities and technical staff.	Development of new products is difficult considering state of currently owned facilities and technical staff.
Development of human resources	Lack of staff able to develop new products and need for development of human resources able to provide guidance on effective quality control.		

Measures (Plate Products (Utensils))

	A	B	C
Manufacturing processes and level of technology	1. Necessity of use of high quality aluminium plate. 2. Improvement of access to imported plate through reduction of tariffs on imports and improvement of quality through intensification of competition between domestic plate and imports.	Due to rolling by pull-over system, use of old fashioned press machines, the inability to perform surface treatment, etc., "inexpensive and inferior" products are supplied to the domestic market. For the time being, the promotional measures will be aimed at the A rank companies.	Due to rolling by pull-over system, use of old fashioned press machines, the inability to perform surface treatment, etc., "inexpensive and inferior" products are supplied to the domestic market. For the time being, the promotional measures will be aimed at the A rank companies.
Product development	1. Promotion of technical tieups (OEM production etc.) 2. Provision of overseas marketing information. 3. Making use of experience in press work etc. to go beyond utensils and advance into production of parts for electrical machinery and automobiles.		
Development of human resources	Development of manpower able to perform quality and process control through technical tieups with companies in same fields in advanced overseas countries.		

Features and Issues (Plate Products (Roofing Plate))

Manufacturing processes and level of technology	1. Work is simple, involving single roll forming process, so there is no difference in technical level. 2. If precision of thickness and flatness of raw material aluminium coil are insufficient, precise forming becomes impossible. The raw material coil is supplied on a monopolistic basis by a single company. This company is a competing manufacturer also making roofing plate. Therefore, the quality of the raw material coil cannot be expected to be improved. The quality of the raw material coil is one just barely enabling use.
Product development	1. The light weight enables the framework for supporting the roof to be built at low cost. The formability is excellent and the heat reflectivity is good. Further, the appearance is good. Making use of these features of aluminium, aluminium roofing has increased in demand beating out such competing products as colored steelplate, slate, etc. 2. In the field of roll forming, new products may be expected to be developed such as siding materials for walls, stormdoor materials, and other building material products.

Measures (Plate Products (Roofing Plate))

1. Elimination of the monopoly on domestic supply caused by the tariff protection of raw material aluminium coil and creation of a state of competition with imports so as to improve the precision of thickness and flatness of the aluminium coil.
2. Use of high quality aluminium coil as materials and proceeding with development of new products in the field of roll forming such as siding materials for walls, stormdoors, and other building materials.

Features and Issues (Plate Products (Impact Tubes and Cans))

A	B	C
Manufacturing processes and level of technology	One company 1. Vertical production from aluminium metal and sale of some slabs to other manufacturers. 2. Overwhelming share of domestic market. 3. Use of used West German machines and receipt of technical guidance from West German manufacturer whenever needed. 4. Poor quality of slabs. 5. Problems in precision of printing machines, printing plates, and paints.	Four companies 1. Used machines are used and the quality of the material is inferior, so productivity is low. 2. There is considerable trouble at the printing stage. Several workers station themselves around each machine to deal with problems.
Product development	1. In the advanced countries, aluminium toothpaste tubes compete with plastic laminates and aerosol cans compete with tin cans. Demand has been slow to grow. 2. By improving the forging technology, it should be possible to advance into the fields of electrical components (capacitor cases, copy drums), automobile parts, and optical parts.	

Measures (Plate Products (Impact Tubes and Cans))

	B	C
Manufacturing processes and level of technology	Improvement of slab quality. Improvement of finished printing.	Improvement of slab quality. Improvement of finished printing.
Factory control and quality control	Analysis of composition in all melted lots.	Analysis of composition in all melted lots.
Product development	Manufacture of auto parts, optical parts, etc. through improvement of forging technology.	
Development of human resources	Guidance and education by engineers of advanced foreign countries.	

Features and Issues (Die Castings)

	A	B	C
Manufacturing processes and level of technology	Six companies In-house production of foreign affiliated motorcycle and home electrical equipment manufacturers. Introduction of foreign facilities and technology. Guidance received. Corresponding to B class of Japan. 1. Insufficient automation in casting Only one company using melt feeder and spray. Others mostly doing work manually. 2. Dies [1] Die design and fabrication technology is immature and while simple dies can be made, complicated, high class ones cannot and imports are therefore relied on. [2] Insufficient measures taken to increase durability of dies. Insufficient heat treatment and surface treatment of dies. 3. Die casting machine and die maintenance. System of control is insufficient. Strong tendency to deal with problems after they occur. Weak measures to prevent problems in advance. 4. Insufficient measures to prevent porosity defects, i.e., die measures and machine measures. 5. Quality of domestic aluminium alloy is low in reliability and therefore imports are relied on.		One company 1. Lack automation in casting. Completely relies on manual labor. 2. Dies [1] Die design and fabrication technology is immature and while simple dies can be made, complicated, high class ones cannot and imports are therefore relied on. [2] Insufficient measures taken to increase durability of dies. Insufficient heat treatment and surface treatment of dies. [3] Unsuitable maintenance and storage of dies. 3. Die casting machine and die maintenance. Strong tendency to deal with problems after they occur. Weak measures to prevent problems in advance. 4. Insufficient measures to prevent porosity defects, i.e., die measures and machine measures. 5. Quality of domestic aluminum alloy is low in reliability and therefore imports are relied on. 6. Factory layout is bad. Cold chamber machines adjoin facilities and problems occur of intermixture of wrong materials. 7. Unsuitable temperature control For example, no thermometer provided in holding furnace. 8. Rough storage and handling of products In the deburring work, products are laid on the ground and the burrs removed one by one by a tool. Handling marks and scratches are easily caused.

	A	B	C
Factory control and quality control	1. Layouts are generally good. The working environment was orderly and good. 2. The standards used for work is not clear in many cases. 3. Quality control systems have been established, but the actual activities are not very energetic. 4. The flow of products is good.		1. Ageing of machinery. 2. Rough work methods. 3. Unsuitable control of work in progress, with semifinished products piled up on the floor. 4. Insufficient standardization of work, with work varying among workers. 5. Work environment is poor, with organization, orderliness, and cleanliness being ignored.
Product development	1. With the exception of simple shapes, products are designed overseas. 2. Energetic development is not possible due to lack of manpower.		1. Lack of manpower. 2. Insufficient facilities. 3. Difficulty in independent R&D activities. Lack of public organization for supporting same. 4. Difficulty in obtaining technical information.
Development of human resources	1. Lack of middle level engineers. 2. Insufficient use of educational and training organizations		1. Lack of middle level engineers. 2. Lack of consciousness of workers of quality control. 3. Lack of use of educational and training organizations. 4. Insufficient education in principles of "organization, orderliness, and cleanliness"

Measures (Die Castings)

	A	B	C
Manufacturing processes and level of technology	1. Analysis of elements of manual work in each process and replacement of same with automatic equipment able to deal with the same. 2. Examination and establishment of a measurement and control system for the melt temperature, die temperature, flow rate of the cooling water, and adjustment of the temperature. 3. Sufficient acquisition of basics of die design, casting theory, die casting machine performance, etc. sufficiently learned., [1] Product specifications and detailed product design [2] Shrinkage allowance and dimensional precision [3] Dynamic issues and die design [4] Basic design and detailed design of casting plan [5] Design of die cooling plan [6] Die lifetime [7] Behavior of injection apparatus of die casting machine and hydraulic considerations in conditions for charging products. 4. Implementation of heat treatment and surface treatment of dies. 5. Maintenance control of die casting machines and dies to be performed by making a system of checks comprised of daily, weekly, monthly, three monthly, six monthly, and yearly inspection items. 6. Selection from among the methods for prevention of porosity now being developed the method most suitable for Indonesia (vacuum die casting method, reduced pressure die casting method, oxygen atmosphere die casting method, gas free method, local pressured die casting method, high pressure coagulation method, squeeze casting method, etc.)		1. Analysis of elements of manual work in each process and replacement of same with automatic equipment able to deal with the same. 2. Examination and establishment of a measurement and control system for the melt temperature, die temperature, flow rate of the cooling water, and adjustment of the temperature. 3. Sufficient acquisition of basics of die design, casting theory, die casting machine performance, etc. sufficiently learned., [1] Product specifications and detailed product design [2] Shrinkage allowance and dimensional precision [3] Dynamic issues and die design [4] Basic design and detailed design of casting plan [5] Design of die cooling plan [6] Die lifetime [7] Behavior of injection apparatus of die casting machine and hydraulic considerations in conditions for charging products. 4. Implementation of heat treatment and surface treatment of dies. 5. Maintenance control of die casting machines and dies to be performed by making a system of checks comprised of daily, weekly, monthly, three monthly, six monthly, and yearly inspection items. 6. Selection from among the methods for prevention of porosity now being developed the method most suitable for Indonesia (vacuum die casting method, reduced pressure die casting method, oxygen atmosphere die casting method, gas free method, local pressurization die casting method, high pressure coagulation method, squeeze casting method, etc.) 7. Arrangement of cold chamber and hot chamber machines completely separated from each other.

	A	B	C
			8. Introduction of hot charge system where alloys are melted in separate melting furnaces and the melt is supplemented by a holding furnace. 9. Improvement of deburring (work for removing of portions not part of product) and method of storing good products. 10. Storage in die receptacles, washing casted dies, applying rust preventing oil to them for storage, polishing seized portions, correcting dimensions, and repairing problematical portions of function portions (ejector pin, movable core, guide pin, sprue bush, sprue pin, cooling pipe).
Factory control and quality control	1. Raising consciousness of employees as a whole of quality. During work, giving instructions as to quality demanded for the product. 2. Maintenance of machinery and tools. 3. Implementation of inspection of initial castings during mass production. 4. Standardization of work. 5. Livening up of QC activities.		1. Raising consciousness of employees as a whole of quality. During work, giving instructions as to quality demanded for the product. 2. Maintenance of machinery and tools. 3. Implementation of inspection of initial castings during mass production. 4. Replacement of machinery 5. Improvement of work methods 6. Standardization of work. 7. Thorough attention drawn to organization, orderliness, and cleanliness.
Product development	Introducing foreign technology, checking the results of the casting, and using the design plan of the good products as the general rule so as to build up know-how. Basic design of [1] product design, [2] die design, [3] casting plan required as basic knowledge.		1. Introduction of well-rounded facilities. 2. Introduction of technology.
Development of human resources	Periodic education of workers. Education starting from rudimentary, issues relating to organization and orderliness and also alloys, dies, die casting machines, casting, quality, and safety.		Periodic education of workers. Education starting from rudimentary issues relating to organization and orderliness and also alloys, dies, die casting machines, casting, quality, and safety.

Features and Issues (Low Pressure Die Castings)

Two companies
1. Introduction of foreign (German and Japanese) technology and high level of technology.
2. Spare dies are prepared. One company designs and makes dies, while other imports from technical tieup partner.
3. Complete work standards are prepared and production system is fully set up.
4. Main defects are porosity, leaks, and remaining black film.

Measures (Low Pressure Die Castings)

1. Problems resolved by guidance from technical tieup partner and high export ratio.

Fig. 3-6-3: Basic Concepts in Formulating Promotion Measures for Aluminium Product Industry

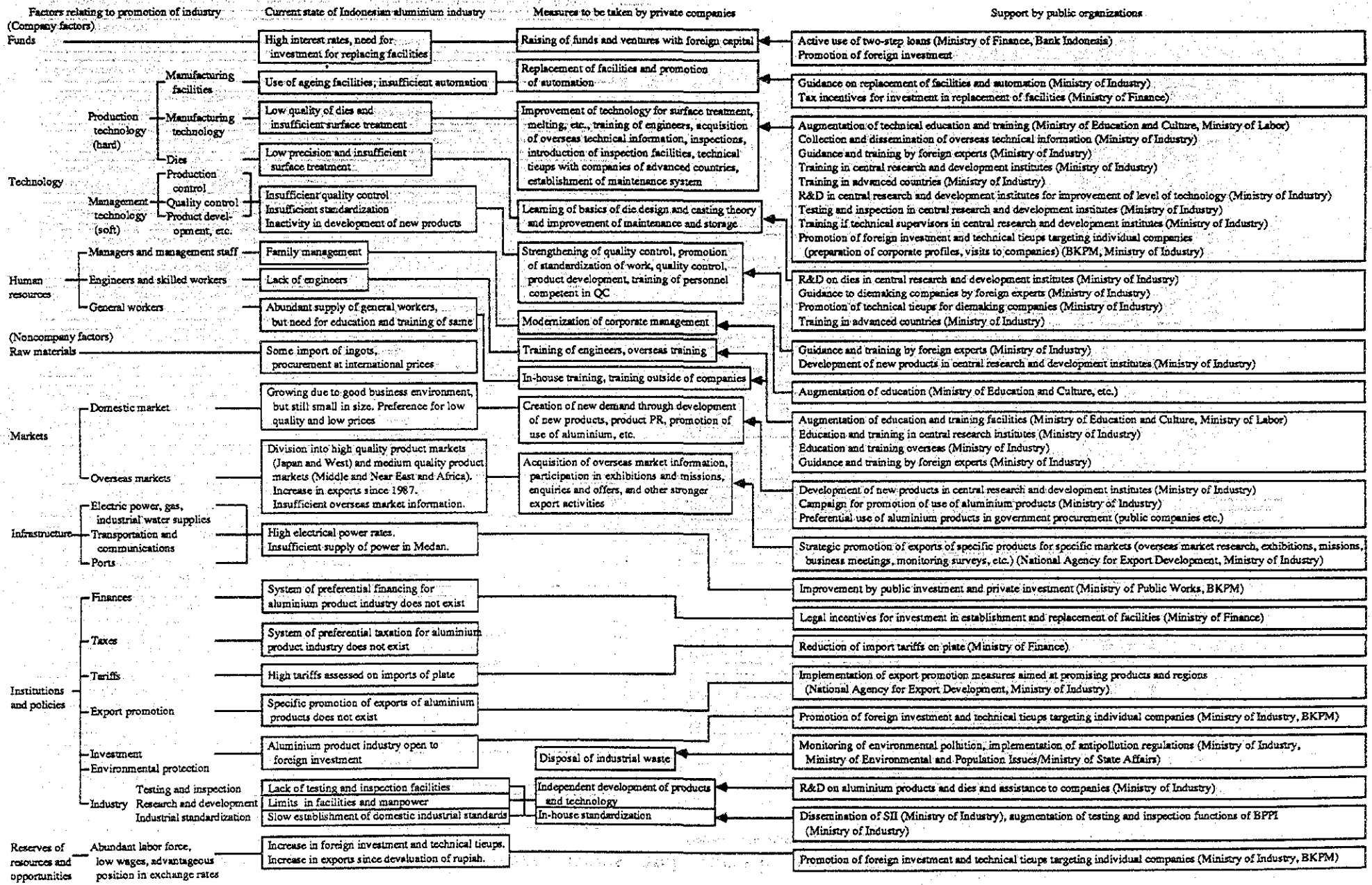
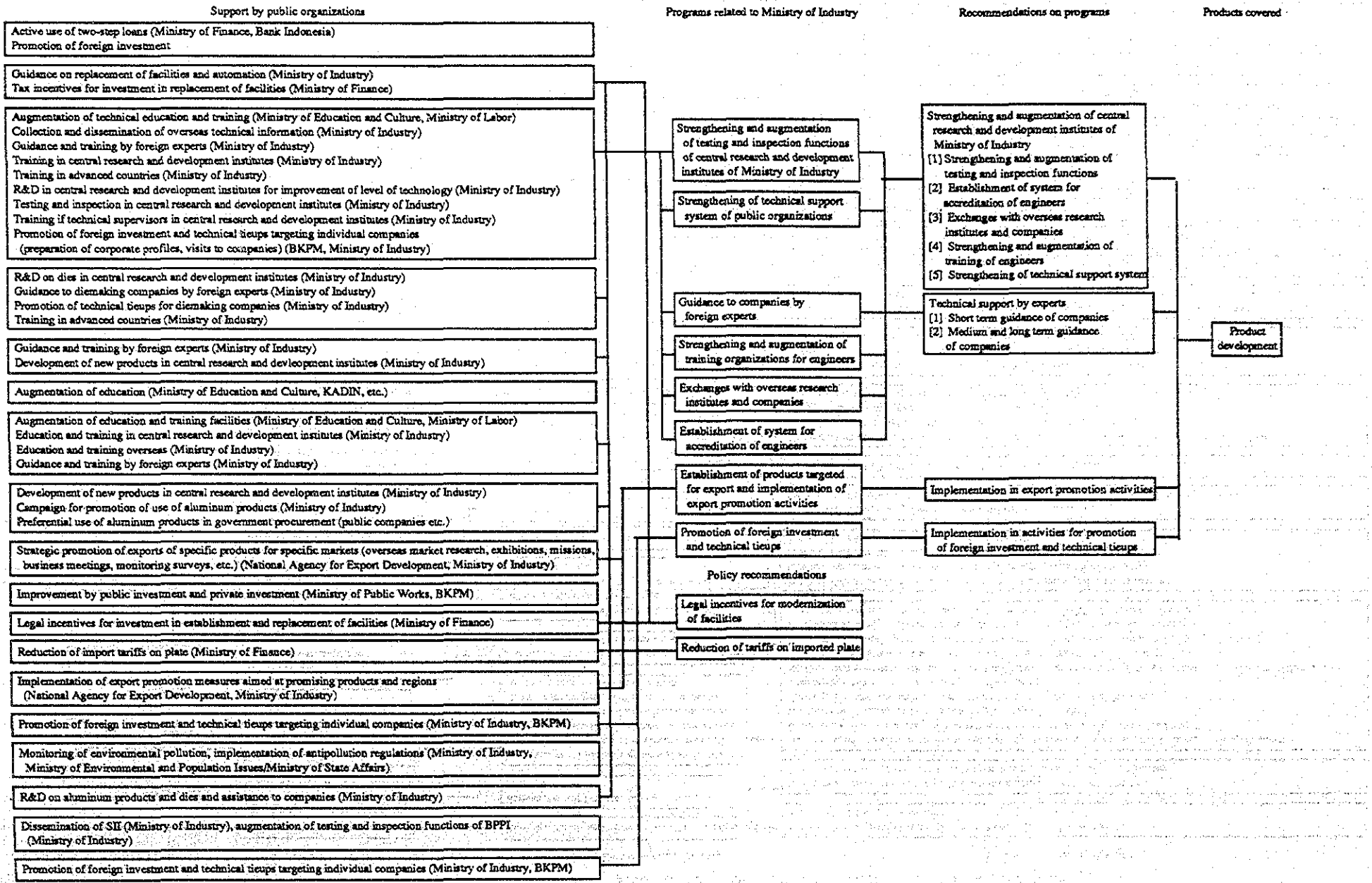


Fig. 3-6-4: Support by Governmental Organizations and Specific Programs



3-6-2 Policy Recommendation

(1) The policy which the government is recommended to include, as mentioned earlier, 1) to establish the business environment enabling private companies to realize exports and 2) to resolve problems common to the Indonesian aluminium industry and difficult to solve by private companies alone.

1) The establishment of the business environment for private companies would entail improvements in institutions and include [1] elimination of obstacles to realization of exports and [2] introduction of incentives for realization of exports.

[1] Elimination of obstacles would include step by step reduction of tariffs on aluminum sheet. It is necessary to provide tariff protection at the initial stage for protecting infant industries, but after a certain period of time, tariff protection might be reevaluated after study of the level of development of the industry. The import duty on aluminum sheet, including the surcharge and value added tax, is 30 percent to 60 percent. The sheet manufactured by sheet making companies protected by tariffs is inferior in quality and therefore difficult to export. Further, the products made using this sheet have no export competitiveness. Therefore, it is recommended to lower the tariff on sheet etc. step by step to make competition with imports possible and thereby induce improvements in quality and enable processing companies to use imports.

[2] Incentives are introduced with the aim of promoting investment by existing companies in renovation or development of facilities, promoting new entries by companies into this field, and promotion of exports. The government is recommended to provide administrative guidance so that private companies take these measures. If there are no incentives, however, it would be difficult for a company to take these measures on its own as they would increase costs. For example, tax incentives applied to investment for modernization of production facilities and introduction of inspection equipments could be suggested.

2) Measures for dealing with commonly seen problems may be organized as follows:

a) Problems related to production
- Antiquated manufacturing facilities
- Insufficient automation
- Insufficient surface treatment
- Unsatisfactory control over maintenance
- Improper factory layout

b) Problems related to alloys
- Poor quality of in-house alloys
- Unreliable quality of local alloys for die casting
- Improper control and stock of alloys

c) Problems relating to dies
- Insufficient knowledge and immature technology for production and design of dies,
- Difficulty in making complicated dies,
- Insufficient heat and surface treatment
- Immature maintenance technology

d) Problems related to quality control
- Insufficient understanding and implementation of quality control
- Few inspection processes or inspections by operators
- Inspection by visual check and intuition

e) Problems related to R&D
- Product development is not undertaken

f) Problems related to standards and inspection and testing
- Slowness in establishing and using industrial standards
- Visual checking and checking by intuition
- Shortage of inspection and testing equipment

g) Problems related to information
- Shortage of technical and product development information
- Shortage of overseas market information

h) Problems related to education and training
- Insufficient systematic education and training of employees
- Shortage of engineers who can design dies, lead QC activities and develop products

i) Others
- High cost and poor quality of local aluminium sheet

These problems should primarily be solved by private companies. The measures recommended, primarily with regard to production technology, are described in 3-6-1 (3) "Viewpoints by Products and Types of Companies". In Indonesia, however, it would be difficult for private companies to solve the problems on their own in reality due to their limited funds, facilities, manpower, experience, etc.

Therefore, resolution of these problems requires some support from outside of these private companies. As support from outside the companies, consideration may be made of support by public organizations of Indonesia and cooperation from private foreign companies. The public organizations of Indonesia are limited in how they can support the aluminium industry and will require cooperation from overseas economic cooperation organizations.

General measures for problems shown above can be organized as follows:

a) Production

Modernization of production facilities is a prerequisite for improvement of the quality of extruded and rolled products. Automation of diecasting machinery is needed for the same purpose. Modernization and automation of manufacturing equipment should be done by private companies at their own initiative and cost. Modernization requires investment. Guidance by the Ministry of Industry to promote modernization is not enough to encourage private companies to embark on investment for modernization. Solutions to the problem include joint ventures and technological tie-ups with foreign companies and the introduction of official incentives such as tax deductions for modernization investment and concessional loans.

For the improvement of surface treatment, it is necessary to improve the quality of the extruded material itself. In addition, the thickness of film should be controlled and composite film treatment is needed. A host of problems including the quality of materials and the precision of dies are to be solved for the improvement of the quality of extruded products. Composite film treatment requires installation of equipment, strict control over the treatment liquid and the liquid temperature. Strict control over thickness necessitates inspection and testing using appropriate equipment. If private companies face difficulties in performing inspection and testing, it should be done with the assistance of

governmental institutions.

Satisfactory maintenance can be performed after determining what should be inspected and how often this should be done. It is desirable that maintenance manuals be prepared. Upgrading of technical levels, stricter control over the production process and education and training of manpower are necessary for the improvement of surface treatment, establishment of a maintenance system and improvement of factory layout.

b) Alloys

The improvement of alloys requires modernization of melting, casting and soaking facilities, analysis of composition and stricter quality control such as control of soaking temperature. Alloys are to be stored carefully to prevent corrosion and dirt.

c) Dies

The basics of design, casting theory and the performance of diecasting machines must be sufficiently studied. As insufficient heat treatment and surface treatment shorten the life spans of dies, heat treatment and surface treatment facilities must be modernized. A system of periodic inspection is to be established for the proper maintenance of dies.

d) Quality control

Defective products are not separated from acceptable ones. The method of handling products and the method of storing good products are rough. This indicates a lack of understanding of the fundamentals of quality control. It is necessary to educate employees on the basics of quality control and to train core personnel to perform quality control. Inspection systems such as statistical control by sampling inspection are to be established. Installation and augmentation of inspection equipment by private companies is desirable, but if this is difficult, the assistance of governmental institutes is required.

e) Problems related to R&D

To exercise R&D activities such as product development and improvement of the production process, training of manpower and support from governmental institutes are needed.

f) Problems related to standards, testing and inspection

Establishment of domestic industrial standards and adherence to them by the industry is necessary. Almost no private companies are fully equipped with testing and inspection facilities. Governmental testing and inspection institutes are generally, but not fully, equipped and many of their facilities are antiquated. It is desirable that the facilities at the governmental testing institutes be augmented and that these institutes undertake testing and inspections for private companies on a commission basis or support private companies through calibration of their testing and inspection facilities.

g) Problems related to information

Local companies face difficulties in obtaining information on technology, product development and overseas markets. It is necessary to improve the functions of governmental organizations to promote the collection of technical and product development information and its dissemination to private companies.

h) Problems related to education and training

With the exception of some PMA companies, almost no companies provide systematic education and training for their engineers, skilled workers and general employees. Well-trained and disciplined manpower are the basis for industrial development. In the medium and long term, improvement of educational and training facilities is desired. In the short term, it would be desirable to hire experts from advanced countries and have them visit companies to provide on-the-job training.

i) Others

There are quality problems with the aluminium sheet supplied exclusively by leading rolling firms to manufacturers of utensils and roofs, but importing aluminium sheet is virtually impossible because of the high import tariff. It is recommended that the import tariff be gradually reduced so that the quality of local aluminium sheet will be improved through competition with imported sheet.

These general measures can be implemented through the following seven measures.

- Strengthening of testing and inspection organizations
- Acquisition of basic technology and skills
- Automation and modernization of facilities
- Strengthening of human resource development
- Augmentation of QC activities
- Augmentation of R&D activities
- Assistance in export activities

Programs considered to be applicable to the downstream aluminium industry in Indonesia follow from these measures. Five programs which are considered appropriate for Indonesia are proposed in 3-6-3. Recommendations for major programs take into consideration the following factors.

- There are existing organizations for implementation
- The programs can be easily implemented
- It is urgent that such measures be implemented
- The programs will have a large effect on the industry

3-6-3 Recommendation on Main Programs

The specific measures mentioned in the previous section are all important for the promotion of the aluminium industry and desirably would be implemented comprehensively. In reality, however, programs are implemented under limitations of funds and manpower and so it is necessary to start with those with the highest priorities. From this viewpoint, it would be desirable to start with programs for which there are existing implementing organizations, which could be easily implemented, which are urgent, and which would have a large effect on the industry. Considering this, the following five programs have been selected:

(1) Program 1: Strengthening and augmentation of research and development institutes of Ministry of Industry
(2) Program 2: Technical assistance by experts (short term and long term)
(3) Program 3: Implementation of export promotion project
(4) Program 4: Implementation of project for promotion of foreign investment and technical tieups
(5) Probram 5: Development of new products

The final goal of these programs is to build up the Indonesian aluminium industry into an export industry. They would give managerial and technical assistance to individual companies and improve the export environment.

Looking at the programs individually, program 1 "strengthening and augmentation of research and development institutes of Ministry of Industry" may be termed a comprehensive program for technology. It aims at strengthening fundamental technical capabilities from a long term perspective and would be comprised of the several specific measures mentioned for technology in the previous section. Program 2 "technical assistance by experts (short term and long term)" would attempt to provide on the spot consultation at factory site and technical guidance by visits to companies by foreign experts hired abroad. This program would further include a short term and long term aspect. By directly instructing private companies, it would aim at a fast effect. On the other hand, program 4 "implementation of project for promotion of foreign investment and technical tieups" would attempt to prepare an environment enabling brisk transfers of advanced technology from overseas companies on the private level and simultaneously could be expected to stimulate the domestic market through the introduction of the principle of competition. The implementation of these technical programs would promote the Indonesian aluminium product industry and establish it as an export industry. This is recommended in program 3 "implementation of export promotion project". Program 5 "development of new products" aims at promotion of product development by private companies with support from public organizations and foreign companies.

It is believed that each of the recommended programs will contribute to the development of the downstream aluminium industry in Indonesia. Table 3-6-2 indicates the products or fields in which the program is expected to have effects. An asteresk "**" means very large effect and a circle "*" means large effect.

Table 3-6-2: Expected Effects of Recommended Programs

	Rolling	Extrusion	Plate Work	Die Casting	Casting
(Program 1)					
[1] Strengthening and augmentation of testing and inspection functions	*	**	*	**	**
[2] Establishment of system for accreditation of technicians	*	*	*	**	*
[3] Exchanges of personnel with overseas research organizations and companies	**	**	*	**	**
[4] Strengthening and augmentation of training function of engineers	**	*	*	**	**
(Program 2)					
[1] Short term guidance to companies	*	*	**	*	**
[2] Medium and long term guidance to companies	**	**	**	**	*
(Program 3) Export Promotion Program	*	**	**	*	*
(Program 4) Cooperation in Promotion of Foreign Investment and Technical Tieups	**	*	**	**	*
(Program 5) Development of New Products	**	**	**	*	*

(1) Program 1: Strengthening and augmentation of research and development institutes of Ministry of Industry

Among the nine research and development institutes under the Research and Development Agency on Industries (BPPI) of the Ministry of Industry, mention may be made of the Institute for Development of Metal and Machinery Industries (IDMMI) and the Institute for Research and Development of Industrial Materials and Technical Products (IRDMTP) which are the institutes providing technical support to the aluminium industry. IDMMI handles research and development of metal machinery and IRDMTP testing and inspection of industrial materials in general. Both institutes maintain the minimum necessary amounts of personnel, facilities, and apparatuses as governmental central research institutes but have little of the latest facilities and use mostly antiquated facilities and equipment. IDMMI has as one goal of its establishment the provision of technical support to private companies, but with the exception of simple casting and heat treatment equipment has almost no facilities relevant to the aluminium industry. Further, it has limited number of staffs familiar with die casting, die, heat treatment, surface treatment, and other technology and therefore is not set up to be able to provide support to the aluminium industry either in terms of manpower or equipment.

The program aims at strengthening and augmenting the research and development institutes which can provide strong technical assistance and provides technical support to private companies for improvement of the quality of their aluminium products and improvement of productivity. The content of the program is as follows:

[1] Strengthening and augmentation of testing and inspection functions

The Research and Development Agency on Industries (BPPI) of the Ministry of Industry surveyed the current facilities of the IDMMI and IRDMTP in 1987 and is choosing equipment which require strengthening or renovation. However, this survey only evaluated the basic facilities and equipment and did not consider the equipment essential for promotion of the aluminium industry. In particular, mention may be made, as facilities which should be strengthened or renovated, of equipment for analysis of the composition of aluminium materials, precision machine tools for making dies, and heat treatment and surface treatment equipment.

Table 3-6-3: Equipment and Facilities To Be Installed at R&D Institutes

Field	Necessary Equipment	Unit
Die-casting facility	- Induction furnace	1
	- Crucible furnace	1
	- Quenching facility	1
	- Electric furnace	1
	- Gas atmosphere furnace	1
	- Salt bath	1
	- Cold chamber die-casting machine	1
	- Hot chamber die-casting machine	1
Surface treatment facility	- Electroplating/Chemical plating facility	1
	- Hull cell tester, Thickness tester, Pinhole tester, etc.	1 each
	- PH meter	1
	- BOD/COD meter	1
	- Deionizer, Demineralizer	1
Precision metal processing facility		
	- CNC milling machine	1
	- Copy milling machine	1
	- CNC lathe	1
	- Boring machine	1
	- Radial drilling machine	1
	- Shaping machine	1
	- Wire electric discharge machine	1
	- Electric discharge machine	1
	- Electrolytic grinding machine	1
Testing apparatus		
	- Metallurgical microscope	2~3
	- Profile projector	1
	- Universal tester	1
	- Charpy impact tester	1
	- Hardness tester: Rockwell, Brinnel, Vickers, etc.	1 each
	- Fatigue tester	1
	- Radiographic testing unit	1
	- Ultrasonic testing unit	1
	- Spectrophotometer	1

[2] Establishment of system for accreditation of technicians

This would attempt to promote technical education, improve the technical expertise of technicians, and improve the remuneration of technicians. The accreditation would be by a national test, for example, which would set one to five classes and set by law minimum wages for each qualification class and which would guarantee accredited technicians priority employment in companies.

[3] Exchanges of personnel with overseas research organizations and companies

Education and training would be given to engineers of Indonesian research and development institutes and private companies by engineers brought over from overseas research organizations and companies. Toward this end, a support system would be established aimed at the hiring of engineers. Further, a scholarship system would be established so that superior students and engineers could study at overseas universities and research organizations to promote acquisition of frontline technology and technical transfers.

[4] Strengthening and augmentation of training function of engineers

The type of engineers which are urgently required in view of the current state of the industry are those who (a) can apply technology introduced from abroad to the domestic industry, (b) can handle independent technical development and product development, and (c) can serve as the key personnel in company-wide quality control systems as medium level engineers. The training given to engineers would mainly consist of production technology, but it would be a combination of theory and practice and would also include training in managerial matters such as cost analysis.

There are still very few diecasting engineers in Indonesia and the fostering of such engineers is urgently required. In education and training on die casting, the technological focus should be placed on design of dies. Casting and practical training will be added if necessary. Because diecasting technology is diverse, training courses should include elementary and advanced courses. It is recommended that engineers from Japan or other industrialized countries where diecasting technology has advanced be invited to lecture.

The training may include curriculums as shown in Table 3-6-4 for an elementary course and in Table 3-6-5 for an advanced course.

Table 3-6-4: Elementary Diecasting Training Program

Program	Hours
Hydrodynamics	9
Diecasting machine and injection ability	4
Casting theory	4
Alloys and hardening	4
Fill path theory	4
Casting system	6
Cavity fill time	4
Case study of fill path theory	4
Design of die casting product	4
Parting line of dies	4
Runner, over flow well, air vent shrinkage allowance	6
Material of dies	3
Heat treatment of dies	3
Hardness design of dies	3
Fixed and movable core	3
Method of taking movable core	3
Ejector system	3
Design of spire plug	3
Cooling method of dies	3
Standardization of dies	3
Total	80

Table 3-6-5: Advanced Diecasting Training Program

Program	Hours
Basic of casting theory	6
Fill path theory of casting	6
Casting system and design of dies	6
Casting system for aluminium diecasting	6
Casting system for zinc die casting	6
Theory of hardening of alloys	6
Diecasting casting theory	6
Casting system of magnesium alloy diecasting	6
Method of quick change of dies	6
Calculation of casting system	6
Total	60

[5] Strengthening of technical assistance system

Comprehensive implementation of the above technical assistance measures is aimed at promotion of the aluminium industry, but assistance would be provided not only to individual companies, but also to the industry as a whole through promotion of unified standards and standardization of products and stimulation of the aluminium industry.

(2) Program 2: Technical assistance by experts

A look at the level of technology of the aluminium industry in Indonesia by product field shows that the overall level is low, although the international level has been reached in some low pressure die casting operations etc. The low technical level of Indonesia is a problem caused by all five elements of production (materials, machines, methods, men, and money), but technology wise the problem lies in the materials, machinery, methods, and the men managing the same. To promote the Indonesian aluminium industry into an export industry, it is necessary to solve the problem by studying these production elements and providing guidance in individual companies.

The program aims at building up the industry so that it is able to produce products suitable for the overseas markets with sufficient international competitiveness in both quality and price. The content of the program would be as follows:

[1] Short term guidance to companies

Medium size manufacturers would be individually visited, their factories studied, and guidance provided on production technology and management. In the implementation of the program, guidance to medium sized local companies would be provided by joint technical teams of the IDMMI and IRDMTP, primarily staff of the Ministry of Industry, plus foreign experts. The guidance provided would be mainly improvement of production technology, but would emphasize not only acquisition of skills, but also product standards, design, quality control, total quality control activities, and other managerial matters. It is recommended that a technical support team comprising an expert on production technology, an expert on aluminium industry technology and a management consultant provide one to two weeks guidance to one company twice or three times a year.

[2] Medium and long term guidance to companies

Particularly superior companies would be given a wide range of technical and managerial guidance continuously over the medium and long term so as to build up leader companies with international competitiveness in quality and price. The fields of technology to which guidance is to be given include production technology and R&D technology. R&D technology is especially important to develop value-added products. It is expected that technology can be transferred from the company to which guidance is given to the whole downstream aluminium industry. In addition to production technology, guidance would be provided in managerial and marketing areas and assistance given to in-house development of human resources. Further, target products with potential competitiveness would be selected and guidance provided until they are sufficiently competitive in the overseas markets in price and nonprice areas. This assistance would be provided with cooperation from experienced experts from economic cooperation organizations.

Because of the limited supply of available human resources in the downstream aluminium industry in Indonesia, it is desirable that experienced experts from overseas technical cooperation organizations join the technical support team. The technical support team should comprise an expert on production technology, an expert on R&D, an expert