

3. Exports

3-1. Exports

(1) Summary

When discussing exports of plastic processed products, it is necessary to separate them into final products and intermediate goods, but trade statistics on intermediate plastic goods are not available. In recent years, however, exports of bicycles, motorcycles, televisions, radios, fans, and other home electric appliances have been increasing. Some plastic processed parts are being used for these and clearly the importance of the plastic industry as a supporting industry is rising.

Exports of end products of plastic have clearly been increasing. In particular, in 1987, exports grew by a large 56.5 percent compared with the previous year. In 1988 too, this trend continued, with exports growing 57.1 percent.

A look at the shares of plastic have clearly been increasing. In particular, in 1987, exports grew by a large 56.5 percent compared with the previous year. In 1988 too, this trend continued, with exports growing 57.1 percent.

By item, the main export products were tableware, kitchenware, and "other containers".

The value of exports of these plastic processed products stood at 2.2 billion bahts in 1987 and 3.5 billion bahts in 1988, but the ratio of the value in the total value of Thailand's exports is less than 1 percent.

In terms of export marketing, there are few businesses which have tried to open up markets on their own. These are products for which export promotion will be necessary in the future. The Ministry of Commerce is setting export targets for plastic products and promoting exports.

(2) Position of Thailand in World Market

Thailand's exports of plastic processed products (household goods) have been higher than its imports since 1980 and this trend seemingly is becoming deeply

entrenched. While Thailand has been gradually rising in its share of the global plastic processed product trade since 1970, its share of that trade stood at only 0.5 percent in 1986, small compared with the 4.8 percent of Hong Kong and the 1.6 percent of Korea.

While small in value, however, a comparison with the rates of export growth of other countries shows that Thailand's export competitiveness is steadily increasing.

3-2. Market Trends

3-2-1. Trends in Use of Plastics

Before going into the state of the main markets, a summary will be given of the state of use of plastics around the world. This is because plastic products are very widely used and it is necessary to develop plastic products meeting the changes in lifestyles and changes in the industrial structure.

Although, there are differences between each country, generally speaking of the total amount of plastic used, the amount used for household goods is less than 10 percent while the amount used for industrial goods is much more.

3-2-2. Trends in Main Markets

A summary will be given here of the state of the markets of Thailand's key export destinations, the U.S. and the U.K., and Japan, which has recently been increasing its imports of Thai household goods.

1) U.S.

[1] Import Trends

In 1987, the U.S. imported US\$3.8 billion worth of plastic household goods, giving it an import penetration of 6.9 percent. While the import penetration of these products is low, the value of imports has been rising, though slightly, in these past three years. The main regions of origin have been Canada and Taiwan. Imports from Taiwan account for 14 percent of all imports in value and 1 percent of the value of sales of plastic household goods in the U.S. Hong Kong and Korea account for 5 percent and 3 percent of imports, respectively. A trend in recent years has been for higher imports from China

than ASEAN, i.e., at 1.3 percent of total import value. Imports from ASEAN account for only 0.9 percent. The position held by products of Thailand, which is only one member of ASEAN, in imports by the U.S. is therefore low.

[2] Market and Distribution

An important point in getting plastic products to penetrate the U.S. market is the price. The large sized retailers of the U.S. face competition over their market shares and are striving to shorten distribution channels as much as possible to obtain cheaper products. This does not mean that they ignore quality, but that they seek products with a proper balance of price and quality. The products of the NIEs have been losing price competitiveness due to rising labor costs etc., giving Thailand and the other ASEAN countries a chance to take their place.

Some 50 percent of household goods were distributed through wholesalers in the U.S. in 1966, but by 1986 87 percent was being sold directly to retailers. Among the retailers, the discount stores, supermarkets, and chain stores account for the largest shares. Successful plastic product manufacturers are establishing ties with these distribution channels.

Exports of plastic products are influenced by the market trend of household goods as a whole. This in turn is influenced by several factors including the purchasing power of various age groups, the increase in two-income families, and changes in lifestyles. New products are required meeting these changes.

An effective means for coping with this market trend is participation in famous household good fairs. Sales of plastic household goods are expected to grow by 2.7 percent a year until 1992.

[3] Evaluation of Market for Thai Products

The volume of imports of Thai products is relatively small, so importers, merchandisers, and other distributors have a low level of knowledge about Thai plastic products.

Therefore, the interest of U.S. plastic processing manufacturers, retailers, importers, wholesalers, etc. in Thai plastic products must be stimulated.

2) U.K.

[1] Import Trends

The market for plastic household goods in the U.K. is characterized by the lowest degree of import penetration. This is because domestic businesses have strong services, product lines, and sales forces and, further, the added value of plastic products themselves is low, so after high transport costs, imports do not pay. What imports there are mainly come from West Germany, the Netherlands, France, and other European countries. Total imports of kitchenware, containers, bottles, etc. in 1988 came to 150 million pounds, of which Thai products accounted for 1.6 percent. Imports from Thailand are small when judging from overall imports of the U.K., but tripled in 1988 compared with the previous year and has been increasing for two years.

[2] Market and Distribution

The market for plastic products is highly price competitive, as in the U.S., and the competition is forcing large discounts in the distribution sector. Further, the market for plastic products is mainly occupied by domestic manufacturers. Imports play only a small role in the market.

The main distribution channels in the U.K. for plastic products are the supermarkets, DIY, hardware stores, haberdasheries, wholesalers, and mail orders. Imports from Asia have to go through importers having connections with these distribution channels.

In general, U.K. businesses consider imports from the Asian region too expensive due to the transport costs. According to the importers, even if products were sold directly to the retailers, the FOB prices would have to be 30 percent lower than domestic products.

Imported plastic products which have succeeded in the U.K. market have been mostly novelties with low transport costs. This shows the direction which Thailand should take in developing the U.K. market in the future. The U.K. market is characterized by development of products with balanced price and quality and further with design changes based on color. Regarding color, it is necessary to select colors

suited to the lifestyle of the British. The colors themselves used tend to be limited by individual national characteristics.

[3] Evaluation of Market for Thai Products

In the U.K., Thailand is known as a supplier of plastic products, but the products from Thailand are considered to be small bulk items. Higher added value products are not known.

Importable Thai products would be novelties with little transport costs, kitchenware consisting of combinations with metal, etc.

3) Japan

[1] State of Imports

Japan's imports of household goods and other plastic products reached US\$872 million in 1988 and US\$983 million in 1989. The main countries of origin were the U.S., Taiwan, and Korea. These three areas accounted for approximately 70 percent of all imports. Imports from Thailand constituted only a 1.7 percent share in 1988 and 3.2 percent share in 1989. The share, however, is increasing as a general trend.

The majority of the imports of plastic products by Japan are industrial use products. Household goods, tableware, and kitchenware account for only 8 percent or so of the imports of plastic products.

Imports from Thailand are mostly of household goods and tableware/kitchenware. A breakdown shows the former accounting for US\$7.57 million in 1988 (19.3 percent of the imports by Japan, second place after Taiwan) and US\$9.59 million in 1989 (21.4 percent, second place after the U.S.) and the latter accounting for US\$6.99 million in 1988 (22.7 percent, first place) and US\$7.81 million in 1989 (22.2 percent, second place). Thailand is therefore a major supplier of such products.

A feature of Thai products is the import of inexpensive items compared with the imports from the U.S. etc.

[2] Market and Distribution

Plastic household products come in a vast variety of types and differ according to the purpose of use. The quality demanded also differs.

When Japanese consumers purchase household products commonly used in Japan, they stressed ease of use.

The priority of course differs according to the product. Consumers stress durability for trash containers, planters, and the like, good color and pattern for dishes etc., and sanitariness for chopping boards, lunch boxes, etc. This shows that measures tailored to the individual product are required when developing or selling products.

The complaints Japanese consumers have about plastic products for daily use are the ease by which they become dirty, the ease by which they break, and the insufficient weight and thickness.

A feature of the distribution of plastic household goods in Japan is the use, in almost all cases, of wholesalers between manufacturers and retailers, supermarkets, and department stores.

[3] Evaluation of Market for Thai Products

In the Japanese market, there has been remarkable growth seen in imports of tableware and kitchenware from Thailand, but there is no established evaluation of these products. The market for plastic products differs from that for textile products etc. in that the domestic companies are not particularly wary of any increase in imports. Therefore, Thailand could increase its exports in the future depending on the products it develops.

3-3. Current State in Competing Countries

Exporting regions competing with Thailand in plastic products would be Hong Kong, Taiwan, Korea, etc. In this section, a look will be taken at Hong Kong and Korea.

3-3-1. Hong Kong

The U.S. has been a main market for Hong Kong plastic products since the 1950s. Hong Kong increased exports to that country from 140 million HK dollars in 1960 to 6,244 million HK dollars in 1987. In 1988, however, exports fell to 4,599 million HK dollars. The share of the U.S. in its total exports, which was 50.7 percent in 1985, fell to 38.8 percent in 1988. The decline in the share of the U.S. in recent years has been a major feature of Hong Kong's exports.

The main export items are plastic toys and dolls and decorations, which are outside of the scope of the present survey. Exports of household goods are only about one-sixth of those of toys and dolls. Hong Kong's exports of plastic products are shifting from those of simple molded plastic products to higher added value products using plastics. Hong Kong's industries as a whole are developing as centers of design and packaging and at the same time are shifting low added value, labor intensive production to China. The same trend is visible in the plastic industry.

The main means used to increase exports have been slashing production costs, creation of new products, improvement of product design and quality, and close contacts with buyers.

Hong Kong plastic products are generally introduced not only by way of publicity and letter, but also by trade fairs. The TDC trade magazine is highly evaluated as a means for introducing products overseas. Market and other information is obtained from exporters, sales agents, trade related documents, trips overseas, etc.

There are four private organizations relevant to plastic. These organizations engage in activities in cooperation with the Federation of Hong Kong Industries (FHKI). Under the assistance of the FHKI, the Hong Kong Plastic Council was established. Its purpose is to advise the government on matters pertaining to the plastic industry and to suggest means of resolution of problems. In the past, the Hong Kong government actively intervened in the economic activities of the private sector, but it is now providing positive support to the plastic industry through the establishment, in cooperation with the private sector, of a technical center, in the Hong Kong Polytechnic, for providing information on plastic technology etc.

3-3-2. Korea

The value of exports of Korean plastic products increased from US\$950 million in 1986 to US\$1,730 million in 1987 and US\$2,370 million in 1988. Exports in 1989 probably grew only 5 to 6 percent due to the appreciation of the won, the soaring prices of raw materials, and the slackening of overseas demand.

Overseas markets are being developed aggressively by the large corporations by dispatch of salesmen overseas, invitations to foreign buyers and mass merchandisers, dispatch of samples overseas, invitations to buyers to attend domestic exhibitions etc., while small and medium sized enterprises most often contact general trading companies or large sized manufacturers to obtain orders for production. They sometimes also use the guidebooks of the Korean Trade Agency (KOTRA).

As an organization of plastic processing manufacturers, there is the Korean Plastic Industry Cooperative Association, which boasted 704 members as of 1989. Its activities include the provision of technical information, the promotion of technical guidance programs, the promotion of exports, and the promotion of the establishment of industrial estates for the plastic sector. The industry is pressing forward with plans for construction of a technical training center for resolution of the shortage of expert technical staff. It is scheduled to prepare its basic plans in 1990 and complete the project within two years. This organization also provides suggestions to the government on the tax system, financing, etc. and also participates in overseas trade fairs, participates in seminars relating to the industry, introduces business partners, etc. It deliberates when necessary with government organizations (Small and Medium Enterprise Promotion Corporation) for technical guidance and introductions.

At the present time, the problem being faced by the Korean plastic industry is the dissipation of its export price competitiveness due to soaring domestic wages. One leading company is taking the step of establishing joint venture in Southeast Asia to deal with this.

3-4. Export Targets

The Thai Ministry of Commerce establishes targets every year for exports of Thai plastic products.

The target for exports of plastic products in 1990 is as follows:

Since the value of exports in 1989 is estimated at 4.8 billion bahts, a target of 6.0 billion bahts has been set for exports in 1990. This anticipates a growth of 25 percent over the previous year.

3-5. Problems and Countermeasures

(1) In exporting plastic products, it is necessary to give separate consideration to parts and household goods.

(2) Regarding parts, the question is whether there has been complete import substitution in the domestic market. Production of parts depends largely on the procurement plans of companies manufacturing end products. In many cases, parts manufacturers are able to sell parts because of close ties with such companies. It would be nearly impossible for an independent parts manufacturer in Thailand to suddenly walk into a manufacturer of final products and make a sale.

Planned measures are required to increase such ties. This would require increasing the reliability of Thailand's plastic processing technology. First, it would therefore be necessary to prepare plans for the level of technical competence.

(3) In exporting household goods, there are two types of commodities: those where the price factor comes first and those where nonprice factors take priority. When exporting plastic products, the products are generally low in added value and the transport costs account for a large percentage of the sales price, so the regions where they are price competitive are limited. In developing markets, it is therefore necessary to take a regional strategy differentiating between Europe, the U.S., the Middle and Near East, the ASEAN countries near to Thailand, and East Asia, including Japan. Therefore, information regarding the market trends in each of these regions would have to be collected. This would be impossible for individual companies to do on their own. An industrial organization and the Ministry of Commerce's DEP would have to collect the information.

Regarding products where the nonprice factors are predominant, while much depends on the product design capabilities of the individual companies, it is necessary to produce export products matching the lifestyles in the export destinations. In that sense, Thai companies should participate in the major global trade fairs on daily use items and

make use of the same as opportunities for development of new products. To increase the frequency of participation, consideration may be given to joint participation by the plastic industry association.

Development of new plastic products includes not only mechanical development, but creation of new products along with the appearance of new plastics. For example, there are the plastic products usable in microwave ovens. This type of product development cannot be handled by individual companies alone.

Research in such plastics and their use in new products should be handled by a public organization. Where this type of research is impossible, further, the public organization must shoulder the task of collecting and disseminating this type of information.

(4) According to reports from different areas, Thailand is not recognized as a supplier of plastic products. When participating in trade fairs, it is necessary therefore to positively participate in conferences etc. and to push the image of Thailand's plastic industry.

For such activities, it would be necessary for joint participation of the Ministry of Industry etc. in trade fair activities previously handled only by the Ministry of Commerce.

(5) In exports, research on the distribution systems of the different countries is necessary. Their distribution systems are based on historical factors and therefore differ considerably by country. Development of export routes in line with the distribution situation in the different countries is necessary. Dissemination of such information is also considered a proper activity of an export promotion organization.

(6) The plastic industries of Hong Kong and Korea are now trying to shift from household goods etc. to more higher added value products. Plastic products are diverse in type, even already developed ones, and diverse in the required technology as well. To deal with this, Hong Kong industrial organizations have established a technical information center. These activities of Thailand's competitors would be of reference to the Thai plastic industry.

(7) In the export of plastic product, note must be taken of one trend. The import dependence of plastic products used for household goods, as seen from the market

situation in the U.S. and the U.K., is extremely low. The share in imports of manufactured goods is at its highest 0.9 percent in the U.K. and a small 0.1 percent in Japan. For this reason, it is very necessary that the markets supply household goods that meet the needs of export markets.

Note: Information on key markets and the current state of competition from other countries contained in this chapter is based on the Survey of the Market and Survey of Competing Countries by JICA.

4. Production Activities and Technology

In the plastic processing industry, the type of company differs tremendously depending on the type of product manufactured. This is because the fields in which plastics are used are extremely diverse, so not only the quality and performance demanded of plastic processed products, but also the business practices of the industries to which those processed products belong differ.

4A. Plastic Industrial Parts

A classification by type of company of the 12 manufacturers of plastic industrial parts surveyed gives Table III-4A-1. That is, it is possible to divide them into Group I companies which are manufacturers specializing in plastic parts and produce genuine parts, Group II companies which primarily engage in metalworking but also produce genuine plastic parts, Group III companies which are comprehensive plastic processing manufacturers which produce plastic processed products other than parts as well, and Group IV companies which are manufacturers of nongenuine plastic parts.

Table III-4A-1. Classification of Manufacturers of Plastic Industrial Parts

Types of parts	Manufacturers of industrial parts		General plastic processing manufacturers
	Specialized plastic processing	Primarily metal working, some plastics	
Genuine parts	(Group I) 6 companies	(Group II) 2 companies	(Group III) 3 companies
Nongenuine parts	(Group IV) 1 company	—	—

4A-1. Planning and Development of Products

(1) Planning and Development System

Plastic industrial parts may be roughly classified into parts for home electric appliances, electronic equipment, motorcycles, and automobiles. The planning and development of these parts are all handled by the assembly manufacturers. Processing manufacturers, except those in Group II, do not participate in these activities. Even in the

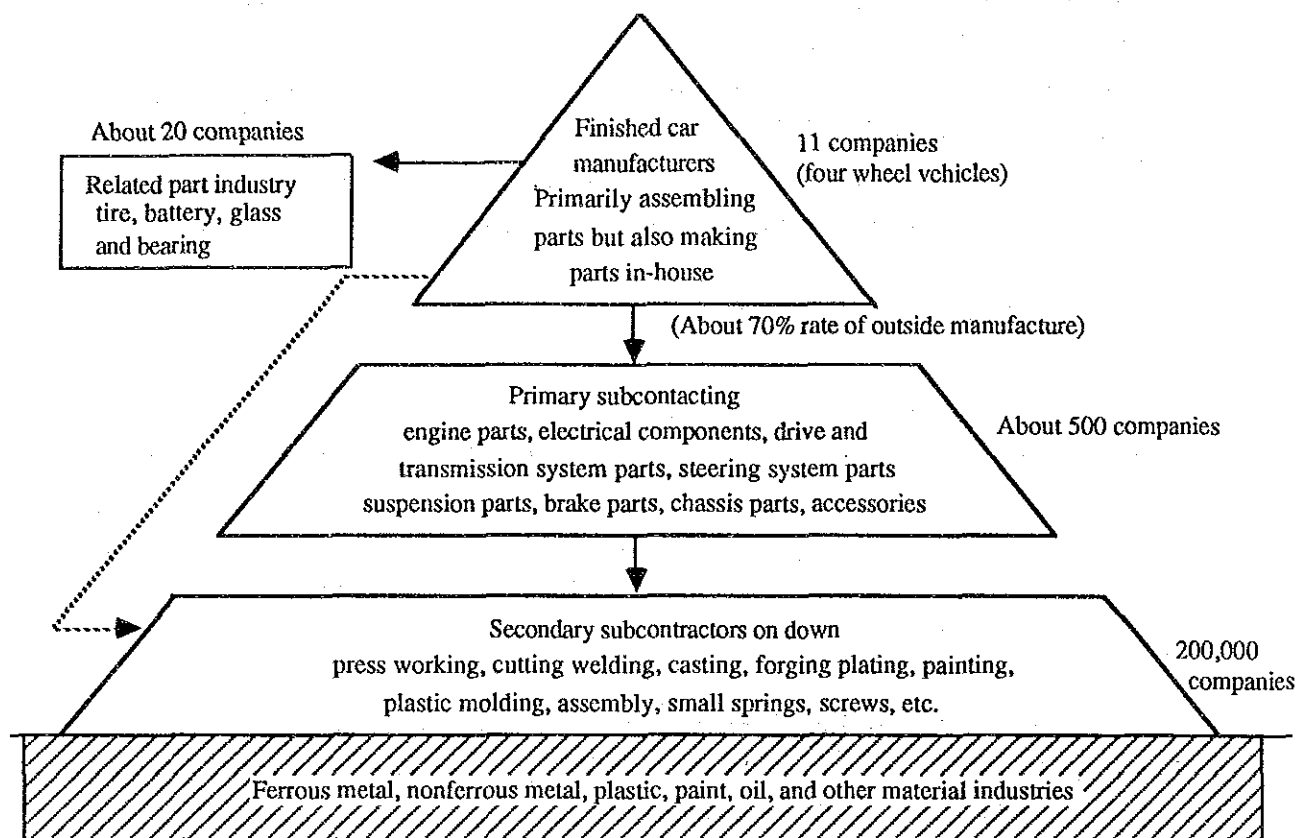
assembly manufacturers, companies which produce with the aim of exporting their total production have all of the product planning and development handled by the parent companies of the joint ventures. Other companies consider the Thai domestic market as primary and exports as secondary, so primarily the local assembly manufacturers plan new products to fit the Thai market. However, in this case too, the overseas parent companies set the materials under the plans, design the molds (including joint manufacturing), and handle other technical development.

(2) State of Planning and Development

Parts manufacturers have little desire of their own to participate in the planning and development activities of the assembly manufacturers or to develop products or production technology together with the assembly manufacturers or material manufacturers and in fact do not feel any need for the same. The two companies belong to Group II, however, have their own brand of products and engage in independent planning and development.

As opposed to this, Japanese manufacturers, which face fierce competition, engage in routine contacts with assembly manufacturer and continue to strive to obtain information on new products even a little ahead of other companies in order to maintain superiority in parts development and securing of orders. Behind this, as shown in Fig. III-4A-1, is the fact that while there are 11 automobile assembly manufacturers, there are 200,000 metal, plastic, and other parts manufacturers. On the other hand, in Thailand, there are 12 automobile assembly manufacturers and only 10 or so plastic processing manufacturers having the ability to supply parts. These 10 companies, further, receive orders not only for auto parts, but also for parts for motorcycles and household electrical appliances, which differ in quality demands.

Fig. III-4A-1. Structure of Auto Part Industry of Japan



Source: *Jidosha Zairyo no Shintenkai* (New Developments in Automobile Materials), Toray Research Center

(3) Future Trends

At the present time, assembly manufacturers of household electrical appliances and electronic equipment order 80 to 90 percent of their plastic parts from outside plastic processing manufacturers and make the remaining 10 to 20 percent in-house. The assembly manufacturers, however, are dissatisfied with the quality of parts ordered out, with two of three assembly manufacturers indicating an intention of raising their rates of in-house production in the future.

As for motorcycle parts, 100 percent of the parts are ordered out. About 70 percent of the molds, however, are imported from Japan. The plastic materials are also

either supplied or designated as to the grade. On the other hand, the Thai market is relatively large and local assembly manufacturers are pressing forward with development of models and designs fitting the Thai market.

Turning to automobiles, while there are differences according to the assembly manufacturers, 70 to 90 percent of the plastic parts are imported. The parts produced locally are small in size and do not require sophisticated technology, such as battery trays, wheel caps, side moles, etc. Automobile assembly manufacturers are working to raise the rate of local procurement of plastic parts, but this would necessitate as a precondition a major improvement in economic policies and technical expertise.

4A-2. Production

(1) Molding Methods

The main molding method used for industrial parts is injection molding. Thermoforming (vacuum and compression molding) is also used for large, relatively simple design parts such as inner housings of refrigerators and blow molding is used in cases of large parts and bottle shaped parts.

(2) State of Facilities

1) Molding Machines

As shown in Table III-4A-2, assembly manufacturers of household electrical appliances and electronic equipment have a certain number of molding machines and are moving in the future toward greater in-house production.

On the other hand, assembly manufacturers of motorcycles and automobiles do not have plastic molding machines in-house. Instead, they supply outside processing manufacturers with molds, materials or designate grades of materials, and provide detailed assistance in mold maintenance etc.

Table III-4A-2. State of Stock of Molding Machines of Assembly Manufacturers

(Unit: units)

Industry	Co.	Molding machines			Molds (including supplied units)
		Injection	Vacuum	Etc.	
Home electric appliances and electronics	A	—	—	—	Japanese, some Korean
	B	3 +3 (added)	2	—	Japanese (80%) Thai (20%)
	C	8	3	Foam	Japanese (35%) Taiwanese (35%) Thai (30%)
Motorcycles	D	—	—	—	Japanese (80%) Thai (20%)
	E	—	—	—	Japanese (50%) Thai (50%)
Automobiles	F	—	—	—	—
	G	—	—	—	Japanese (80%) Thai (20%)

Note: Size of injection molding machines (clamping force)

Co. B 280T, 350T, 650T (same size set being added) / Co. C 100T, 300 to 650T

Table III-4A-3. State of Stock of Processing Facilities of Industrial Part Processing manufacturers

Industry	Co.	No. of employee	Processing facilities (units)		Molds
			Injection molding machines	Other equipment	
Home electric appliances	A	300	10 (100-850T)	Silk screens 12 Surface treatment equipment	Customer 100%
	B	80	13 (1.5-5.0 OZ)	—	Own 70% Customer 30%
	C	40	6 (100-550T)	Hot stamping Silk screens Roll printing	Customer 100%
Home electric appliances & motorcycles	D	620	52 (22-1,300T)	Silk screens Spray booths	Own 80% Customer 20%
	E	206	15 (55-450T)	Silk screens	Customer 100%
	F	350	50 (22-850T)	Blow molding machines 4 Silk screens	Own 100% (of which, 95% made in-house)
Automobiles, motorcycles & home electric appliances	G	390	10 (60-350T)	Ultrasonic welding machines Vacuum deposition machines	Own 100%
	H	200	13 (20-850T)	Silk screens Metal plating	Own 70% Customer 30%
	I	573	23 (60-1,200T)	Silk screens	Own 90% Customer 10%
	J	2,000	81 (30-1,400T)	Compression molding machines 121	Own 95% Customer 5%
Automobiles & motorcycles	K	791	—	Vacuum molding machines 2	Own 100%
	L	120	10 (0.5-22 OZ)	Silk screens	Own 100%

Note: Figures in parentheses indicate clamping force of injection molding machines.

With the exception of Company B and Company K shown in Table III-4A-3, the parts processing manufacturers are equipped with large numbers of general use injection molding machines of sizes from 20 tons to 1,400 tons clamping force. The most prevalent models are in the 300 to 800 ton class. Eighty percent of the injection molding machines are made in Japan and most of the rest are made in Singapore and Taiwan, but two or three West German and Australian makes were also seen. Company C and D have been introducing updated machines which enable automatic extraction of molded products by robots.

2) Peripheral Equipment

Various types of peripheral equipment are required for full use of the performance of the main molding machines. Dryers were installed in factories using water absorbent materials such as nylon, but also no mold temperature control facilities were installed. Despite the molding machines having the latest, high performance models, insufficient investment in peripherals was seen as resulting in an increased occurrence of flashes and numerous other matters reducing the quality of the products.

Some sort of secondary processing facilities such as surface finishing or welding were present in almost all companies. All companies were equipped with crushers and extruders for recycling of scraps.

Almost none of the companies had the equipment necessary for blending materials, however. Only several companies had tumbler type blenders for mixing color master batches.

3) Testing and Inspection Facilities

There were almost no facilities for testing incoming materials. Products being shipped out were inspected by calipers, micrometers, etc. for inspecting the dimensions in almost all manufacturers. Twenty to 30 percent of the companies performed sampling inspections of the weight of the products. Visual inspections were performed for the external appearance and color. Therefore, in general, the companies are equipped with extremely rudimentary inspection equipment. Nowhere was there seen facilities for testing product performance or various material tests.

4) Molds

The assembly manufacturers ordinarily import 70 to 80 percent of their molds and supply them to the processing manufacturers. The remaining molds are fabricated in Thailand based on drawing obtained from the overseas parent companies and are supplied to the processing manufacturers or used in-house. The large sized, local capital manufacturers generally have in-house mold fabrication divisions and a high rate of in-house fabrication, with them even handling some outside orders. The molds fabricated in Thailand, however, are limited to ones for relatively simply shaped parts. The molds required for producing larger sized parts or parts with greater precisions cannot be fabricated due to technical limitations. Further, even the molds which can be fabricated, when more sophisticated, are higher in fabrication cost and require longer delivery times compared with those from Korea, Taiwan, or Japan.

(3) Production Control

1) *Summary of Production System*

With the exception of the three Companies G, K, and L shown in Table III-4A-3, all the industrial part processing manufacturers produce based on received orders. Some processing manufacturers, however, print production numbers or molds with logo marks on each part for the purpose of quality control.

Molds are usually supplied from the customers, but in the case of domestic fabrication, there is the problem of longer fabrication times compared with imported molds. Regarding the plastic materials, general use grades of LDPE, HDPE, PS, and PVC are produced domestically, but these are often not suited for industrial parts. In particular, special compounds etc. cannot be procured domestically. In the final analysis, almost all raw materials for industrial parts are imported at the present time.

2) Production Control

In Thailand, there are fewer industrial parts manufacturers with the ability to supply assembly manufacturers than there are assembly manufacturers, so the processing manufacturers engage in small run production of diverse items. Therefore, productivity differs tremendously depending on the level of the production control.

Production control includes production planning, materials control, process control, quality control, inventory control, and maintenance and repair of facilities. While there was a considerable difference among the parts processing manufacturers visited, some relatively good companies were also seen.

Looking at the materials purchased, much of it was raw materials, adjuvants, and parts required for part assembly. If one were to add up all the required materials for the part, the total would easily come to several thousand to 10 thousand or more items. Some companies were seen which organized these neatly and engaged in sufficient inventory control. In terms of process control, many companies were managing data on the rate of materials loss, the rate of defective products, labor productivity per group, etc. Two companies were recording personal productivity of workers. Quality control was being performed mostly by inspection. About 70 percent of the manufacturers had staff specializing in inspection work.

3) Materials Procurement

Procurement of the main materials, plastic resin, is not that big a problem, but since the companies rely on imports, the delivery periods and prices are unstable. There are domestic stock points of dyes and adjuvants other than the main materials and the processing manufacturers do not import them directly, so there are no particular problems there.

4) Manufacturing Costs

The materials costs represent a major share of the total manufacturing costs of industrial parts. While there are differences according to the processing manufacturers, these account for about 55 to 65 percent of total costs. In the case of use of high priced engineering plastics, generally most of the products are extremely small in size, so the mold cost and personnel cost are relatively greater and the cost of the materials in the product cost becomes small, falling to as low as 30 to 40 percent.

4A-3. Product Evaluation

The main aspects of products evaluated in the factory inspections were the product outer appearance (scratches, color, flow marks, weld marks, striping, scorches, etc.), product dimensions, printing, plating, etc.

Looking at the external appearance of the products, flashes are removed by hand work, so the edges of almost all products show traces of cutting. By way of note, in Japan, the molding is performed in a way so that no flashes are produced. Further, gate marks are kept from being noticeable by using the pin gate or tunnel gate method and also by taking great pains in the placement of the gates. Flow marks and weld marks are particularly easily observed in products with dark colors. Audio equipment and the like are usually colored black and for this reason alone the mold structures become complicated. In addition, processing manufacturers take great care in the molding conditions relating to the fluid characteristics of the resins. In Thailand, there are numerous problems in these respects and satisfactory quality is not achieved except in the foreign capital affiliated manufacturers.

Product dimensions which are important in the shipment inspections were not posing any substantial problem. There are, on the other hand, numerous problems in the printing, plating, and other surface decorative techniques, resulting in products which would not be readily accepted in the international market. Therefore, the assembly manufacturers must order external parts of export products requiring printing or plating from specialized foreign capital affiliated processing manufacturers.

4A-4. Technology

(1) Technical Know-how and Level of Same

1) Molding Materials

Processing manufacturers do not receive sufficient know-how from the assembly manufacturers on the performance and functions required for plastic parts, so do not give consideration to the same in the selection of materials for the parts. Basically, the processing manufacturers must have the know-how and ability enabling them to participate in development of materials, but in Thailand even the large processing manufacturers have a low level of understanding of molding materials. In other words, they mold parts using the supplied materials and supplied molds under the designated conditions. They were not seen as trying to understand the relationship between product quality and molding materials or to truly absorb the technology when engaging in production.

2) Design of Molded Articles

The processing manufacturers do not design the industrial parts and do not have the ability to do so. Even the local affiliates of assembly manufacturers may engage in considerable planning of products to meet market needs, but there are no companies with sufficient design capabilities and specific designs are handled by the parent companies in Japan etc.

3) Molds

The main technical problems in molds are [1] design, [2] fabrication, and [3] operability, economy, and product quality from the processing manufacturer's standpoint.

The biggest problem in the molded articles is their large number of flashes. There are various causes for flashes, but one may first of all point to the low precision of the molds. Next, the volume of the sprue runners is somewhat large and therefore the amount of recycled material increases. Some further ingenuity is required in the position and size of the gates. Further, it is necessary to sufficiently understand the shrinkage ratio, fluid characteristics, heat degradation, and other characteristics of the molding materials and incorporate the same in the mold designs.

4) Molding Conditions

Among the molding conditions, the molding cycle time most affects the productivity. It is important to shorten the molding cycle time as much as possible while maintaining the quality. In Thailand, the molding cycles are much longer than in Japan. To shorten the molding cycles, it is necessary to optimize the overall molding conditions such as the state of kneading of the plastic resin, the cooling conditions of the molds, fine temperature control for specific locations, and the position and number of knock pins required for removal of the products.

The rate of defective products in the companies is an average 5 to 10 percent at present. This is extremely high when compared with the less than 1 percent rate of Japan. The main reason for the high rate is the lack of progress in optimization of molding conditions, though there are other reasons as well.

5) Secondary Processing

Secondary processing for molded articles includes printing, painting, plating, adhesion, welding, etc. Among the processing manufacturers visited, about 80 percent were equipped with silk screens and spray booths, but the processing technology has not reached a level acceptable on the international market. In particular, there are problems in the printing of household electrical appliances and electronic equipment, such as the weakness of the print fastness, peeling, and off-centering. The reasons for the weakness of the print fastness and the peeling are the overuse of silicone agents for product removal in the molds and the incomplete surface treatment of the print foundation.

Motorcycle parts and helmets are painted by processing manufacturers under the guidance of the assembly manufacturers and the quality of the work is of a satisfactory level. However, much greater improvement is required in the work environment and the wastewater treatment, including treatment of use plating solutions.

(2) Technical Training

1) In-House Education

The in-house education given to general workers is primarily on-the-job training. Some companies offer technical staff (graduates of vocational schools etc.) overseas training or training in domestic educational organizations.

2) Education by Industrial Organizations

As an education and training organization set up by an industrial organization, there is the Thai Petrochemical Industry and Trade Association, but the content of the training offered is the extremely rudimentary handling of molding machines.

3) Education by Public Organizations and Educational Organizations

The vocational schools and junior colleges have recently made progress in the establishment of course and educational facilities for plastic processing, however, the emphasis in all cases is on mold making technology. The educational system and curriculum on the most basic aspect, plastic resins, are extremely rudimentary and almost all textbook study.

There are plans for incorporation of a training course for plastic processing technology in the Eastern Industrial Promotion Center, for which plans are proceeding as part of the regional promotion program of the DIP. These plans, however, also seemingly stress handling of molding machines. Almost no consideration is given at the present to training engineers in analysis and testing of materials.

4B. Plastic Household Goods

4B-1. Planning and Development of Products

Of the 13 companies surveyed engaged in the processing of plastic household goods, five were engaged in independent planning and development of products. The others relied on plans of their customers

Of the five companies doing their own planning, two were organized so as to allow planning and development, while the other three relied on the business sense and ability of their individual managers.

4B-2. Production

(1) Molding Methods

The typical methods of processing plastic household goods include compression molding, injection molding, blow molding, extrusion, and inflation. These are widely utilized throughout Thailand.

Of these, no survey was made this time of companies engaged in inflation molding.

(2) State of Facilities

1) Molding Machines

As shown in Table III-4B-1, the ratio of installation of injection molding machines as the different types of molding machines is an overwhelmingly high 69

percent. Next most numerous are compression molding machines (about 27 percent). In addition, some blow molding machines and extrusion machines were installed.

Table III-4B-1. State of Installation of Molding Machines

Co.	Injection molding machines		Blow molding machines	Extrusion molding machines	Compression molding machines
	No.	Etc.	No.	No.	No.
A	81	30-1400T			121
B	52	22-1300T			
C	26	50-220T	2	3	
D	32	40-750T			
E	16	20-360T	Several		
F	54	20-180T			
G	14	0.75-220T			
H	18	25-180T			
I	4	20 g/shot	4		
J	9	300-850T			
K	About 50	22-850T	4		6
L					15
M	4	—			
Total	360 (about 69%)		10-15 (about 3%)	3 (about 1%)	142 (about 27%)

All the injection molding machines used, except for one fabricated in-house with a clamping force of 0.75 ton, had molding capabilities of a mold clamping force of 20 tons to a maximum 1400 tons. All except for a handful of Hong Kong and West German makes were made in Japan. The blow molding machines were all of Thai make and were highly evaluated as to performance by the processing manufacturers. The extrusion machines used were foreign makes (Japan and Hong Kong), but these companies seem to have selected imported machines due to their strong ties with Japan through the products produced. The compression molding machines (melamine use) used are Japanese and West German makes in the case of the largest company and Japanese makes in the case of one other firm.

2) Peripheral Facilities

The most important among the peripheral facilities are the facilities for storage and mixing of raw material resin, facilities for processing runners, flashes, and defective products, and secondary processing facilities for the molded articles.

Facilities for storage of the raw material resin were not present in any of the companies. There are only a few companies which use large amounts and they use flexible containers. Other companies keep it in bags and stack it in warehouses or in storage spaces near the molding machines.

Mixing facilities for the raw material resin etc. were present in eight of the 13 companies, with these eight having simple tumbler type blenders for mixing different resins together or resins and dyes. Of the five companies not having blender facilities, three were producing products not requiring mixture with dyes and the remaining two was handling small lot sizes, so could get along with manual mixing.

As for runner, flashes, and defective product processing facilities, all but one company had crushers. Four companies, further, recycled the runner etc. with granulating machines. In recycling, consideration is given to mixing the material with virgins material for products not demanding high quality and so there are no problems.

Printing, plating, and other secondary processing facilities were installed in all processing manufactures considering their functions necessary. In the majority of places, both silk screen and hot stamping machines were installed for the printing facilities. One company was even handling the plating work in-house.

3) Testing Facilities

None of the companies surveyed was testing the properties or characteristics of the raw material resin and further none of them were even inspecting the resin. Inspections of the molded products were limited to inspections of the external appearance and dimensions, though some manufacturers were seen to engage inspections of weight. Therefore, the only facilities possessed were simple tools and implements. These inspections were performed almost all during the actual processing by process workers. *Just five of the large companies, further had independent quality testing sections.*

4) Molds

Most of the technical problems in the molding relate to the molds. The quality of the molds is the decisive factor in the determination of the overall level of technology in a considerable proportion of cases.

In general, companies able to plan the products by themselves and engage in anticipatory production tend strongly to develop molds on their own and have high technical capabilities.

Table III-4B-2. State of Development and Procurement of Molds

Co.	Development of molds	Procurement of molds	Others
A	95% by own company	95% made in-house, 5% outside orders	Has mold making joint venture. Uses CAD, CAM
B	Customer	Customer and outside orders (to subsidiary)	Has mold making joint venture
C	Own company	Made in-house (from molding base) and outside orders (large sizes imported, small sizes obtained domestically)	Maintenance done in-house
D	Own company	Outside orders	Maintenance done in-house
E	Own company	Outside orders (imports and domestic) -> currently switching to in-house production (from mold base)	Maintenance done in-house
F	Own company	Almost all outside orders (domestic). Only complicated ones made in-house.	Maintenance done in-house
G	Own company and customer	Customer and outside orders (domestic)	—
H	Customer	Customer and outside orders (domestic)	Has maintenance division, but does only simple work
I	Customer	Customer and outside orders (domestic)	—
J	Own company	Outside orders (domestic)	Maintenance also ordered out
K	Own company	Almost all made in-house. Some outside orders (domestic)	Maintenance done in-house
L	Own company	Made in-house	—
M	—	Almost all made in-house	—

Regarding the procurement of molds, three out of the eight companies fabricating them in-house (including ordering them out to subsidiaries) were a manufacturer specialized in compression molding of melamine diningware, a manufacturer of copies of products with low quality demands, and a manufacturer with technical and management problems. All of these took the policy of giving priority to cutting costs. Two of the remaining five companies were superlarge Thai plastic molding companies with mold making subsidiaries, and two more were manufacturers with used to order the molds from the outside (imports or domestic makes) but were moving in the direction of in-

house fabrication by the purchase of molding bases. The remaining company fabricated difficult molds in-house and ordered out general ones to domestic manufacturers, supplying its own designs and drawings, and further maintained the molds itself. These five companies all are moving toward specialization into specific technologies and division of labor. Two companies relied completely on outside orders for their molds. Of these, one was providing technical guidance to the mold manufacturers when placing orders.

(3) Production Control

1) Production Plans

There are two types of production methods: production on order and anticipatory production. Of the 13 companies surveyed, five were engaged primarily in anticipatory production (also including joint receipt of orders). The majority were engaged in production on order. All of these currently had large production demand and were strongly moving to expand the volume of production.

2) Production Control

Thailand has been becoming aware of the importance of production control in recent years. Along with this, the number of companies establishing production control systems has been increasing. As for production control including both quality control and factory environmental control, the qualities of this system in the companies surveyed are as follows, making an overall judgement based on the impressions gleaned from the factory inspections:

- Companies with relatively good control systems: 6
- Companies with some degree of control systems: 2
- Companies with problems in control: 5

However, even though some companies had staff specializing in production control, almost none of the companies had prepared written work standards, control standards, quality standards, safety standards, etc., which are required for production control. The control was being exercised by personal judgement. Note that while some companies were observed to have in-house control standards, these were in almost all cases Japanese standards used as is.

As control indicators, in general the companies statistically record the rates of material loss and defective products. Quality control generally consisted of inspections of the external appearance, dimensions, weight, etc., but some superior companies had established independent quality control sections which performed a wide range of tests and inspections on the products.

Whatever the case, there were no companies which had an effectively organized vertical control system covering everything from control of orders received to inventory and delivery control. Each company was only doing part of this in accordance with its own actual needs.

3) Materials Procurement

The main materials used for household goods in Thailand are the thermoplastic materials of LDPE, HDPE, PP, PS, and ABS and the thermosetting material melamine. The ratio of use of domestic materials has been increasing in all cases, but the ratio of use of imported materials is still high overall. There are no major problems in procurement of either domestic or imported materials, other than fluctuations in purchasing prices.

4) Manufacturing Costs

Regarding the cost composition, questions were posed only as to the ratio in overall material costs. According to the responses obtained, the ratio of materials in total costs was a large 40 to 75 percent.

4B-3. Molding Technology

The technical problems in plastic household goods may be roughly classified into those in molding technology, secondary processing technology, and materials control technology.

(1) Molding Technology

The technology of the injection molding, compression molding, and blow molding used most often for molding plastic household goods may be judged to have reached a suitable level in most processing manufacturers, but there is considerable room

for improvement, such as in the setting of molding conditions according to the molding cycle and material characteristics. In the case of injection molding, while also a problem of the mold technology, considerable flashes and traces of removed flashes were observed in the products, which would be problems in export products. Large flashes also occurred in and around the spool and gate portions, causing problems not only in maintenance of quality, but also a reduction in the efficiency of utilization of materials, so care will have to be taken in areas other than the products proper as well. Further, there were many products with too much spools and poor gate positions, causing uneven product thickness and having an effect on production efficiency as well. In other words, the processing technology for thin products has not yet been established.

Large flashes also occur in the compression molding of melamine diningware. The rate of material loss is about 5 percent, somewhat higher than in injection molding. From this too, it may be said that improvement is needed in the technology for measuring out materials. In addition, problems of uneven color, black spots, and whitening were seen due to poor molding technology.

(2) Secondary Processing Technology

Overall, not enough care is taken in the silk screen, hot stamping, and other surface treatment technology, with there being much positional deviation, unevenness, and distortion of letters and patterns. Further, there are defects in the diningware patterns arising from poor handling of the melamine paper. There were many cases of insufficient treatment of the foundation, e.g., removal of dust, moisture, oil, etc. from the surface of the products, in the surface treatment, causing fading of color, wear, peeling, etc. of the printed portions.

(3) Materials Control Technology

In general, processing manufacturers do not perform inspections on incoming materials. Some processing manufacturers obtained certificates of materials from the manufacturers supplying the materials and checked against those, but even in those cases did not have the ability to check the materials in-house. This situation is a result of the lack of dissemination of the techniques for selecting or mixing optimum materials with consideration given to the product function and quality and the productivity and of the low recognition of the necessity of the same among the managers.

In addition, when using domestically produced materials, the limitations in the grades of the materials and problems in control of the materials result in the problem, for example, that it is difficult to produce products requiring transparency. Further, it is difficult to say that strict control is being exercised in the mixing of dyes as well. There are cases of problems in differences in color in different molding lots.

4C. Problems and Countermeasures

4C-1. Problems

(1) Lack of Product Planning and Development Capabilities

In the case of industrial parts, the assembly manufacturers arrange for the molds and the processing manufacturers perform just the molding work. With few exceptions, the processing manufacturers have no product planning and development capabilities. In the case of household goods, there is a notable lack of information regarding overseas product trends, price trends, etc. and, further, methods of product planning and development and means for improving existing products are not known.

(2) Immaturity of Molding Technology

While the latest molding machines are being introduced, full use is not being made of their capabilities. The reasons are [1] a lack of peripheral equipment, [2] a low level of mold performance, [3] an insufficient grasp of the characteristics of the molding materials, and [4] insufficient knowledge of other matters for setting molding conditions.

(3) Immaturity of Secondary Processing Technology

The technology for printing, hot stamping, plating, and other surface decorative treatment is inferior and not good enough for the international market.

(4) Immaturity of Knowledge and Technology Regarding Molding Materials

Production of plastic products requires not only general use resins, but also engineering plastics, compounds, and polymer alloys. The lack of the ability to analyze and test these materials and to obtain a grasp of their physical properties is inhibiting product development and the improvement of molding technology.

4C-2. Countermeasures

(1) Necessity for Positive Planning and Development

The assembly manufacturers are gradually moving in the direction of planning products tailored to the Thai market. Further, they are confronted with a need to raise the rate of local procurement of parts. In response to these movements, the part processing manufacturers must equip themselves with positive technical strategies enabling technical compatibility with the assembly manufacturers in molding technology, material technology, and other specific fields. On the other hand, in the case of household goods, it is necessary for industrial organizations etc. to work to collect overseas market information and to promote the sharing of information among companies. Further, it is important to obtain the cooperation of experts for each of the foreign markets and to study the methods of product planning and development.

(2) Setting of Higher Targets for Product Quality

Much greater improvement of technology is required in all fields of primary and second processing. Toward this end, it is necessary to set higher targets for product quality. The Thai market is not that severe when it comes to quality, so both the managers and technicians do not recognize that there is that great a problem with the current levels of quality. However the industry requires some framework enabling them to obtain a grasp of the level of quality and technology in the industrialized countries through products, processing equipment, and the actual state of production control overseas.

(3) Augmentation of Public Plastic Technology Centers

At the present time, almost no measures are being taken in either the public or private sector regarding research and dissemination of technology regarding molding materials - which is of crucial importance in plastic processing. In practice, research, testing, and analysis of materials and determination of their physical properties would require sophisticated specialized know-how and expensive facilities, so individual processing manufacturers would find it extremely difficult to secure their capabilities on their own. Therefore, as part of the country's industrial policies, public organizations should be equipped with such functions and should offer education and guidance to processing manufacturers and assistance in product development. In implementation of

this, close contact would have to be maintained with industrial organizations and education organizations.

5. Corporate Management

5-1. Summary of Companies

(1) Comprehensive Content in Business Characteristics

The general characteristics of business in the plastic processing industry, which is in the development stage, are as follows: [1] Small and medium sized family run companies are prevalent, but large sized companies etc. are striving to expand the volume of production through construction of factories and augmentation of facilities. [2] Manufacturers using primarily injection molding constitute about 70 percent of all manufacturers and further are increasing in number. [3] Product planning for industrial parts is left to the assembly manufacturers, including specifications of materials. There is a strong tendency to rely on the customers for planning of household goods as well, but independent company planning is increasing. [4] Numerous factories are producing several types of products with different objects of use, such as industrial parts and household goods, using the same facilities and technology. Few manufacturers try to limit themselves to certain production lines and differentiate their production technology. [5] Behind this there is an overwhelming shortage of market information and technical information. [6] There is a lack of the coordination among companies necessary for focusing the power of the industry.

(2) Characteristics of Business as Seen from Sales Lines

Overall there is insufficient progress made in establishing a horizontal division of labor for products. There is a strong tendency for the sales lines of each company to spread over a wide range of products. Therefore, it is difficult to build up specialized technology. This is due in part to the fact that the domestic market is small in size, so companies are forced to broaden their sales lines in order to secure sufficient operating volumes. Looking at industrial parts, there is a tendency for orders from a wide range of product fields to concentrate in the companies having above a certain level of technical expertise. In the case of household goods, manufacturers able to plan and develop their own products tend to limit their lines of manufacture, but the greater majority of the companies indiscriminately expand to lines where quality is not in that much demand in accordance with buyer requests. In the future, it will be important for companies to accurately judge the domestic and foreign market situations and specialize in certain sales lines.

(3) State of Introduction of Foreign Capital

The assembly industries are striving mightily to maintain production and obtain transfers of technology through joint ventures with foreign capital. The processing manufacturers tend more strongly to include foreign capital the higher the rate of production of industrial parts. Manufacturers converting from processing of household goods to industrial parts or producing both product lines even today do not have any ties with foreign capital with the exception of a few cases. Behind the strong feature of inclusion of foreign capital in the parts processing manufacturers is the guidance or demands of the assembly manufacturers. The assembly manufacturers are dissatisfied with the production capacities and quality of the parts processing manufacturers and it is judged that solicitation of joint ventures and technical guidance will become even more prevalent in the future under the guidance and requests of the manufacturers.

(4) State of Utilization of Sub-contractors

The majority of the processing manufacturers make use of sub-contractors in one way or another. The parts processing manufacturers order out part of their parts processing work and part of the manufacture of molds. The parts processing work includes the manufacture of molds, but sometimes the molds and plastic materials are supplied when ordering processing of parts. The manufacturers of household goods often order the manufacture of molds from outside companies.

(5) Business Expansion Plans

The companies surveyed were extremely aggressive about expanding the volume of their businesses through increased production or expansion of their product lines. Seventy-five percent of the processing manufacturers had plans for business expansion or were in the middle of such expansions. These plans included [1] augmentation of facilities, including expansion of factories, [2] new construction of factories, and [3] establishment of new companies. The plans called for increasing production capacities of current products two to four times in the case of processing manufacturers of parts and two to three times in the case of processing manufacturers of household goods.

5-2. Sales

(1) Features of Sales Methods and Background of Same

The basic method of sale of the processing manufacturers of industrial parts is direct wholesaling to the assembly manufacturers, but some parts are sold through wholesalers as replacement parts (spare parts). Household goods are sold to retailers through wholesalers or trading companies, but there are also cases of direct sales through directly managed outlets of companies. Further, regarding exports, there are numerous direct transactions made with overseas buyers. A characteristic of the parts processing manufacturers is the lack of any tendency to sell to only specific assembly manufacturers. The reasons are [1] There are only a limited number of parts processing manufacturers able to meet the demands of the assembly manufacturers, [2] The size of the market is small and orders for parts cannot be made big enough to enable assembly manufacturers to bring parts manufacturers under their sway and strengthen ties with the same, etc.

(2) Thinking in Setting of Sales Targets

Parts are processed with molds supplied from the assembly manufacturers or with mold drawings supplied and technical guidance given in the mold manufacturing. The plastic materials are also either supplied by the assembly manufacturers (mainly imported materials) or the grade of the materials is specified. In this way, many of the parts processing manufacturers rely on the assembly manufacturers for product planning as well, including technical aspects of design, materials, molds, etc. The independent planning of household goods mostly is in the field of sundry goods. Tableware, kitchenware, cosmetic containers, etc. are mostly based on buyer plans. Further, the higher the export product ratio of a manufacturer, the greater the tendency for reliance on buyer plans. The production lines are determined in accordance with samples brought in by the buyers in the majority of cases. Some of the manufacturers with their own brand product work with overseas sales organizations for product planning.

(3) State of Exports of Products

Eighty percent of the processing manufacturers surveyed were engaged in exports in some form or another. Export products were diverse in type and use, and the export destinations were spread all over the world. Due to the nature of the products, industrial parts were indirectly exported and household goods directly exported in the majority of

cases. There were some direct exports of auto parts to nearby countries, but there are also movements on the part of foreign capital companies to use Thailand as a base for processing of parts for export and plans for promotion of a horizontal division of labor for parts among the ASEAN countries. In the case of household goods, some manufacturers engage indirect transactions with overseas buyers and are aggressively developing markets and promoting sales. The vast majority of companies, however, export through wholesaler organizations, so lack information and knowledge about the export markets.

(4) Features of Sales Channels

Industrial parts are almost all directly delivered to the main orderers, the assembly manufacturers. Household goods are delivered directly to specialty stores, department stores, supermarkets, and other mass merchandisers without going through trading companies and wholesalers and further are directly sold in transactions with overseas sales outlets. In Japan's case, only 1.3 percent of manufacturers engage in direct transactions with retailers - a different ratio compared with the distribution channels of Thailand.

5-3. Labor Management Situation

The plastic processing industry depends to a relatively small degree on the abilities and skills of the workers, but on the other hand is largely influenced in the development of business by the management capabilities and judgement of the managers. Further, there is a strong tendency for a company's entire capabilities to be determined by the state of the administrative and technical management staff in charge of practical day to day matters. In small and medium sized companies, family management was often seen, where even if personnel suitable as candidates for staff or foremen positions were trained, they would never be given an opportunity for advancement and therefore it would be difficult to establish a work organization for planning or managing production, sales, etc. Therefore, there is a great possibility of difficulties accompanying any appropriate measures taken to deal with the rapidly diversifying product trends. Whatever the case, there are deep problems in the industry of shortages and difficulties of employment of factory control class staff, higher level engineers, technicians, etc. and further of the mobility of the same.

5-4. Problems and Countermeasures

(1) Problems

* Large Dependence on Assembly Manufacturers by Parts Processing Manufacturers

The majority of the parts processing manufacturers rely on the assembly manufacturers for technical aspects of processing and also materials etc. Therefore, they do not understand product design, processing methods, materials, quality, and other individual aspects of technology nor the mutual relationship among the same.

* Insufficient Market Information in Processing Manufacturers of Household Goods

There is no system established in the industry for organized collection of market information, including overseas market information, suitable judgement of market trends, and creation of products enabling companies to open up markets on their own.

* Evil of Tendency of Expansion of Production Volumes

The manufacturers all strongly want to expand the volume of their production. As a result, they try to produce products with different purposes of use (required quality) using the same know-how, facilities, and technology, making the industry one in which accumulation of technology and know-how and specialization in certain processing technologies are difficult.

* Limits to Family Managed Companies

With the increasing diversification of product directions and the shortening of product lives, there is a strong possibility that management limited to close relatives will prove a major hindrance to company operations. It is important to train personnel in-house and make effective use of that personnel and at the same time to transform into modern management.

* Difficulties in Securing Human Resources

The industry as a whole faces the problem of insufficient technicians with specialized plastic processing know-how and factory management staff. Further, there is a problem as to the job hopping of technicians.

* Lack of Coordination Among Companies

The opinion is beginning to spread in the industry that it is necessary to focus the power of the industry so as to promote it, but there is little awareness in the management ranks of the manufacturers of the need for implementation or promotion of hits.

(2) Countermeasures

* The Role of Private Organizations for Improvement of Technology and Dissemination and the Support by Government

It will be necessary for the processing training facilities established by some industrial organizations to be augmented activity both in quality and quantity by the industry as a whole and for effort to be made to increase the number of experienced workers in the factories. On the other hand, it is necessary to establish a new place for education and training which can provide education based on practical theory so as to increase the number of higher level technicians and, based on that, can provide practice in processing, testing, analysis, and other areas. The Ministry of Industry desirably would play a guiding role in this as part of its industrial promotion policies, maintain close ties with public research organizations, including universities, and industrial organizations, and plan and implement plans in the form of support to the private sector.

* Collection of Overseas Technical Information and Market Information and Dissemination in Industry

It would be practical to establish a system enabling the government to seek support from overseas organizations and to promote sharing of collected materials and information in the public and private sectors and, further, in utilization of the same, to make use of the organizations and funds of the industrial organizations for arrangement of the information, translation, etc. Further, dispatch of an observer to the industrial

conference of Asian NIEs sponsored by the Japan Plastic Federation should be effective in terms of collection of information.

* Strengthening of Guidance for Improvement of Management and Management Capabilities

It would be good to switch the content of seminars, which previously tended to lay emphasis on improvement of technology, so as to gradually touch more concretely on business management. Government and industrial organizations must give full consideration to this point in their plans for seminars and corporate guidance.

* Supply and Ensurement of Human Resources

In the long term it will be essential to increase as much as possible the number of staff with technical backgrounds in the higher educational facilities, both by augmenting current educational ranks and increasing the allowed number of the same. The formulation of practical plans for this by the Ministry of Industry and the educational authorities based on long term industrial policies is desired. In the short term, scholarship systems could effectively be established by individual companies or industrial organizations in accordance with the situations in the same so as to give capable students an opportunity for study, with an obligation of employment being made a condition.

6. Raw Materials

6-1. Domestically Produced Raw Materials

Thailand became able to produce all general use plastic resins with the operation of the NPC-1. This situation is shown in Table III-6-1. These materials, however, are primarily for household goods for the domestic market and for exports of materials. Use for parts of export type industrial products would seemingly be difficult. The reasons are the scarcity of grades for each resin and problems with quality. For example, looking at polypropylene (PP), Thailand produces homopolymers, but does not produce the copolymers for industrial parts requiring impact strength. In the case of polystyrene (PS), Thailand also produces high impact strength grades (HIPS), but in many cases does not offer the grades designated by the customers.

Further, when using imported raw materials for parts for exports of finished goods, such as home electrical appliances, a tax refund is available and so imported raw materials become cheaper than domestic raw materials.

As mentioned above, in actuality, almost no use is made of domestic raw materials for industrial parts due to both quality and price factors. On the other hand, considerable use is made of domestically produced LDPE, HDPE, PVC, and PS for household goods, which mostly use general use grades of general use plastics.

Table III-6-1. Thai Plastic Producing Plants

Product	Manufacturer	Capacity (T/Y)	Start-up
PE	Thai Petrochemical Industry	65,000 (LDPE)	On stream
		60,000 (HDPE)	"
	Thai Polyethylene	137,500	On stream
	Chotsiri	(LDPE/HDPE) 140,000	Approved
PP	HMC Polymer	100,000 (HOMO)	On stream
	Thai Polyethylene	80,000	Approved
	Thai Petrochemical Industry	80,000	Approved
PVC	Thai Plastic and Chemical	140,000	On stream
	Solvay	135,000	Approved
PS	Pacific Plastics	22,500 (GPS/HIPS)	On stream
	Eternal Resin	30,000 (GPS/HIPS)	On stream
	Srithephai Plaschem	14,000	On stream
	Huntsman	25,000	Approved
	Thai Petrochemical Industry	29,000	Approved
EPS	Thai Polystyrene	3,000	On stream
	Srithephai Plaschem	3,000	On stream
ABS	Thai Petrochemical Industry	18,000	Approved
	Eternal	7,200	Approved

Source: Plastic Industry Club 1989: The Development of the Plastic Industry in Thailand

6-2. Imported Raw Materials

The total consumption of plastic resins in Thailand is as shown in Table III-6-2. With the exception of melamine and other thermosetting plastics, a total of about 440,000 tons of thermoplastic resins were consumed in 1987 in Thailand. On the other hand, it exported 4,951 tons and imported 210,837 tons in 1987. Of this, a total of 46,150 tons of thermoplastic resins were imported from Japan, as shown in Table III-6-3. In addition, 6,444 tons of thermosetting plastics were imported from Japan. Limiting ourselves to processing manufacturers of industrial parts, almost all materials were imported from Japan. In the case of processing manufacturers of household goods, use is being made of imports of PP, ABS, AS, etc., which previously were not produced domestically. The biggest problem with imported raw materials is the large fluctuations in price.

Table III-6-2. Plastic Consumption in Thailand

(Unit: 1000 metric tons)

Material	1983	1984	1985	1986	1987
LDPE	40	42	45	50	60
LLDPE	—	—	—	2	10
HDPE	70	65	68	75	85
PP	83	78	87	97	99
PVC resin	65	60	71	77	85
PVC compound	45	40	40	45	60
PVC paste	5	5	6	7	10
PS	16	17	21	24	28

Source: Plastic Industry Club 1989, The Development of the Plastic Industry in Thailand

Table III-6-3. Exports of Plastic Materials to Thailand

(Amounts Imported From Japan)

	Tons	1,000 yen
Thermosetting plastics		
Melamine resins	2,106	450,968
Phenol resins	973	261,153
Epoxy resins	578	346,055
Other thermosetting plastics	2,787	937,442
Total of thermosetting plastics	6,444	1,995,618
Thermoplastic plastics		
Polyethylene	16,906	2,071,807
Polypropylene	7,645	1,160,875
Polyvinyl chloride	5,682	903,805
Polystyrene	4,751	915,786
Polyvinyl alcohol	3,498	771,581
ABS	3,408	725,084
Polyamides	1,071	376,883
Polymethyl methacrylate	457	114,792
Other thermoplastic plastics	2,732	650,895
Total of thermoplastic plastics	46,150	7,691,508
Total of plastics	52,594	9,687,126

Source: Nihon Boeki Nenpo (Japan Trade Yearly) 1987

6-3. Problems and Countermeasures

Even today, with the NPC-1 beginning operation, the quality specifications of grades of resins for plastic industrial parts are sophisticated and production costs are high. Further, the Thai market is a small one. Therefore, in the future, companies will probably have to still rely on imported raw materials. In terms of price, both the processing manufacturers and the manufacturers supplying the raw materials judge that

while there will be improvement in delivery periods and price stability due to the operation of the NPC-1, the market price of the raw materials will not themselves fall. The majority of companies expect that the domestic prices will be based on the CIF price of imported raw materials plus the tariffs and expenses relating to storage and transport. The processing manufacturers of household goods find this price aspect to be a particular problem.

With the above situation being projected, the following two countermeasures may be considered:

(1) Promotion of Plastic Compounders

Compounds of materials are used for industrial parts in most cases. Therefore, it is necessary to promote compounders with a high level of technical expertise which would import the cheapest plastic resins from overseas manufacturers of the raw materials and make compounds of the materials in Thailand.

(2) Establishment of Testing and Research System for Plastic Resins

It is necessary to establish a research system which can perform full analyses of imported compounds and use the results to blend various types of materials to produce other compounds and a system for providing guidance to processing manufacturers and compounders. This would preferably be done by a public organization as it would be impossible for individual compounders both in terms of money and manpower.

7. Supporting Industries

7-1. Facilities

(1) Domestic Production Facilities

The majority of the plastic processing facilities being used in Thailand are imported, but domestic products account for a large share of the domestic market for some processing facilities and some of these are even exported.

There are three manufacturers of injection molding machines established by local capital and these produce small quantities of mainly small sized injection molding machines for domestic users. Note that the production capacity of the three companies is about 100 units a year. These companies having been producing injection molding machines for surprisingly long times, having started out with manual type injection molding machines in the 1950s and moving on to production of hydraulic type injection molding machines from the middle of the 1980s. The models produced fall under the category of the old style vertical and horizontal hydraulic types and have the capacity of about a dozen odd horsepower, enabling molding of sundry goods, toys, and simple industrial parts.

Looking at production, these companies well realize they cannot compete with overseas molding machines and therefore are trying to maintain their markets by target suitable users. While there is the difficulty that the types of functions offered are fewer than with imported molding machines, their machines are lower in price and they have the ability to offer good after sales service - these are the points on which they manage to maintain their business. At the present time, they enjoy a good flow of orders even without any special sales activities.

Turning to the procurement of materials and parts, the finished steel is imported steel procured domestically while the electrical components and hydraulic system components etc. are imported through agents. At the present time, there are no problems in the procurement of materials, but the rate of procurement of imported parts has reached over 60 percent on a purchase value basis.

The sales prices range from 50,000 to 60,000 bahts to 400,000 to 500,000 bahts per set, about one-quarter the price of Japanese made injection molding machines of the same molding capacity. Note that materials account for 60 percent of the total costs.

Looking at the user evaluation, Thai machines suffer from many problems in the parallelism of the tiebars and the overall toughness, so are very poorly evaluated by the processing industry. This is recognized by the manufacturers of the molding machines as well, who understand there are problems in the precision of fabrication and strength. Further, no consideration is given at all to worker safety. These machines, however, have been exported to nearby countries.

Japanese affiliated sales outlets of injection molding machines consider that Thai companies could produce injection molding machines of up to a clamping force of 50 tons and if the models were limited could produce ones of up to a maximum 150 tons.

There has been a rapid spread of extrusion blown film making machines for making plastic bags starting from the middle 1980s and a large number of manufacturers are producing them. These account for the majority of the domestic market and are busy exporting as well.

Domestic makes of blow molding machines and compression molding machines are also being used. There are presently two companies producing blow molding machines in Thailand, of which one is producing eight models, based around a 1.5 liter product volume, and has a capacity of 20 units a month. Thailand's blow molding machines are relatively good in performance and have spread widely throughout the Thai market. Further, about 40 percent of the production is exported from the ASEAN nations to the Middle and Near East countries. Note that the maximum capacity of blow molding machines which can be produced in Thailand is 5 liters. For the production, the companies import thick steel plate, special cast steel, and other materials and hydraulic components, outfitting, and motors of over 10 PS.

The prices are over 1 million bahts per unit for PE use average specification models with product volumes of 1.5 liters and 10 percent higher for PP use models, but in both cases are one-third the price of imports from West Germany and Italy.

In addition, foreign capital affiliated auto parts makers are using Thai vacuum molding machines for processing fenders, inner liners, etc.

As to related facilities, granulators and pulverizers are also being made by domestic Thai machine manufacturers and are being widely distributed. Thai pulverizers, however, are evaluated extremely poorly as to performance in that they require cleaning along with disassembly using a chain block when changing the color of the materials, so require massive labor, are noisy, and suffer from large variations in size of the particles of material. There is strong dissatisfaction that despite this, BOI tax incentives cannot be obtained for imported machines.

Note that three Japanese and Taiwanese manufacturers of injection molding machines are planning joint venture factories with Thai companies and two are already in the middle of construction of factories. Part of the injection molding machines produced by these factories are scheduled to be exported from Thailand. The production of these three companies is estimated at about 100 units a year for the time being. Japanese companies estimate demand for injection molding machines in Thailand of about 1,200 units a year. Therefore, several Japanese injection molding machine manufacturers are studying production in Thailand. Further, Japanese affiliated companies have recently been starting production of hopper loaders by the knockdown (KD) method.

Problems mentioned as accompanying Japanese investment include (1) the forced reliance on procurement of the majority of materials and parts from Japan and other countries (about 400 parts excluding nuts, bolts, packing, etc.), (2) the large burden of import tariffs on the same, (3) the inability to secure quality processing and assembly due to the lack of skilled workers, etc. In particular, it is difficult to guarantee the quality of steel materials and the companies have to rely on imports. Problems in local procurement of materials such as the inability to produce and process the ductile gray cast iron (FCD) frequently used for strength and sliding of the mold and also the bottleneck in the heat treatment technology for sliding members are considered critical.

7-1-2. Imported Facilities

According to import statistics, the state of Thailand's imports of the key plastic molding facilities of injection molding machines was as follows (including used facilities):

(Unit: Sets)

<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
701	333	277	380	1,095	1,876

The country of origin of the injection molding machines was Japan in an overwhelming number of cases, with that country supplying 1,158 of the machines in 1988. Other than this, Taiwan accounted for 323 machines, Hong Kong for 268, and West Germany for 57. All regions have increased the volume of their exports to Thailand considerably since 1987.

However, there are those which doubt the above statistics. Eight representatives of the industry, including processors, molding machine manufacturers, and machinery importers brought individually researched data to a conference at the Hilton Hotel in May 1989 wherein it was concluded that as of 1988 there were a total of 2000 injection molding machines installed in Thailand, broken down in 1,100 Japanese makes and 500 to 600 Hong Kong and Taiwanese makes.

By way of note, the numbers of injection molding machines (including used ones) exported to Thailand from Japan, according to a survey by the Japan Plastic Machinery Association, were 255 in 1985, 306 in 1986, 709 in 1987, and 456 from January to May 1988, with a total of 1,726 exported in just that period.

On the other hand, the local affiliate of the biggest exporter of Japanese made injection molding machines to Thailand judged that the total number of injection molding machines in Thailand, including used machines, stood at 12,000 units as of 1990, of which half were considered to be Japanese make.

According to materials of the above conference at Hilton Hotel, the biggest country of origin of the plastic processing facilities in Thailand was Japan, followed by Taiwan, Hong Kong, West Germany and Italy, in that order. Further, it was reported that Thai makes of processing facilities accounted for only a 2 to 3 percent share of the market and that 50 percent of all their parts were imported.

The same report touched on the technical level of the Thai makes of injection molding machines and concluded that while they were superior to Philippine, Indonesian, and Malaysian makes, they were not superior to Singaporean makes.

Further, according to discussions with Japanese processing engineers residing in Bangkok, the recently increasing number of Taiwanese makes of injection molding machines mostly use a mechanical method of clamping and are not too suited for

sophisticated molding, but the Korean makes use a noncontact electrical control method and are superior in performance.

A survey was made of the trends in market prices according to data of local affiliates of Japanese injection molding machine manufacturers, giving the following ranges. Note that the survey covered similar injection molding machines with clamping force of about 150 tons, but that the functions, safety measures, and other specifications differed completely.

Price of Thai injection molding machines	About 35% of price of Japanese injection molding machines
Price of Taiwanese injection molding machines	About 40-60% of price of Japanese injection molding machines
Price of Hong Kong injection molding machines	About 40-70% of price of Japanese injection molding machines
Price of South Korean injection molding machines	About 50-70% of price of Japanese injection molding machines
Price of West German injection molding machines	About 80% of price of Japanese injection molding machines
Price of Italian injection molding machines	About 60-70% of price of Japanese injection molding machines

Note that according to import statistics, regarding processing facilities other than injection molding machines, France accounts for the overwhelmingly large share of extruders, followed by Taiwan and Japan, while blow molding machines are imported from Taiwan and Japan. Vacuum molding machines are mostly imported from Taiwan, followed by Japan and the U.S.

7-2. Secondary Materials

The main secondary materials used for plastic processing are coloring dyes and various additives such as oils and fats for compounds. Considerable use is also made of finishing paints, plating chemicals, and solutions and adhesives for assembly etc.

The processing manufacturers surveyed had relatively little interest in these secondary materials did not seem to feel there were any problems in the quality, price, or acquisition of the same. In general, these can be easily acquired in sales outlets in the

cities, so the companies do not make any distinction as to whether the secondary materials they use are domestically made or imported.

A joint venture was established in 1976 with a Swiss firm for colors and additives. This is the largest company in Asia outside of Japan and produces alone 40 percent (value base) of the amount of these items used in Thailand a year. The company also exports, primarily to Asia.

There are currently five Japanese affiliated color manufacturers, all of which import their raw materials from Japan. At the present time, the only colors which can be produced using domestic Thai materials are cyan blue and carbon type rubber use colors, which pose no problems in quality and which numerous companies are thus producing.

Thailand depends almost completely on imports for color materials other than the above. The colors produced in Thailand (Dry Color (DC)), however, are not considered a problem in quality, price, or delivery either by Thai or foreign affiliated companies. Regarding the color compound color master batch (MB) and colored pellets (CP), however, there are problems in the resin materials made in Thailand, so the quality is unstable in Thai companies.

At the present time, Thailand has numerous production companies for such secondary materials, including these firms, and, aside from these, could make use of domestic materials for some dyes, paints, and inks and further liquid stabilizers etc. quality wise. Further, it has sufficient supply capabilities for the plastic processing industry. However, it has to rely on imports for dispersants, flame retardants, lubricants for resin mixing, solvents, and powder stabilizers (Japan etc. shifted considerably earlier to powder stabilizers in view of the quality of the products, and they were used to products for exports from Thailand).

7-3. Problems and Countermeasures

(1) Training and Securing of Technicians for Maintenance and Repair of Facilities

The maintenance and repair of imported injection molding machines and other processing machines is a difficult problem for processing manufacturers. In principle, the processing manufacturers themselves should establish maintenance and repair systems and deploy the necessary staff, but the industry as a whole suffers from

insufficient personnel knowledgeable in the maintenance and repair of facilities and is forced to rely on the service personnel of the manufacturers of the processing machines for everything except simple work. In the future, it is expected that further high performance processing facilities will be introduced - a trend that probably will become more and more pronounced. On the other hand, there are also limited numbers of service personnel in the manufacturers of the processing machines, so the industry as a whole must work to train more maintenance and repair personnel.

Toward this end, it is considered that necessary to establish courses of the maintenance and repair of processing machines in the plastic processing education and training facilities run by some industrial organizations so as to provide basic training in general machine maintenance and also to obtain the cooperation of manufacturers of processing machines and their instructors so as to provide maintenance and repair training for individual processing machines.

(2) Flexible Application of Import Tariffs

The tariff rates on parts required for the assembly of machinery and equipment are on the average higher than the tariff rates assessed on finished processing facilities. For Thai manufacturers of processing machinery, which procure 50 to 60 percent of the parts for plastic processing facilities from abroad, the rate of the tariff burden in production costs cannot be ignored. Further, this forms an obstacle to raising the quality of products by using good quality overseas parts. The tariff rates on the good quality machine tools and tools required for production are high ones of 30 to 40 percent, making them very difficult to introduce. This is a problem shared by the general machinery manufacturing industries of Thailand. To promote and protect the domestic machinery industry and parts industry, it is desirable to flexibly sharply reduce the tariffs on the above products by limited duration legislative means, the strong opinion was expressed in the related industries.

(3) Support by Government to Companies Investing in Thailand

There has been tremendous promotion of investment using the BOI scheme, but recently numerous problems have begun to appear from such technical areas as the BOI examination and procedures for ordering overseas of materials including raw materials required for production, exports of products and deliveries to domestic export oriented

industries, etc. This has begun to have an effect on the production plans of companies as well.

Leaving aside the question of single products and assembled finished products, most of the above is believed to have been due to the surge in investments from a wide range of fields classified as supporting industries and the rapid diversification and sophistication of the materials (including raw materials), parts, facilities, etc. used for the same, making it impossible for the BOI administrative staff to keep up in the technical knowledge regarding the same. In other words, the staff does not understand the types of materials (raw materials), detailed use, application, methods of use, types of parts and facilities, functions, and comparative performance, objects of use etc., so complicated procedures and long examinations are required. Sometimes the amount of the refund of the import tariffs turn out to be far less than planned.

Further, Thailand inherently has little sense of the division of labor in production. The production system has been adopted wherein everything is handled in the same company. This is judged to be one aspect of the reasons why there is insufficient understanding of production systems where product specifications and production volumes cannot be determined by the company itself, for example, as in the supporting industries, and the complexity of the applications of products or their distribution channels.

Therefore, in the future it would be desirable to train staff with a wide range of knowledge regarding technology, both in its quality and members aspects, and to deploy them on a preferential basis in channels dealing with the private sector.

8. Environmental Problems

Demand for plastic processed products has increased in all fields, but in recent years we have been confronted with a serious problem of what to do with the used products. Due to the global discussions regarding the environment, the handling of waste plastic has become an important issue.

The problem of plastic waste products cannot be resolved by control in the manufacturing processes alone for the reason that it is less a problem caused by the manufacturing process than one after use of the products.

In the U.S., some states with strong powers have restricted use of certain kinds of plastics. Movements have also begun to place the burden of the costs for the cleanup on the plastic producers.

At the present time, three methods of dealing with waste plastic are in use: 1) recycling, 2) incineration, and 3) burying. In the West, there is a strong movement for promotion of recycling, but there are serious economic problems with this and full realization of this has yet to be achieved. Research is going on at the present time in all countries on methods of disposal. Even the producers are moving to develop biodegradable plastics.

Thailand too will have to consider such measures. The present survey did not go into the disposal problem, but this type of problem might influence exports of plastic products. A study of the problem will be necessary not only as a problem of exports but also from the viewpoint of environmental protection in Thailand.

Therefore, the Ministry of Industry, private organizations, the Ministry of Welfare, and other organizations related with the environment may have to collect this kind of information and establish countermeasures for the problems. Seen globally, both producers and environmental groups are tackling this problem, so Thailand will have to take comprehensive measures not bound by jurisdictional constraints.

Main Problems and Countermeasures: Plastic Processing Industry

	Problems	Countermeasures
1. Summary of Industry	<ul style="list-style-type: none"> • Technical problem of applying to the diversity of products • Lack of matching interests in upstream sector (raw materials) and downstream sector (processing industry) • While the percentage of small and medium size companies is high, technology is required in many areas (raw materials, molds and dies) and official guidance is necessary. • The private organizations are more active than in other industries, but there is a lack of official organizations which could help promote effective joint activities. 	<ul style="list-style-type: none"> • Upgrading of techniques for the diversity of products • Quick establishment of section in charge of plastic industry in Ministry of Industry
2. Supply and Demand	<ul style="list-style-type: none"> • Demand for plastic products includes both final demand and intermediate demand. The methods for promoting the processing industry must be tailored to these types of demand. • A broad range of measures would be required to deal with intermediate demand being expected to grow tremendously in the future. 	<ul style="list-style-type: none"> • Information is required to enable formulation of a broad range of measures to deal with this. As a first step, it is necessary to quickly compile statistics. • Formulation of development plans tailored to different demand sectors.
3. Exports	<ul style="list-style-type: none"> • Considering two different types of exports - parts and household goods. • Strengthening of relations with assembly manufacturers and parts manufacturers. • Existence of different types of household goods 	<ul style="list-style-type: none"> • Improvement of reliability of processing technology of parts manufacturers. • Collection of information on markets and new products by official organizations and technical assistance by those organizations.

	Problems	Countermeasures
4. Production Activities and Technology	<ul style="list-style-type: none"> — those with the priority of the price factors or with the priority of non-price factors. Regional strategies are necessary. • Insufficient awareness of Thai plastic products in the world market. • Lack of sufficient planning and development capabilities in most parts manufacturers (complete dependence on the assembly manufacturers). • Insufficient knowledge about methods of planning and developing household goods, methods of improving existing products, etc. • Low level of molding technology. • Low level of secondary processing technology (printing, plating, and other surface decoration). • Lack of knowledge and technical ability in molding materials. 	<ul style="list-style-type: none"> • Participation in international trade fairs to raise the image of Thai plastic products. • Establishment of system for complementary technology between parts manufacturers and assembly manufacturers. • Collection of information by industrial organizations etc. and sharing of the same. • Active use of cooperation from experts in overseas markets. • Establishment of high targets for quality of products. • Augmentation of public plastic technology centers.
5. Corporate Management	<ul style="list-style-type: none"> • Tendency of parts manufacturers to rely to a large extent on assembly manufacturers. • Lack of market information among manufacturers of household goods. • Obstacles to increase of the volume of production (production of different products with same knowhow, technology, and equipment) • Limits to family managed 	<ul style="list-style-type: none"> • Private sector support for improvement of technology under guidance of Ministry of Industry (cooperation with various organizations). • Strengthening of guidance for improvement of management and managerial capabilities (including seminars, not only in technical matters, but also business management). • Ensurement of supply of

	Problems	Countermeasures
6. Raw Materials	<p>companies.</p> <ul style="list-style-type: none"> • Difficulties in securing manpower (technicians, management staff, etc.) • Lack of coordination among companies. • Reliance on imports for grades of raw materials necessary for industrial parts. • Little hope of improvement of prices of domestically produced raw materials 	<p>manpower (cooperation between Ministry of Industry and educational organizations)</p> <ul style="list-style-type: none"> • Promotion of compounders with high levels of technical expertise. • Establishment of testing and research system for plastic resin.
7. Supporting Industries	<ul style="list-style-type: none"> • Lack of manpower for maintenance of processing machinery. 	<ul style="list-style-type: none"> • Establishment of courses for training in maintenance in the educational and training facilities.
8. Environmental Problems	<ul style="list-style-type: none"> • Problems in disposal of waste plastic 	<ul style="list-style-type: none"> • Preparations for formulation of comprehensive countermeasures by official organizations, including the Ministry of Industry, related to environmental issues.

PART-IV.
CERAMIC INDUSTRY

Part-IV. CERAMIC INDUSTRY

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PART-IV. Ceramic Industry

1. Summary of Industry

1-1. Summary of Industry

The Thai ceramic industry began in the era of the Sukhotai dynasty of the 13th century under the influence of the Chinese. Since then, tableware and ornaments have been produced on a small scale. It was not until the 1960s that ceramics developed as a full-fledged industry, so the industry is relatively new.

At the present time, the only ceramic products produced in Thailand on a large scale by modern facilities are floor and wall tiles, mosaic tiles, sanitary porcelain, insulators, tableware and kitchenware. There are only 10 odd companies engaged in such mass production in all of Thailand.

A look at the ceramic manufacturers registered at the Thai Ministry of Industry shows there are 218 companies in Bangkok and its environs, 128 in Chiang Mai, Lampang, and other areas in the North, and 191 in the South, for a total of 537 companies (however, including those making bricks) (Table IV-1-1). In addition, there are numerous cottage sized companies which are unregistered, but there are no statistics or other materials regarding these enterprises and the state of their production lines, production volumes, etc. is not known.

In Bangkok and its environs, there are factories producing tiles, sanitary porcelain, tableware, insulators, and refractory brick using modern facilities. These are active not only in the domestic market, but in exports as well.

Chiang Mai in the north of the country is mainly producing traditional artistic products (tableware and novelties) generally known as celadon. Further, Lampang is producing general household use tableware and novelties consumed by regional cities other than Bangkok. In both regions, the majority of the factories are small in size, but in the case of Lampang some factories are engaged in mass production using modern facilities.

On the other hand, the centrally located Ratchaburi is producing mainly water vessels and flower pots. Further, the South is producing mainly bricks and flower pots. These are being produced mostly by cottage sized enterprises.

Unless otherwise specified the ceramic products to be covered by this survey, selected for their relatively high added value from the standpoint of promoting export industries, are porcelain, pottery, semiporcelain, stoneware, bone china, and other porcelain and pottery corresponding to the following two items. In terms of geographics, it was decided to focus on the northern areas of Lampang and Chiang Mai together with Bangkok and the surrounding region, all of which are major producing regions for these products.

- 1) Porcelain and pottery tableware and kitchen ware (of SITC Nos. 691110 and 691210)
- 2) Statuettes and other ornaments of porcelain and ceramic (SITC 691310 and 691390)

In this section, for convenience sake, 1) will be referred to as "tableware and kitchenware" and 2) as "novelties".

Table IV-1-1. Ceramic Industry (Number of Factories Registered at Ministry of Industry)

	Product	No. of factories
(Central Region)	Sanitary porcelain	8
	Tableware and kitchenware	6
	Novelties and artistic works	17
	Tiles	22
	Refractories	8
	Flower pots and braziers	62
	Brick	92
	Insulators	3
	Sub total	218
(North)	Tableware and kitchenware	40
	Novelties and artistic works	30
	Tiles	8
	Braziers	7
	Brick	43
	Sub total	128
(South)	Bricks	176
	Flower pots	10
	Braziers	5
	Sub total	191
Total		537

Source: Department of Industrial Works

1-2. Industrial Structure

(1) Summary

The production capacity of ceramic products in the 82 factories known to the Ministry of Industry, including refractory brick, was about 350,000 tons as of 1986.

A look at the production capacity of the 82 factories by product shows floor and wall tiles accounting for 141,660 tons, or 40 percent of the total, followed by refractory brick, mosaic tiles, tableware and kitchenware, and sanitary porcelain, in that order.

1) Tableware and kitchenware

The industry can be roughly divided into two groups of companies according to their technical level and scale of operations.

First there are the 10 medium and large sized companies, of which nine are enjoying the investment incentives of the BOI as of 1985. These 10 companies together have a production capacity of 31,175 tons a year. These companies produce medium and high grade tableware and kitchenware. Their customers are hotels, high class restaurants, high income families, and exports. About 40 percent of the tableware and kitchenware produced domestically is estimated to be of medium and high grades.

The majority of the 10 companies rely particularly on Japanese and West German technology. Their machinery (kilns, ceramic machines, SIC plates, aluminum layers, etc.) are imported, but some machinery (ball mills, vibrate sieves, slip tanks, etc.), kiln materials, and electrical systems are procured locally.

The second group consists primarily of 60~70 medium and small sized factories located around Lampang. Statistics on the production scale and production figures of these small and medium sized factories are not available, but it is estimated that they had a total production capacity of 20,500 tons a year in 1985. In the past, the products of these small and medium sized companies were mostly for the general domestic consumer and exports were extremely limited, but in recent years there have been considerably brisk exports.

2) Novelties

There are no large companies in this sector. Ninety to 100 small and medium sized, or cottage sized, companies throughout the country mass produce various types of products. Their production capacity and production figures are unknown. Estimates have it that about half of their products (50 to 60 percent) are for the local market, but in recent years exports of some of their products, mostly superior ones, have been increasing considerably.

(2) Current State of Competing Countries

1) Korea

According to a survey of the Economic Planning Agency, manufacturers of ceramic tableware and kitchenware having over five permanent employees rose in number from 45 in 1984 to 87 in 1987. The number of employees in those companies rose from 7,603 to 10,644, but the average number of employees per company fell from 169 to 122. During this period, further, the per company value of production rose from 1,281 million won to 1,462 million won. This was due to the increasing mechanization accompanying rationalization measures meant to deal with soaring labor costs.

On the other hand, novelty manufacturers increased in number from 89 to 125 in the same period, with the total number of employees rising from 4,224 to 4,411. The number of employees per company, however, fell from 47 to 35. In the case of novelties, the per company value of production fell from 282 million won to 252 million won, with the companies thus becoming smaller in size.

The sizes of the companies are generally small in both tableware and kitchenware and novelties. In 1987, there were five tableware and kitchenware manufacturers with over 500 employees and just one such novelty manufacturer. As opposed to this, there were 66 tableware and kitchenware manufacturers of a small size with less than 100 workers (76 percent of the total) and 115 such novelty manufacturers (92 percent of the same).

2) Taiwan

According to a survey report on industry and commerce by the Statistics Office of the Administrative Yuan, there were 894 manufacturers of home use ceramic products as of October 1988. This represents the total of all business type enterprises, including cottage industries.

When one takes away the small sized cottage industries and jointly managed companies, one is left with the 165 companies of the Taiwan Ceramic Industry Association.

Of these 165 companies, 73 are manufacturers specializing in tableware and kitchenware, 83 are manufacturers of arts and crafts and novelties, and 39 are manufacturers engaged in production of both.

The Taiwanese manufacturers of home use ceramic products with less than 20 employees account for over half (503) of the companies. In recent years, the percentage of companies with fewer employees has been rising due to the shortage of labor.

Small and medium sized manufacturers are defined as those with an annual production of less than NT\$50 million (about US\$1.75 million). A full 852 companies, or 95 percent of the 894, fall under this category.

Since 1985 there have been no official statistics given on the shipments of home use ceramic products. According to nonofficial materials, NT\$6,773 million worth of tableware and kitchenware, NT\$9,285 million of arts and crafts and novelties, or a total of NT\$16,058 million (about US\$569 million) were shipped in 1988.

1-3. Position of Ceramic Industry

According to the National Economic and Social Development Board (NESDB), the ceramic industry accounted for 0.91 percent, or 1,770 million bahts, of the added value production (1972 real prices) of all manufacturing industries in 1980. This percent represents more than a three-fold growth over the 0.29 percent of 1975, five years before, but its share as an industry is still extremely small.

On the other hand, ceramic products accounted for 0.53 percent of the total value of exports as of 1988. The figure in 1980 was 0.25 percent, signifying a more than two-fold increase in eight years.

1-4. Industrial Organizations and Their Activities

At the present time, there are three organizations relating to the ceramic industry. All of these have few member companies and do not cover the industry as a whole. Further, they have not been active that long.

A summary of the three organizations is given below:

(1) Ceramic Industry Club of Thailand

This was established in 1980 and currently has 29 member companies. The members include manufacturers of tiles, sanitary porcelain, tableware and kitchenware, novelties, refractory brick, insulators, etc. and also manufacturers of raw materials and traders. The companies participating include not only large sized ones, but small sized ones as well.

The object of the establishment of the club was to assemble together companies for mutual cooperation. Specifically, the club engages in negotiations with the government of industrial policies, export marketing, participation in trade fairs, introduction of new technology, quality control, and training of technicians.

(2) Lampang Ceramic Association

This organization was established in 1989 and has 63 member companies. The majority of the ceramic manufacturers in Lampang in Northern Thailand are members (there are four to five outsiders).

The object of the establishment of the association was the promotion of development of the ceramic industry and coordination with the government for improvement of product quality so as to raise the economic level of Lampang and promote coordination in the industry.

Since the association has just been established, it has yet to do much in terms of specific projects or activities, but it is contributing to the reduction of fuel costs by the joint purchasing of fuel gas. The challenge for the time being will be the implementation of specific measures for improvement of quality.

(3) The Thai Ceramic Society

This organization is located in the Department of Materials Science, Faculty of Science, Chulalongkon University. It was launched from the club activities of the university about 20 years ago and began using the name of a "society" about 15 years ago.

The current members fall under the following three groups:

Students

Private individuals, small business owners, private ceramic lovers About 150

Corporations, ceramic manufacturers, material manufacturers, trading companies, etc.

About 50

The main activities include technical training for workers of ceramic manufacturers, seminars on new technology, business management, etc., and the like.

The society issues an annual journal in which it gives information on business trends, new technology, society activities, etc.

1-5. Problems and Countermeasures

In the present survey, we visited 44 ceramic manufacturers in Lampang, Chiang Mai, and Bangkok and its environs (including surrounding regions).

Generally speaking, one problem common to the three regions is the extremely good market for tableware and kitchenware and novelties. This has created a situation where anything produced can be sold regardless of the quality and this has led manufacturers to focus more on producing larger quantities than on improving the quality of the products.

Another problem is that while most manufacturers are aware of the unstable quality of locally-supplied raw materials (clay or stone), they can do nothing about it.

One reason for this is the heavy demand for raw materials from the ceramic industry in general, which has created a seller's market for raw material suppliers.

In addition, most of the manufacturers are small businesses and are not organized very tightly and thus their bargaining positions are weak with respect to the raw material suppliers. It has also been pointed out by some in the industry that there are problems with the management of mining concessions.

The quality of ceramic products, and tableware and novelty items in particular, is heavily affected by raw material quality, and the competitiveness of these products is in effect determined by the quality of raw materials which can be obtained. If the government hopes to promote exports, therefore, it must become fully aware of this problem and make proper use of the concessions.

Located in the northern region, in Chiang Mai city, is the Northern Industrial Promotion Center (NIPC), which is engaged in various projects for promotion of industry in the 17 northern provinces. The NIPC, however, suffers from a lack of staff and insufficient technical capabilities, so cannot fully cope with the needs of business. Further, the activities of the NIPC are not sufficiently publicized, so are not necessarily used by the industry.

To deal with this situation, the Ministry of Industry plans to establish a Ceramic Center in Lampang province. This center would be formed by breaking off the ceramic division of the NIPC and would work to raise the level of technology in the industry around Lampang and to promote the economic development of the region.

While there are differences in the size of companies in Lampang province, similar types of companies tend to concentrate in the same regions, so the establishment of the center in such an area would be effective in terms of provision of market information, technical guidance, and numerous other areas.

The industrial organizations, the NIPC, or the planned Ceramic Center have to strengthen much more their seminars, training, participation in exhibitions, and other projects much more.

Concerning raw materials in particular, there is a need to strengthen cooperative relationships between industry associations and improve the status of manufacturers. At

the same time, government-affiliated institutions should work to improve mutual cooperation and policy adjustment efforts and remove the restrictions on raw material supply. Furthermore, it is strongly suggested that the organizations of relevant government institutions (NIPC and the Ceramic Center) be reinforced and their cooperative ties with industry improved. In particular, the lack of interest and closed-mindedness regarding the collection of market information seen in some owners is a "state of mind" problem and will probably be impossible to change in the short term. Government organizations should exert effort in collection and dissemination of information and should engage in exchanges with industry so as to open up the minds of the managers. Toward this end, it is most important for the Ceramic Center to work to win the image of a reliable organization.

2. State of Supply and Demand

2-1. Supply

The only statistics that could be obtained on domestic production of tableware and kitchenware are for the nine companies covered by the investment promotion program of the BOI. The amount of production of other small and medium sized manufacturers is not known. Further, there are no production statistics on novelties. Therefore, it is only possible to roughly estimate the state of supply.

(1) Tableware and kitchenware

The nine major companies produced a total of 13,770 tons of tableware and kitchenware in 1985. This figure corresponds to 45.7 percent of the total 30,140 ton production capacity of the nine companies. From these production figures, the operating rate of the production facilities can be estimated as being 45.7 percent.

On the other hand, Thailand imported 7.5 tons of tableware and kitchenware in 1985, so the supply for that year was 13,777.5 tons.

Imports fell 37 percent in 1978 compared with the previous year, but this was due to a ban on all imports of ceramic tableware and kitchenware by the government in January of that year with the aim at protecting domestic products. The government once lifted the ban, except on porcelain, in March of the same year, and raised the tariff from the old 50 percent to 80 percent. This tariff rate continues even today.

The government also decided to ban imports of pottery and stoneware at the end of 1982 and enforced the ban from January of 1983, causing a sudden sharp drop in imports of tableware and kitchenware.

Next, the other 60~70 small and medium sized manufacturers for which production statistics are unavailable can be estimated to have a total production capacity of 20,500 tons.

The operating rate of the production facilities of the small and medium sized manufacturers is 41.5 percent, according to a survey on 41 manufacturers (including

manufacturers of novelties in addition to tableware and kitchenware) in Lampang by the Ministry of Industry's NIPC.

If we apply this 41.5 percent operating rate to the 60~70 small and medium sized manufacturers, we would get a figure of 8,058 tons ($20,500 \times 0.415$). If this is considered the production of the 60~70 companies and the 13,770 tons production of the nine companies mentioned earlier is added, the result would be 21,828 tons. This may be estimated as being the domestic production in 1985. By adding the 7.5 tons of imports to this domestic production, it is possible to estimate the total supply as being 21,836 tons.

However, exports have been growing tremendously since 1987. In addition to the establishment of new companies (including investments made by foreign companies), there are reports of expansion of facilities by existing companies. Further, from the increase in the supply of domestically produced clay, the raw material for tableware and kitchenware, etc., it is possible to deduce that there has been a striking increase in the production capacity of the tableware and kitchenware manufacturers, including small and medium sized enterprises.

A very rough estimate of the current production figures is given below.

Calculated from the production of just the previously mentioned nine companies and export and import figures, domestic demand in 1985 was 14,000 tons. Assuming that this remained constant, since 14,070 tons were exported in 1988 (assuming zero imports), then a figure of 28,070 tons is obtained as the production for 1988. This volume of production corresponds to about twice the production of 1985. If this rate of production growth is applied to the production of the small and medium sized companies as well, then their production would be two times 8,058 tons, or 16,116 tons. To total of the two, 44,168 tons, would be the domestic supply, but it is possible that one factor behind the upsurge in exports was a clearing out of inventories due to the good business conditions, so the actual domestic production in 1988 may be estimated to have reached around 40,000 tons.

(2) Novelties

Novelties are mainly produced in Lampang and Chiang Mai in the North, but considerable amounts are also produced in Bangkok and its environs. The types of novelties produced are diverse, including furniture, statuettes, decorations, etc. and most

of the producers are small or medium in size or else cottage industries, so data regarding production is not available. In general, however, it is considered that about half of the production is consumed domestically and the remainder is exported.

The amount of exports can be grasped from the trade statistics, so if it is assumed that half of the production is exported, then domestic production can be estimated by multiplying the export volume by two. The volume of exports in 1987 was 1,821 tons, so production in that year is believed to have been about 3,642 tons. Further, 174 tons were imported in the same year, so the supply can be estimated as having been 3,816 tons, adding the imports to the production.

Exports of novelties increased tremendously starting 1987 in the same way as tableware and kitchenware, so domestic production can be estimated as having grown correspondingly.

2-2. Shipment

(1) Tableware and kitchenware

Domestic demand for tableware and kitchenware has conventionally been divided into two groups. The first group is the demand for the medium and low class product market which accounts for about 80 percent of the total demand, including exports, which market primarily consists of medium and low income level households and general food stores and restaurants. The second group accounts for 20 percent of the total demand and consists mainly of demand from domestic, first class hotels, restaurants, high class food stores, and high income families. Exports are also included.

Exports, however, have been rising rapidly since 1987 and exports of products of the medium class and down have grown due to the diversification of overseas markets and other factors. Great changes have been seen in the demand situation for medium class and high class goods and in the export ratios.

The amount of domestic demand for tableware and kitchenware cannot be determined due to the incompleteness of production statistics.

(2) Novelties

In the same way as tableware and kitchenware, the state of production of novelties is unknown, so the domestic demand cannot be grasped.

(3) Sales Channels

Tableware and kitchenware and novelties for domestic demand in general go from the manufacturers through agents or distributors to the retailers and from the retailers to the end consumers. Hotels, restaurants, or mass merchandising department stores or supermarkets, however, usually directly purchase from the manufacturers.

Further, in general, small and medium sized enterprises rely to a relatively high degree on agents for their sales, including their exports, and do not seem to have a sufficient grasp of the margins in the distribution stage or the final sales prices.

In particular, in the case of exports, agents play a large role for the Lampang manufacturers or the small sized manufacturers in the suburbs of Bangkok. Agents in Bangkok purchase goods from large numbers of manufacturers and perform inspections and grading of products using their own standards so as not to sell substandard items. Another major role of the agents is communication between the manufacturers and the foreign importers. The usual business negotiations and collection of information are performed by the agents. The agents are also seen as taking care of delivery control of products for the foreign importers.

2-3. Imports

In January 1978, the government instituted a complete ban on imports of ceramics so as to protect domestic products. In March of the same year, however, it lifted the ban for items other than porcelain. As a result, imports of ceramic tableware and kitchenware have been extremely low.

In place of porcelain, imports of pottery (including stoneware) increased. Imports as a whole subsequently rose.

Nevertheless, the government then placed a ban on imports of pottery in January 1983, resulting in imports of tableware and kitchenware falling to almost zero. Imports totaled 7 million bahts in 1986, but only 360,000 bahts in 1987.

These imports were of high class items for use in hotels. Since March 1983, imports have been allowed with the condition that the hotel name or trademark be clearly indicated on the product.

On the other hand, there has been a large influx of Chinese made novelties. In 1977, these captured over half of the import market of Thailand. Following this, there was a striking rise in imports from Italy, with that country capturing an over 31 percent share of the market in the same year. Spain has also achieved large growth, though its share is still small. As opposed to this, the traditional suppliers of Taiwan, Hong Kong, Japan, and West Germany lost their markets in Thailand.

Novelties are an extremely labor intensive industry and costs directly rebound in price competitiveness. The share of imports from the U.K. has fallen, but value-wise remains about the same due to traditional competitive features (quality, design, etc.) other than price, it seems.

2-4. Problems and Countermeasures

At the present time, Thai tableware and kitchenware and novelty products of the medium class up are mostly exported, while those of lower classes are sold on the domestic market. The majority of the companies visited in the present survey sold both to the export and domestic markets, but a careful look at the actual situation shows that they can be classified into two groups: export oriented companies and domestic market oriented companies.

Right now, the state of production of tableware and kitchenware and novelties in the country as a whole is unknown. There is no grasp of the production capacities, production volumes, or the rate of operation. Without knowing the supply capacity (production), one cannot formulate export promotion plans (projections). Further, it is necessary to obtain a grasp of the rankings of quality in production as a whole (for example, the shares of A class products, B class products, etc.).

Also, to expand production, establishment of a system of supply of raw materials, including imports, would be essential. It is therefore necessary to obtain a grasp of the domestic production of raw materials, for example, the percentage of production of good quality materials suitable for ceramics, in particular, production of tableware and kitchenware and novelties, in the production of kaolin. This would require the establishment of statistics on production of different grades of raw materials.

On the other hand, in promoting exports of both tableware and kitchenware and novelties, a certain degree of consideration must be given to a balance with the domestic market. Overreliance on overseas markets would make the industry very susceptible to overseas economic recessions, fluctuating exchange rates, etc., which could seriously rebound and cause employment problems in the ceramic industry, which is highly labor intensive.

3. Exports

3-1. Summary of Exports

Exports of tableware and kitchenware and novelties remained substantially the same up until 1984, but large growth was shown in both items starting in 1985. In particular, in 1988, exports of tableware and kitchenware increased almost five-fold and novelties 1.7 fold. (Fig. IV-3-1)

(1) Tableware and kitchenware

First, a look at the export destinations in 1988 shows the U.S. absorbing almost half of the exports. Belgium, the Netherlands, the U.K., and other West European countries each accounted for several percent of the market. (Fig. IV-3-2)

Next, a look at the changes over the years shows the total value of exports growing by a tremendous 323 percent and 387 percent in 1987 and 1988, compared with the previous years. A look at this situation by country shows exports to the largest market, the U.S., rising over four-fold in 1987 and almost six-fold in 1988.

In addition, particular note should be taken of the remarkable growth in exports to the Netherlands, Belgium, the U.K., Italy, and other West European countries. For example, in the case of the Netherlands, exports stood at 126,000 bahts in 1986, accounting for a 0.4 percent share, but increased over 60 fold to 7.262 million bahts in 1987, growing to a 6.0 percent share. Similarly, exports to Belgium grew widely from the 205,000 bahts of 1986 (0.7 percent) over 50-fold to 9.059 million bahts (7.5 percent) in 1987.

Exports to Japan increased over twice the previous year in 1988, but the overall growth in exports was larger than that, so the share fell from 5.5 percent to 4.4 percent.

(2) Novelties

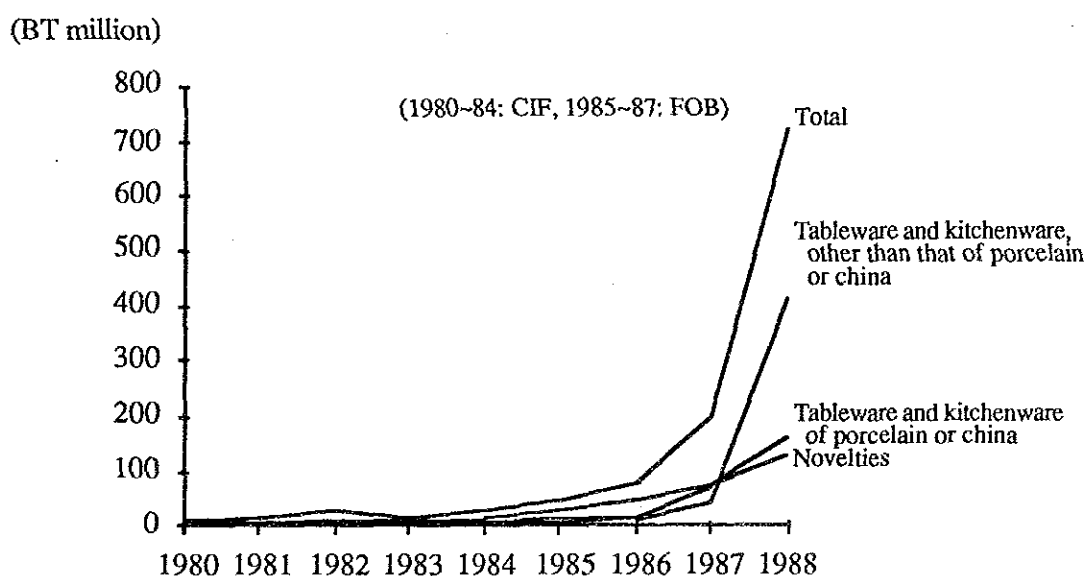
Exports of novelties also grew slowly up until 1984, in the same way as tableware and kitchenware, but rapidly rose starting in 1985. That is, exports grew 97.3 percent in 1985, 80.1 percent in 1986, 53.3 percent in 1987, and 73.5 percent in 1988.

The biggest market is the U.S., but note should be taken that in 1986 Hong Kong absorbed over one-quarter of Thai's exports. The U.S. accounted for 27.9 percent of all exports in 1988, about twice that of the second place West Germany. (Fig. IV-3-3)

In the same way as with tableware and kitchenware, exports to the West European countries rose rapidly in this sector. That is, there was large growth in each year in exports to France, West Germany, the Netherlands, and the U.K., with these countries thus growing into large markets for Thailand.

Japan also grew rapidly as an export market and in 1988 accounted for a 9.2 percent share of Thailand's exports.

Fig. IV-3-1. Trends in Exports of Tableware and Kitchenware and Novelties



Source: Department of Customs, Foreign Trade Statistics of Thailand

Fig. IV-3-2. Share of Main Export Destinations of Tableware and Kitchenware (1988)

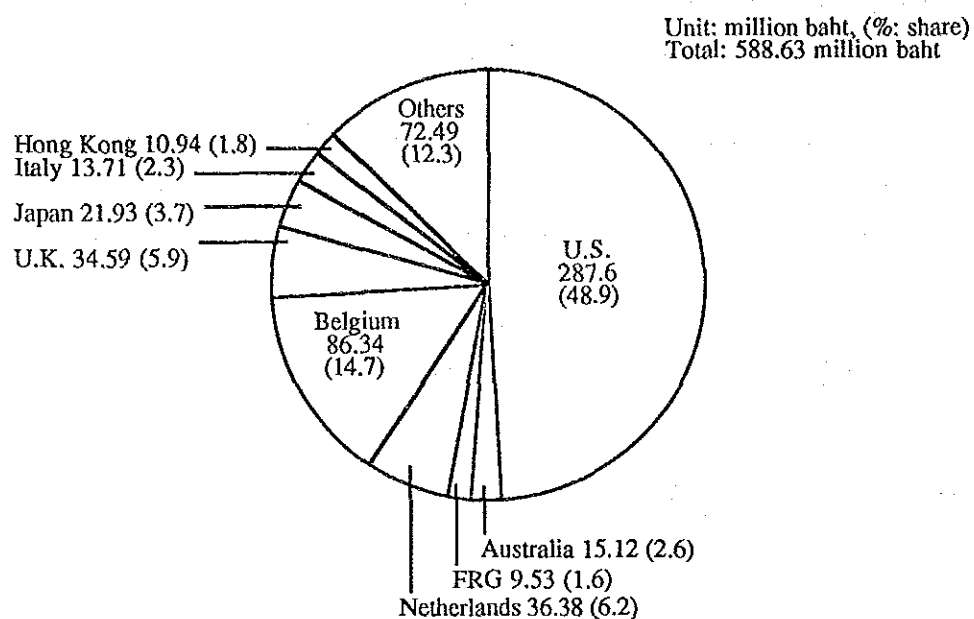
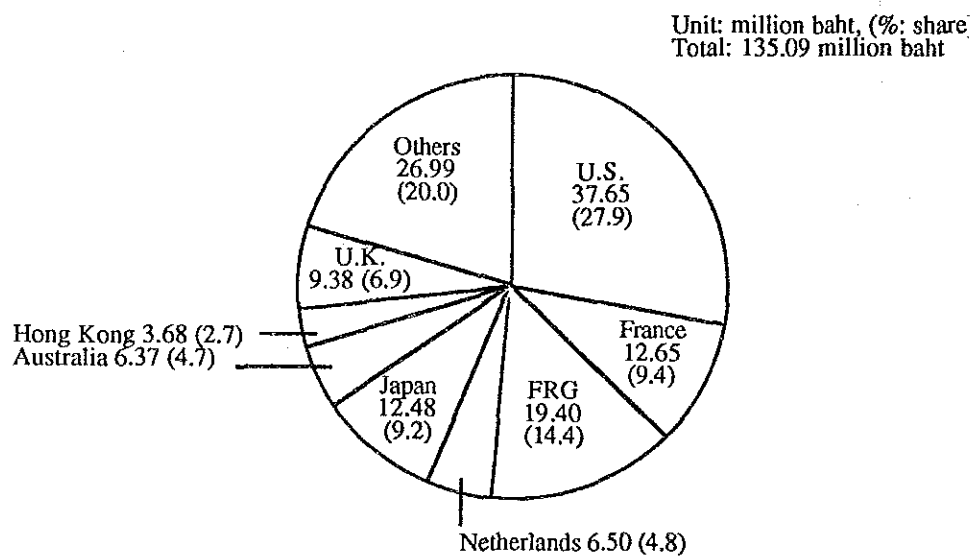


Fig. IV-3-3. Share of Main Export Destinations of Novelties (1988)



3-2. Position of Thai Products in Export Markets

(1) Summary

The UN Yearbook of International Trade Statistics reveals the global trade for the following three types of ceramic products:

(1) Porcelain (tableware etc.)	6664
(2) Other porcelain (tableware etc.)	6665
(3) Ceramic novelties etc.	6666

Global trade in these three items in 1986 totaled US\$866.4 million in porcelain (tableware etc.), US\$674 million in other porcelain (tableware etc.), and US\$710.7 million in ceramic novelties etc. Of this, Thailand accounted for US\$700,000, US\$1.4 million, and US\$2.6 million, very small amounts. Thailand's shares were 0.1 percent, 0.2 percent, and 0.5 percent, respectively, with only slight growth shown in ceramic novelties etc.

Of the three items, exports from Thailand grew in ceramic novelties etc., with the value of exports rising over seven-fold from the US\$500,000 in 1982 to US\$2.6 million in 1986 and the share rising from 0.1 percent to 0.5 percent. Thailand's exports of the other two items either remained steady or fell slightly.

Thailand's exports of ceramic products, however, have grown rapidly since 1987, so the share of these exports in global exports probably has increased as well.

3-3. Main Markets

(1) U.S. Market

1) Summary

The U.S. is the biggest market for Thai ceramic products. The U.S. market for home use ceramic products was worth US\$2,188.98 million in 1988, of which about 60 percent was imported. Imports have increased by an average annual 11.9 percent looking at the period from 1984 to 1988.

Imports of ceramic products from the Southeast Asian countries have increased faster than even those from the NIEs.

The increase in imports from Thailand has been particularly striking, with imports of ceramic tableware and other household goods (except bone china products) increasing eight-fold in value and 16-fold in volume in the period from 1984 to 1988. Further, imports of earthenware tableware increased 96-fold in value and 50-fold in volume in the same period. Also, while small in value, imports of earthenware and stoneware smoking utensils and other household goods rose over six-fold.

A look at the share of Thai products in the U.S. market in 1988 shows products other than bone china tableware, for which import figures are not available, accounting for 0.2 percent to 2.2 percent of the market.

Blue and white patterned Thai products are well known in the U.S. industry. The types of products include napkin rings, spoon holders, mugs and cups, canisters, etc. In addition, there are good gift items and novelties. Thai products are evaluated as being of good quality in view of their price compared with the products of the NIEs and other Southeast Asian countries.

2) Evaluation of Thai Products

U.S. business (importers, manufacturers, and retailers) evaluate Thai products in various ways. A summary of their evaluations is given in Table IV-3-1.

The biggest problem in imports from Thailand is delivery times. Sharp criticism is leveled at the insufficient observance of commitments. In particular, Thailand was considered inferior to the NIEs on this point. Since this was a problem with orders of large lots (in particular of the production system of Thai manufacturers), the countermeasure taken is sometimes to order small lots.

In terms of price, Thai products are competitive. The sales method (routes), however, is considered inefficient since direct transactions with Thai manufacturers are difficult and intermediaries are used. U.S. businesses do not consider the Thai manufacturers to have any basic sales ability. For example, if the manufacturers were to decide on a sole agent for a particular market and push sales through the same, they could probably raise the image of their products, it was considered.

Table IV-3-1. Opinions in U.S. About Thai Products

	Importers (11)	Manufacturers (13)	Retailers (10)
Quality	Fair - very good	Color and dimensions not uniform - very good	Good - very good
Design	Ordinary - many copies	Old fashioned - new design development required	Technical problems exists - very good
Delivery control	Poor - over 30 days required by sea	Late - inferior to NIEs	Poor - importers deal with this by small lots
Price	Very competitive - better than NIEs	Competitive with NIEs	Good - high (not as cheap as Chinese products)
Sales methods	Too many intermediaries	Not efficient	- No response -

Note: The figures in parentheses indicate the number of respondents.

Source: Interview survey

(2) Australian Market

1) Summary

The Australian market for ceramic products was worth 220 million Australian dollars (hereinafter abbreviated as A\$) in fiscal 1989 (July 1988 to June 1989). A breakdown shows domestic production accounting for A\$102 million, imports A\$119 million, and exports A\$1 million.

Of this, tableware and kitchenware accounted for A\$98 million (domestic production A\$17 million and imports A\$81 million), with imports accounting for about 83 percent of this. Novelties are not produced domestically and are all imported.

Australian ceramic manufacturers are weak overall in competitiveness and imports are increasing. In particular, there has been striking growth in imports of high value added tableware and kitchenware.

The domestic production supplies about 16 percent of the domestic market and competes with imports from the NIEs and the other ASEAN nations in the area of medium and low class products.

The main countries of origin are the U.K. and Japan, but in recent years imports have been rapidly increasing from Southeast Asia too. The share of the seven Southeast Asian countries, including Thailand, has risen from the 22 percent of 1985 to 33 percent in 1989, while the share of Japan, the main country of origin, has been cut in half from 39 percent to 18 percent in the same period.

Thailand holds only a small 2 percent share (1989), but the value of imports from that country has risen from the A\$767,000 of 1985 to A\$2.759 million in 1989 - a 4.6 fold increase. The main items being imported are porcelain and ceramic dinner sets, tea sets, kitchenware, and novelties, with novelties in particular rising in imports. In 1989, novelties accounted for 29.1 percent of the total import value.

2) Evaluation of Thai Products

The rapid surge in imports from Thailand attests to the high marks given to the quality and price of its products in the market.

According to interviews with industry experts, there are no complaints as to the quality, design, or price of the products. According to Thebe International Pty Ltd., the largest importer of ceramic products, Thai products are treated as of medium class. As opposed to this, the products of China, the biggest supplier among the Southeast Asian countries, are considered to be cheap items.

(3) Japanese Market

1) Summary

According to I/O tables, there were 1988 places of business in Japan engaged in the manufacture of tableware and kitchenware 529 in the manufacture of novelties. A look at this by size shows that small and medium sized enterprises with less than 200 employees accounted for 1972 of the tableware manufacturers (99.2 percent) and all of the novelty manufacturers. In particular, there is an overwhelming number of cottage sized enterprises with less than 20 workers (83.4 percent of tableware and kitchenware manufacturers and 88.7 percent of novelty manufacturers). (Table IV-3-14)

In the main producing countries of the West such as the U.K., West Germany, and the U.S., the factories generally have 150 to 200 workers - a significant difference from the small sized factories of Japan. The biggest reason for this is believed to be that in the West everything from the refining of the raw materials to the painting is handled vertically in-house, while in Japan there is a division of labor for each of the work processes. That is, there is considerable specialization in work, with there being clay and glaze manufacturers, base manufacturers, decorators, manufacturers of saggers and other ceramic tools, manufacturers of plaster molds, etc.

A look at the value of shipments shows that there is high export reliance in Japan both in tableware and kitchenware and novelties. However, in 1985 to 1986, due to the impact of the yen appreciation, the share of exports plummeted. In the years 1982 to 1985, over half of the tableware and kitchenware produced was exported, but in 1989 exports had fallen to just over 35 percent. The share of exports of novelties also fell from around 90 percent to 43 percent in that period. During the same period, imports gradually rose and the apparent domestic consumption increased in both items.

In the Japanese tableware and kitchenware market, household demand and gift demand account for large market shares. In addition, there is institutional demand such as for hotels and restaurants. As a recent trend, all families have experienced an improvement in their standards of living and are now equipped with almost everything they need, so interest is rising in tableware less as necessities than as means for enjoying their lifestyles. Therefore, the demand for higher class goods has been growing relatively.

On the other hand, there was a large growth in apparent domestic demand for novelties starting 1989, but this has a lot to do with the decline in exports due to the yen appreciation. Recently, however, demand has been growing due to the diversification of consumption accompanying the improvement of the standard of living.

2) Imports

The main countries of origin of tableware and kitchenware imported by Japan are the U.K., West Germany, Denmark, and other European countries. Japan only imported about 130 million yen worth of tableware and kitchenware from Thailand, a mere 1 to 2 percent of its imports.

As to the countries of origin of novelties, Italy and South Korea stand fairly shoulder to shoulder in the lead, followed by Taiwan and China. Thailand has increased its share tremendously in the past three years and in 1989 accounted for 2.7 percent of the imports.

3-4. Exports of Competing Countries

(1) Korea

The structure of exports of ceramic products changed dramatically in the period from 1973 to 1986. That is, the share of tiles, which accounted for about 87 percent of exports of ceramics in 1973, plummeted to 11.5 percent by 1986. This was due to the changeover of tile production to an emphasis on domestic demand. As opposed to this, the relatively high added value tableware and kitchenware and novelty sectors grew tremendously in exports during the same period and came to account for 61.6 percent and 25.1 percent of exports of ceramic products in 1986.

The main markets for exports are the U.S., Europe, and Japan. The main export items are, in tableware and kitchen ware, coffee sets, plates, and bowls.

(2) Taiwan

Exports of ceramic products mainly consisted of novelties up until the early 1980s, with tableware and kitchenware exports only coming to about 20 percent those of novelties. The quality of tableware and kitchenware rose and competitiveness increased, however, resulting in tableware and kitchenware exports coming to 35 percent of novelties in 1988.

In 1989 (estimated), Taiwan exported about NT\$4 billion worth of novelties and over NT\$2.5 billion worth of tableware and kitchenware, with the latter thus corresponding to over 60 percent of the former.

The difference between tableware and kitchenware and novelties is that exports of the former were primarily for the inexpensive product market up until the beginning of the 1980s, but improvements in technology and quality made possible exports of high class products for the general home.

As opposed to this, no progress has been seen toward westernization of novelty designs. Only copies are made of Western products. Further, there is a limited range of designs of Chinese style novelties. As a result, exports are not stable.

The export destinations are primarily the Western countries, in particular the U.S., for both tableware and kitchenware and novelties.

3-5. Problems and Countermeasures

The following problems may be pointed to in exports of Thai products judging from Table IV-3-1:

- | | |
|-----------------------|---------------------------------------------------------------------------------------|
| (1) Quality: | Colors and dimensions are not uniform. |
| (2) Designs: | There are many patterns, but they are old fashioned and there are technical problems. |
| (3) Delivery control: | Poor and slow (inferior to NIEs) |
| (4) Prices: | Competitive, but not as cheap as Chinese products. |
| (5) Sales methods: | Too many intermediaries, inefficient. |

In summary, there are problems in all areas except for prices. In particular, U.S. businesses strongly criticized the delivery control.

These problems seemingly were problems faced by the majority of the factories visited in the present survey and cannot be resolved overnight.

With the exception of a few large companies and the foreign capital affiliated companies, the majority of the factories did not have any specialized technicians or designers. Further, there were only specialists in charge of sales, including exports, in exceptional cases.

To promote exports, these problems have to be resolved. For the time being, it is important for the ISD, NIPC, or industrial organizations to cooperate and sponsor seminars, bring over foreign technicians, etc. so as to disseminate knowledge and information and raise the awareness of the owners. In the medium and long term, it will be necessary to augment the technical capabilities and guidance abilities of the Ceramic

Center for Lampang, where there are many problems with quality, and to develop human resources in coordination with industrial organizations.

Note: Information on key markets and the current state of competition from other countries contained in this chapter is based on the Survey of the Market and Survey of Competing Countries by JICA.

4. Production Activities and Technology

4-1. Product Development

(1) Current State

Product development must be considered from two angles: One is the development of new products differing from old ones in the properties of the materials used and production factors. The other is design development of color, shape, patterns, and the like.

The former new product development starts with basic research and constitutes the development work up until the establishment of the production technology, so a high level of technical ability is required. The latter design development is primarily the province of designers and production engineers and should be performed constantly during the production activities.

In so far as the manufacturers visited in the present survey go, there were no companies seen which had the technical ability enabling them to develop new products with different material properties than old products, products with high degrees of whiteness, and other different qualities like those of bone china. At the present, even the technical capabilities for improving the productivity of products seem to be weak.

Design development is essential for corporate survival. All companies are working at it, but some differences were seen according to region. In Lampang, many manufacturers were seen relying on the designs of the buyers, while in Chiang Mai, a strong trend toward independent design development was felt. In Bangkok, the situation was diverse, with some manufacturers relying on the designs of the buyers and others primarily developing them on their own.

(2) Considerations

In the future, to achieve further growth as an export industry, stress should be laid on both strengthening the development capabilities for the quality and designs sought by the market and the development of new products with different characteristics of those currently in production.

The majority of the manufacturers visited, it was observed, did not have any designers. Strengthening of the design development capabilities requires training of designers. In parallel with this, overseas information should be acquired and inspections and surveys made of overseas markets. The function of acquiring overseas information preferably should be given to the Ceramic Center now under planning. The inspections and surveys of overseas markets would probably have to be done in cooperation with the DEP, ISD, DIP, and other government organizations.

There is little possibility of the companies engaging in new product development on their own. Therefore, a system will have to be set up wherein the NIPC and the Ceramic Center do the basic research and then work with the companies for research into the production technology for commercialization of the same.

4-2. Procurement and Preparation of Raw Materials

(1) Lampang

The majority of the manufacturers in Lampang have stone washing facilities on their own factory grounds. These manufacturers mix about 10 to 20 percent of black clay in the washed materials to make the body. The black clay used by the factories differs in origin. In some cases, use is made of clay from Chiang Mai, Lampang, or Southern Thailand.

The method of washing in the Lampang manufacturers is in general as follows:

- [1] The stone material is crushed by the wet method.
- [2] It is made into a slurry state by an agitator.
- [3] The result is placed in a settling tank and allowed to stand to separate out the rough silica component.
- [4] The supernatant mixture of the clay and fine silica is transferred to a tank.
- [5] Black clay slip is added to this to make the clay slip.
- [6] Water is removed by a filter press to make the body.

The quality of Lampang stone is not uniform. It is not clear how it fluctuates. Therefore, it may be said that the quality of the materials after the washing process is not stable at the present. Further, there is no grasp of the state of its changes.

The manufacturers each prepare their own glazes. The general method they use for this is to mix and crush the materials by the wet method with a crusher or a ball mill. Screening is performed using a sieve, but iron is not removed by a ferrofilter.

(2) Current State in Chiang Mai

Most Chiang Mai manufacturers produce traditional Thai celadon. The materials are prepared using traditional methods. The main material used is the black clay produced in the Mae Rim county in the suburbs of Chiang Mai. The material includes pieces of wood and other foreign matter, so these are removed by the dry or wet method to make the body. In one factory, the black clay was used as is. Also, some manufacturers were seen mixing in about 10 to 20 percent of refined materials produced in Lampang.

The glaze is prepared by traditional methods like the body. The main materials are wood ash and surface clay from the rice fields. In one method, the wood ash is washed and repeatedly allowed to settle to remove the water soluble components and mixed and crushed with surface clay.

(3) Bangkok and Environs

1) Large Sized Tableware Manufacturers

Body and glazes were being prepared by the individual factories themselves. The kinds of materials used fall under the category of factory secrets, and details could not be obtained. Some of the materials are imported.

2) Joint Ventures with Foreign Capital

The two manufacturers which were joint ventures with foreign capital were importing all of their prepared materials. The local factory did not have any facilities for their preparation.

3) Small and Medium Sized Manufacturers

Most factories were purchasing body prepared by Compound Clay Co. of Bangkok. Several factories were observed to be purchasing materials and preparing them on their own and others were observed to be using materials imported from abroad.

(4) Considerations

1) Lampang

The manufacturers rely on Lampang stone for much of their materials, but do not check the quality of the Lampang stone and further do not exercise technical control over the washing in the factories. Therefore, the quality of the body fluctuates, causing various problems in production, it is believed. First, it is considered necessary to establish a method of checking the quality of the materials and body and achieving stable quality. Some public organization, for example, the NIPC or the Ceramic Center, should take the lead in tackling this problem.

2) Chiang Mai

Body and glaze are manufactured here by traditional experience. In the future, to stabilize the quality and increase production, it will be necessary to introduce scientific measurement technology and modern facilities. The NIPC and the Ceramic Center should be active in this area too.

3) Bangkok and its Environs

Almost all small and medium sized manufacturers relay on Compound Clay Co. for their body and glazes, so stabilization of its quality is essential. Cooperation and assistance from public organizations would probably be necessary for this.

**Table IV-4-1. Procurement of Materials by Manufacturers Visited
and State of Procurement**

	Lampang	Chiang Mai	Bangkok and environs		
			Large size tableware makers makers	Foreign capital affiliated	Small and medium sized makers
Clay					
Main ingredients	About 80~90% is Lampang stone, and small amount of black clay	About 80~90% is Mae Rim, black clay, and small amount of Lampang clay	Details unknown	Imports (clay)	Clay mostly purchased. Some made by own factory
Preparation	Washing in own factory (to remove silica component)	Used as is or treated to remove pieces of wood	By own factory	—	Prepared clay purchased Some made by own factory
Glaze					
Main ingredients	Lime glaze (lime- stone, feldspar, clay, silica)	Wood ash glaze	Details unknown	Imports (glaze)	Lime glaze (limestone, feldspar, clay, silica)
Preparation	By own factory	By own factory	By own factory	—	Majority purchased, some made by own factory

4-3. Molding

Almost all of the small and medium sized manufacturers in the Lampang, Chiang Mai, and Bangkok environs use casting as their main method of production. Some factories use hand jiggers to produce rice bowls and plates.

(1) Molding by Casting

1) Quality of Slip

The slip is prepared by adding water and a deflocculant to the body and mixing with a ball mill or agitator. There are not any particular problems in terms of facilities.

Stable production requires control of the properties of the slip, i.e., the viscosity, water content, and the amount of the deflocculant, but at the present time almost no interest is shown in this. Further, as the standardization of operations for removing air holes from the slip has not advanced, pinholes often arise.

2) Quality of Gypsum Molds

The quality of the cast product is considerably influenced by the quality of the gypsum molds. That is, gypsum molds are used repeatedly, so the molds, which are not that hard, gradually become worn and change in shape. Therefore, the number of repetitions of use should be limited, but almost all manufacturers use them until they break. A case was seen of a Bangkok manufacturer with extremely good quality products which discarded molds after using them 40 to 50 times, but the majority of factories use the molds an estimated 150 to 200 times. Further, no measures were taken, except in a few factories, to increase the hardness of the gypsum molds.

(2) Molding by Jiggers

Factories producing mainly novelties used primitive manual jiggers. One exception was a factory mass producing tableware and kitchenware, which used automatic jiggering machines. Another manufacturer was planning to produce large planters using mechanized jiggering machines developed on its own.

The kneading process is any important part of the molding work, but this is currently neglected and the molding is performed with insufficient kneading.

(3) Drying

The drying after the molding is primarily natural drying, making it difficult to deal with changes in seasons.

(4) Considerations

To raise the quality of the products, it is necessary to use proper molds in the molding process. At the present time, many of the factories seem to consider that gypsum molds should be used until they break. First of all, this way of thinking must be changed. Further, training will be required in the fabrication of molds.

Extremely elementary methods are used for production in both the case of use of jiggers and casting and many small defects appear in the products. Work training and guidance are required to reduce these small defects in products for export.

4-4. Decoration

(1) Current State

Almost all the novelties in Lampang are produced with under-glaze decoration. Further, some use color glazes. Among these, blue and white decoration is prevalent.

The Thai Celadon of Chiang Mai falls under the category of color glazed products, but this is natural color formation using wood ash and no pigments.

The factories in Bangkok and its environs carry out under-glaze decoration, color glaze decoration and over-glaze decoration. Special items are decorated with lacquer paint.

(2) Considerations

The products of the small and medium sized manufacturers include numerous hand painted items. Especially, many of the novelties, such as miniatures and pottery dolls, are hand drawn. In many places, over half the employees are engaged in decoration work.

The decoration can have a major effect on productivity depending on the design. That is, an awareness of industrial design is important so as to determine how designs should be made from the standpoint of production costs.

To raise the technical level of the decoration process and improve the quality and quantity of the decoration work, training is required. Preferably the Ceramic Center would provide assistance in this regard.

4-5. Firing

(1) Current State of Firing Facilities

In the process of development of the ceramic industry, which goes back far in history, firing facilities have progressed from simple kilns to dragon kilns and on to tunnel kilns and shuttle kilns. The source of fuel has also changed from firewood to coal, oil, electricity, and LPG.

The optimum firing facility depends on the product produced. A tunnel kiln is most suited for mass production of tableware and kitchenware, while in general shuttle kilns are built for novelties. Further, it is necessary to use electric furnaces for production of dolomiteware.

Chiang Mai has a long history of ceramic production and primarily makes traditional celadon products. The firing facilities are also old fashioned, i.e., simple kilns using firewood are still in operation. Modernization is underway, though gradual, and several factories have installed shuttle kilns with superior heat efficiencies incorporating modern foreign technology. Extremely good results are being obtained. In the future, improvements will probably continue to be made.

The novelty producing factories visited in Lampang had an average of three to four shuttle kilns in operation. One factory was seen which had 10 such facilities. Modern, imported kilns have still not yet been introduced, however, i.e., all are made in-house, and there is considerable room for improvement.

(2) Considerations

The kiln facilities of Thai ceramic manufacturers are mostly shuttle types. The situation is as follows:

- Most of the shuttle kilns have a volume of 2 to 3 cubic meters, though an exceptional kiln of 8 cubic meters was also seen.
- In so far as the manufacturers visited went, the Lampang region had the most number of kilns per factory.
- Lampang has not yet introduced any imported kilns.

- Chiang Mai and Bangkok are expected to increase their usage of imported kilns in the future.

Further, other firing facilities were also observed. The situation with them was as follows:

- Dragon kilns were found mainly in Lampang
- Simple round kilns were found in Chiang Mai
- Electric furnaces were mostly for dolomite ware.
- Tunnel kilns are unsuited for the celadon of Chiang Mai and were not installed.
- All the tunnel kilns were imports.

Table IV-4-2. State of Firing by Manufacturers Visited

	Lampang	Chiang Mai	Bangkok and environs		
			Large size tableware makers makers	Foreign capital affiliated	Small & medium sized makers
Kiln facilities [hardware]	Majority is shuttle kilns. Most places having 3-4 kilns made in-house. In some places, old fashion dragon kilns operating. A manufacturer equipped with tunnel kilns.	Majority is shuttle kilns. Mostly made in-house, but in recent years, imported kilns being installed. Old fashion single kilns still remain.	Tunnel kilns of advanced countries	Tunnel kilns or shuttle kilns of advanced countries. Electric furnace (imported) used in dolomiteware factory.	Mostly shuttle kilns made in-house. Some introducing imported kilns. Electric furnace (imported) used for dolomiteware.
Technical staff	None	None	Some technical staff	Some technical staff	None
Software	Generally, lack of technical knowhow	Somewhat insufficient	No problems	No problems	Generally, lack of technical knowhow

4-6. Problems and Countermeasures

(1) Information Concerning Products for the Export Market

In order to develop the ceramic industry as an export industry, it is necessary to obtain information concerning the products that will be accepted in overseas markets, and to expand the capacity that can design these products. However, most of the small and medium size manufacturers we visited seemed to be lacking in this capacity.

Small and medium size manufacturers, when they gather product information for the export market, seemed to have difficulty in responding by solidifying and developing information sources, in communication and understanding foreign languages, in securing staff, and in bearing the costs etc. In each of the small and medium size manufacturers, we got the feeling that they were not progressing at all in gathering product information.

For this reason, it would be useful at present to establish a function, as a public institution, which would acquire product information concerning the overseas market, and publicize it in a form easily understood by the ceramic manufacturers.

(2) Manufacture of Raw Materials at Lampang Ceramic Manufacturers

The majority of Lampang ceramic manufacturers make their own body. However due to the unstable composition of the stone, the lack of technical control over processing methods, and the insufficiency in equipment, body of consistent quality is not manufactured. This is not a problem when producing and shipping low cost and low quality goods. However, in order to enter the higher quality and higher price product field, stabilizing the quality of the body is indispensable.

For this reason, at least the following are necessary for ceramic manufacturers:

1. Knowledge concerning raw material character and product quality.
2. Introduction of appropriate control methods for processing raw materials.
3. Moving towards routine checks of body quality.

However, a key point for obtaining stable body is for the mining companies to supply the ceramic manufacturing companies with raw materials of consistent quality. There is an immediate need for mining companies to firmly establish their quality control methods.

(3) Quality Control of Slip and Gypsum Molds

Small and medium size manufacturers mainly use casting as their molding method. However, it could be seen that the quality of slip and the gypsum molds extended a deleterious influence over productivity and product quality.

For the slip, there were insufficient checks concerning the amount of water and deflocculant. At least undertaking checks using measuring equipment should be inserted into the manufacturing process. Concerning the gypsum molds, there are still many manufactures with the concept of "use them until they break." It is necessary to revise this concept, and to saturate them with the idea that there is a limit to the number of times gypsum molds can be used.

Finally, introducing vacuum agitators for manufacture of the slips, and for the manufacture of gypsum molds, would be advantageous to the improvement of product quality.

(4) Improving the Efficiency of Decoration Through the Introduction of Industrial Design

Along with the recent increase in Thai ceramic exports has come an increase in hand painted products which are the main export product of small and medium sized manufacturers. For this reason, a trend has appeared which is a shortage of workers skilled in hand painting. There is the possibility that this will prove a bottleneck in the expansion of exports by small and medium sized manufacturers.

For this reason, there is a necessity for steps to carry out greater manufacture of export products with a limited supply of skilled workers. Thus it is necessary to actively introduce industrial design, such as technology to improve productivity by the betterment of decoration design itself, as well as technology involving the joint use of transfer papers and hand paintings.

(5) Inefficiency of In-house Shuttle Kilns

There were many cases of shuttle kilns being the main firing equipment, among the ceramic manufacturers we visited. Further many of the manufacturers had in-house kilns, 31 out of the 44 we visited. However, as inappropriate designs and materials were

used, there were many cases of inefficiently heating kilns. In the future, these inefficient kilns should be replaced, but for the present production using these kilns is unavoidable.

For this reason, it is necessary to cover these defects with operation technology of firing, and to strengthen measures to maintain product quality. In this regard, at least the system for the adjustment of the conditions which cause the defects after firing and pursuit of these causes is necessary.

(6) Reinforcement of Technical Support System in Lampang

Through visits to the manufacturers in Chiang Mai, Lampang and Bangkok, we were made aware of the necessity of technical support, particularly for small and medium sized manufacturers in Lampang. In the future, in order to increase their ratio of activities in the export field, as a ceramic manufacturer it is necessary to improve their quality and their yields. At the same time, technical support of ceramic manufacturers is indispensable. For this reason reinforcement of technical support by official organizations in Lampang would be desirable.

5. Corporate Management

5-1. Establishment of Sales Targets

(1) Small and Medium Sized Manufacturers in Chiang Mai

In Chiang Mai, the foreign tourist market and the export market are the main sales channels for most manufacturers producing traditional celadon novelties. In general, the quality of the products is higher than that of the Lampang ceramic manufacturers and the price is set higher accordingly.

(2) Small and Medium Sized Manufacturers in Lampang

In Lampang, most of the manufacturers determine which items to produce and set quality and prices targeting primarily the domestic market. The domestic market is founded on inexpensive products, so in most cases the manufacturers produce and ship out low cost, low quality items. Therefore, they are not positive when it comes to investment in manpower, facilities, technology, etc. as these would lead to higher production costs. The tendency is strong to maintain the status quo.

(3) Small and Medium Sized Manufacturers in Bangkok and Environs

The small and medium sized manufacturers in this region may be roughly divided into those which target the domestic market and those which target the export market. In general, factories with over 60 workers tend to produce and ship out products primarily for export.

The products of the small and medium sized manufacturers engaged primarily in exports include numerous relatively large sized items and hand painted items. Further, some artistic products were also observed. In other words, the manufacturers were targeting fields of products difficult to mass produce by machine and requiring input of considerable skilled labor.

(4) Joint Venture Manufacturers with Foreign Capital in Bangkok and Environs

Recently, joint ventures have been seen established in Bangkok with Taiwanese, Japanese, and other foreign capital. Behind the entry of this foreign capital into Thailand

there has been the desire to use the cheap labor force of Thailand so as to maintain price competitiveness. Therefore, production of troublesome items is being shifted to Thailand. These products are sent on to export channels previously developed in the U.S., Europe, Japan, etc.

5-2. Tackling of Export Products

(1) Polarization Between Manufacturers of Mainly Export Products and Manufacturers of Mainly Domestic Market Products

The ceramic manufacturers visited could be said to have been divided into two groups irrespective of region, i.e., Chiang Mai, Lampang, or Bangkok, that is, manufacturers which primarily engaged in production and shipment of export products and manufacturers which engaged primarily in products for the domestic market. This is due to the difference in the level of quality of export products and products for the domestic market and to the difficulty in running products of different levels of quality through the same production line.

(2) Production of Export Products by Manufacturers with Over 60 Employees

Almost all manufacturers producing primarily export products had more than 60 workers, it was observed. Manufacturers with few than those workers basically produced for the domestic market. A production system consisting of over 60 workers may be said to be the smallest unit of factory size enabling the demands of the export market on shipment volumes and delivery schedules to be met.

(3) Lampang Manufacturers Producing Large Percentages of Products for Domestic Market

In Lampang, there are believed to be many manufacturers stressing production and shipment of products for the domestic market. Even manufacturers with over 60 workers mostly were seen as having high percentages of production and shipment of products for the domestic market.

5-3. Dependence on External Specialized Companies

The majority of the manufacturers in Chiang Mai and Lampang handled all the processes from manufacture of the clay to fabrication of the molds, molding, painting, and firing in-house and did not rely on outside specialists, it was seen. Also, almost all the manufacturers in Bangkok and its environs relied on specialized companies for the manufacture of the clay and handled the rest of the processes in-house. Japanese ceramic manufacturers rely to a large degree on external specialized companies. This is in sharp contrast to the situation in Thailand.

In Lampang, many ceramic manufacturers were seen as washing the materials and mixing the clay in-house, but this is believed to be because [1] there are no clay manufacturers in Lampang and [2] it is possible to make inexpensive clay using the local stone as a principal material.

5-4. Expansion of Production Capacity

(1) Chiang Mai

Chiang Mai has many manufacturers which produce large percentages of export products and products for foreign tourists, but it was not felt that any moves were being made to expand production capacities. In so far as the manufacturers visited went, some places were planning to increase the number of their workers, but there were no plans for expansion of production facilities.

(2) Lampang

Manufacturers with high ratios of export products were expanding their factories. Lampang further has a relatively large number of manufacturers which produce mainly products for the domestic market, but not much movement was seen to expand production capacities there.

(3) Bangkok and Environs

In this region, there were active moves being made to expand production facilities, it was felt. In particular, manufacturers producing primarily export products were seen as briskly expanding their production capacities. This included not only increases in the

number of workers, but also expansion of capacity in terms of facilities, such as with the increase in the number of kilns and the construction of new factories.

Some of the companies in Bangkok engaged in marketing activities primarily for exports were pushing forward with plans to enter the field of production of ceramics on their own.

5-5. Environment of Industrial Sites

(1) Procurement of Labor Force

The wage levels of general workers is lower overall in Chiang Mai and Lampang than in Bangkok and its environs. Further, manufacturers in Chiang Mai, Lampang, and Bangkok all stated it was easy to hire general workers. General workers, however, sometimes take off during the peak agricultural periods, making it difficult to maintain stable production. This phenomenon, in particular, is often seen in Lampang and Chiang Mai.

(2) Procurement of Raw Materials

Manufacturers in Lampang use local stone and make their clay in-house so can keep the costs of materials down. Due to the unstable composition of the stone in Lampang, the insufficient facilities for manufacturing materials in the companies, and the insufficient technical knowhow in manufacturing materials, it is difficult in certain aspects to achieve uniform quality. Also, there are no specialized clay manufacturers in Lampang.

There are specialized clay manufacturers in Bangkok and its environs and these can supply materials of a stabler quality than that in Lampang and Chiang Mai, but even that quality cannot be said to be sufficiently good. Foreign capital manufacturing joint ventures in Bangkok rely on imports for their raw materials due to the insufficient quality available domestically in Thailand.

(3) Land Costs

The cost of land acquired or leased for establishment of factories is lower in Chiang Mai and Lampang. When establishing a new factory, location there is advantageous to the extent of the reduction of the initial investment.

(4) Domestic Transport for Exports

Exports in many cases have to go through Bangkok due to the schedules of ports of loading. Exporting from Chiang Mai and Lampang assumes inland transport over about 700 kilometers to Bangkok. The cost of exports is higher by that amount in these two regions.

(5) Existence of Export Related Companies

Trading companies, marketing companies, and other export related companies exist in large numbers in Bangkok. Therefore, manufacturers of export ceramics located in Bangkok can enjoy an increased frequency of contact with such export related companies and therefore can enjoy a greater opportunity for acquiring information on preferences in the overseas markets and sales channels.

Further, it must not be overlooked that overseas buyers in most cases go through trading companies, marketing companies, etc. rather than directly contacting small and medium sized ceramic manufacturers. A marketing company in Bangkok has analyzed that the reason why overseas buyers use Thai marketing companies is that they require their services in quality control, delivery control, and consulting.

5-6. Problems and Countermeasures

(1) Expansion of Production Capacity of Export Products in Small and Medium Sized Manufacturers

The trend in the global market for an expansion of the share of exports of Thai ceramics may be seen from the rapid rise in the volume of production of ceramics in Thailand in recent years and the aggressive expansion of production capacities by ceramic manufacturers with high export ratios. There are apprehensions, however, over whether

this expansion of the production capacity of export products can keep up with this expansion in demand in the future. There are the following points of concern:

[1] The small and medium sized manufacturers do not seem to be sufficiently set up for training management staff and the foreman class, making it difficult to organize a division of labor necessary for expansion of production and sales. If these small and medium sized manufacturers try to expand the scale of their production and sales, their managers will find it impossible to control things due to limitations in individual management capabilities.

[2] Many of the best selling export products of the small and medium sized manufacturers are large sized items or hand painted items requiring skilled labor. Some manufacturers, however, are already beginning to feel a shortage of skilled laborers.

Therefore, it is believed necessary to quickly study countermeasures in the following two areas:

[1] Support for expansion of production capacities of existing small and medium sized manufacturers. In particular, support stressing introduction of industrial designs and production control techniques aimed at increasing the productivity, training of painting and other skilled workers, and the like.

[2] Expansion of the number of manufacturers able to produce export products. Toward this end, measures to promote shifts of manufacturers from emphasis on production for the domestic market and the new establishment of manufacturers dealing with export products.

(2) Stimulation of Effort in Export Products in Lampang

The manufacturers in Chiang Mai and Bangkok seem to be more positive in tackling export products than the manufacturers in Lampang. In Lampang, however, there are many cases of production and shipment of low cost, low quality products for the domestic market for inexpensive goods and therefore manufacturers do not seem positive about investing in human resources, facilities, or technology which would lead to higher production costs. So long as managers do not see an expansion of export sales channels as leading to greater income, they will not move to investment in improving the quality of their products with the aim of exports.

The Lampang manufacturers have the following disadvantages compared with Bangkok manufacturers when dealing with production and shipment of export products, so measures would have to be considered which would compensate for these.

[1] Lampang manufacturers tend to have fewer opportunities than manufacturers in Bangkok and Chiang Mai for contacting trading companies and marketing companies, which serve as channels for export sales. Further, Lampang has few manufacturers producing products suitable for export, so the region may be said to lack appeal as a production center of ceramics. Therefore, measures are necessary for drawing the attention of the export trading companies and marketing companies in Bangkok and for facilitating contacts by export trading companies etc. with Lampang manufacturers.

[2] There are no clay manufacturers in Lampang, and the ceramic manufacturers all make their own clay using local materials. Due to the unstable composition of the stone and the insufficient facilities and knowhow for making these materials in the companies, the quality of the clay tends to be nonuniform, which often hinders improvement of the product quality and the product yield. The manufacturers would probably find it difficult to reclaim the investment in the facilities they would have to introduce and to secure the technicians necessary for clay manufacture when trying to improve the quality of the clay made in-house. However, even if this is difficult for individual ceramic manufacturers, if a clay specialty manufacturer is invited and commissioned with making clay totally, it still remains a possibility. Further, this method would result in more rapid improvements in clay quality. For this reason it is necessary to consider inviting a clay specialty manufacturer.

(3) Motivation for Use of Lampang Ceramic Center

Even if technical support services were offered to ceramic manufacturers in the northern provinces with the aim of improving the quality of their products (for example, through the Lampang Ceramic Center), so long as the manufacturers stressed the domestic market for inexpensive goods in their sales policies, they would have no motivation for using the technical support services. In Lampang, most manufacturers produce primarily for the domestic market, so the rate of utilization of the technical support services may become low.

Therefore, a campaign is necessary for enhancing the appeal of Lampang as production center for ceramics which would increase inquiries from export trading companies and marketing companies to Lampang.

6. Raw Materials

6-1. Domestic Raw Materials

Table IV-6-1 shows the availability of domestic raw materials and its main producing areas. Most of the principal raw materials can be obtained domestically.

Table IV-6-1. Raw Materials and Main Producing Areas in Thailand

Raw Material	Domestics Usability	Main Producing Area
Kaolin	Possible	Prachinburi, Ranong
Clay	Possible	Chiang Mai, Surathani, Chantaburi
Pottery Stone	Possible	Lampang, Nakornsri
Silica	Possible	Various places
Feldspar	Possible	Tak
Lime	Possible	Various places
Talc	Impossible	-----

(1) Clay Materials

In Table IV-6-2, chemical analysis data obtained from CERMAS CO., LTD. is given concerning kaolin and ball clay as of 1986. This analytical data is viewed as compared with the common analytical data of kaolin and ball clay for white porcelain.

Kaolin: The content of Fe_2O_3 is normally between 0.2% and 0.8%. However, the kaolin from Prachinburi and Ranong are high at 1.25% and 1.38% respectively. This cannot be said to be good from the standpoint of whiteness. Further, the content of Al_2O_3 is normally between 35% and 37%, however the Prachinburi kaolin is low at 29.3%. This shows low purity for kaolin, and means that other substances are contained.

Ball Clay: The most important quality of ball clay is its plasticity, and the content of Al_2O_3 is extremely important. Normally, between 32% to 36% of Al_2O_3 , and under 1.5% if Fe_2O_3 is contained. The ball clay in Chantaburi, Prachinburi and Surathani

contain relatively low amounts of Al_2O_3 at 27.2%, 22.8% and 26.8% respectively, and relatively large amounts of Fe_2O_3 , at 1.38%, 3.50% and 1.62% respectively.

From looking at this chemical analysis data alone, it appears that the raw materials for clay in Thailand are slightly insufficient for use in high class white porcelain, but are sufficient for use in medium class white porcelain.

Table IV-6-2. Chemical Analysis Data of Thai Produced Clay Materials

	Washed Kaolin		Ball Clay		
	Prachinburi	Ranong	Chanthaburi	Prachinburi	Surathani
SiO_2	57.6	49.3	55.5	60.7	48.2
Al_2O_3	29.3	35.1	27.2	22.6	26.8
Fe_2O_3	1.25	1.22	1.38	3.50	1.62
TiO_2	1.07	0.11	0.35	0.79	0.37
CaO	0.07	0.07	0.09	0.15	0.36
MgO	0.10	0.22	0.20	1.05	0.39
K_2O	0.26	2.30	1.62	2.42	2.58
Na_2O	0.01	0.19	0.03	0.19	0.12
Loss	10.32	11.52	13.68	8.57	19.55

(2) Lampang Stone

Lampang stone is a useful material for ceramics. It belongs to the category of China stone. Similar materials are widely used in Japan too. Due to its origin, however, the quality varies and therefore it should be used with sufficient control.

In this survey, a visit was made to Thai Kaolin Co. which is one of the leading mining companies in Lampang. Thai Kaolin Co. has a washing factory for Lampang stone and ships out the following products:

AA.	325 mesh pass.	1,350 B/t (delivered in Bangkok)
A.	250 "	1,000 B/t (")
B.	200 "	750 B/t (")
Crude		250 B/t (delivered at foot of Lampang mountains)

Judging from the chemical analysis values obtained (Table IV-6-3), there are believed to be possibilities of variations in quality. Due to the difference in the time of the sampling, the test methods, etc., it cannot be decisively concluded right off that there are variations.

In the future, it will be necessary to obtain the cooperation of the miners and establish a stance of utilizing stable raw materials.

Table IV-6-3. Chemical Analysis Data of Lampang Stone

	Crude (*1)	Grade B (*1)	Grade A (*1)	Grade AA (*1)	Crude (*2)	Grade AA (*2)
SiO ₂	74.1	61.7	53.9	51.0	76.6	61.9
Al ₂ O ₃	17.3	25.8	29.9	32.1	16.1	26.3
Fe ₂ O ₃	0.9	1.5	1.3	1.5	0.57	0.71
TiO ₂	—	—	—	—	0.07	0.05
CaO	—	0.73	0.62	0.95	0.03	0.04
MgO	—	0.64	0.72	0.36	—	0.03
K ₂ O	3.30	4.38	5.49	5.73	3.46	5.48
Na ₂ O	0.13	0.83	1.27	1.16	—	0.01
Loss	4.08	4.31	6.25	6.56	3.36	5.18

(*1) Analysis data in 1977 from Tahi Kaolin Co.

(*2) Analysis data in 1987 from Japanese porcelaine manufacture.

(3) Feldspar

At present in Thailand, potash feldspars, sodium feldspars and aplite are being mined and used. Feldspar differs from clay raw materials in that, through selective mining, its quality can be improved to a certain extent. As a raw material in porcelain, in order to obtain better quality domestic feldspar, it is at least necessary to improve the understanding between miners and porcelain manufacturers.

(4) Silica

For Silica, high quality silica is used as a raw material in porcelain.

For the silica for body, Lampang stone is used. The silica for glaze as well is generally of good quality.

6-2. Problems and Countermeasures

Lampang stone is the main raw material for the Thai ceramics industry. With recent increases in ceramic production, production of Lampang stone is growing. However, fluctuations in the quality of the stone shipped by mining companies have had an adverse impact on the quality of finished products.

Stone taken from the Lampang mountains is characterized by varying composition; some areas produce soft, clay-rich stone and others hard, silica-rich varieties.

Recent increases in shipments from Lampang have found the mining companies there hard-pressed to meet demand, resulting in declining quality. Since this stone is used by the ceramic manufacturers, it is feared that they will have difficulties in maintaining the quality of their finished products. The first step to improve the quality of finished products is to stabilize the quality of raw materials.

Therefore, it is necessary to investigate the stone quality at the Lampang production site and to control the quality of each shipment. The introduction of testing facilities and relevant know-how will be necessary as well.

7. Supporting Industries

7-1. Manufacturing Machinery

At present, it is possible to use domestic products for ball mills, filter presses, hand jiggers and shuttle kilns. For the other manufacturing machinery, Thailand relies on imports.

No kiln manufacturers are seen, however, there are many cases where the ceramic manufacturers made their own shuttle kilns. However, Thailand relies on imports for tunnel kilns, electric furnaces, and high temperature firing shuttle kilns.

7-2. Kiln Furniture

Formally, import products from Taiwan and Japan had been used for kiln furniture such as saggers, shelves, and support pillars. However, in Thailand as well, pursuant to the increase in demand, these kiln furniture have begun to be manufactured by the Siam Cement Corporation. They are manufacturing various components for use in tunnel kilns, shuttle kilns and electric furnaces.

Kiln furniture which have been domestically produced are of silicon carbide. Mullite and carbolite could not be seen. Kiln furniture of these material are inferior to silicon carbide in terms of heat conducting capacity, but have a price advantage.

In the future, it is quite possible that the domestic kiln furniture of these material will be available, and it would be desirable for the Thai ceramic manufacturers to expand their selection of kiln furniture.

7-3. Pigments

Pigments include stains for over-glaze decoration, under-glaze decoration, color glaze, colored body and liquid gold (for Bencharong), etc.

These pigments are presently mostly imported from Japan, West Germany, etc. Pigments for blue and white decoration are prepared in-house in some manufacturers. Pigments are essential materials for production. Liquid gold is particularly expensive,

however. So it is desirable that some special measures will be taken regarding imports of pigments.

7-4. Problems and Countermeasures

Ceramic machine tool manufacturers are almost completely absent. Ball mills are produced domestically, but are defective in that the number of revolutions cannot be adequately controlled. Further, there are no manufacturers specializing in kilns.

The following two factors can be given as reasons for the lack of ceramic machine tool manufacturers in Thailand:

1. Due to the lack progress of modernization within the ceramic manufacturing industry, the demand for machine tools is small.
2. The machine tool market is small, and the operations of the machinery manufacturers are in an environment in which it is difficult to develop.

In the future, along with the development of the ceramic industry, it can be expected that machine tool manufacturers will gradually develop as well. However, as previously, the situation of relying on imports for much of Thailand's ceramic machine tools will continue for the present. Modernization of production facilities is indispensable for the expansion of ceramic exports. For this reason, at present it is necessary to take the measure of promoting the importation of machine tools.

Main Problems and Countermeasures: Ceramics

	Problems	Countermeasures
1. Summary of Industry	<ul style="list-style-type: none"> • General lack of interest in improving quality. • Lack of staff and insufficient technical capabilities, and short of publicity of the activities of the NIPC. 	<ul style="list-style-type: none"> • Strengthening of the system of NIPC and other government organizations, strengthening of the cooperative relationship among industrial organizations • Collection and dissemination of information. (Establishment of Lampang Ceramic Center.)
2. Supply and Demand	<ul style="list-style-type: none"> • Lack of basic data regarding production. (production capacities, production volumes, or the rate of operation.) 	<ul style="list-style-type: none"> • Collection of basic data regarding production. • Grasp of situation of supply and establishment of a system of supply of raw materials.
3. Exports	<ul style="list-style-type: none"> • No uniform quality of production. • Poor delivery control. • Too many intermediaries. (obstructing of direct trading.) 	<ul style="list-style-type: none"> • Sponsoring seminars. • Bringing over foreign technicians. • Developing human resources (technician, designer, sales manger) with government organization and industrial organizations.)
4. Production Activities and Technology	<ul style="list-style-type: none"> • Insufficient capacity for export product development. • Unstable quality of the clay prepared in-house at the Lampang manufacturers. • Insufficient control of slip properties, i.e. the viscosity, water content, and the amount of defloculant. • Gypsum molds are used 	<ul style="list-style-type: none"> • Strengthening the function of acquiring overseas information about export products. Training product designers. • Introducing proper techniques for clay processing. • Moving towards routine checking of clay quality. • Introducing quality tests using measuring instruments. • Introducing quality con-

	Problems	Countermeasures
5. Corporate Management	<p>too many times. No steps are being taken to make the gypsum molds rigid.</p> <ul style="list-style-type: none"> • Necessity of higher productivity in the decoration process. • Insufficient heat efficiency of in-house shuttle kilns. • Bottlenecks preventing expansion of production capacities of small and medium sized manufactures, i.e. insufficient in-house systems for training management staff and foreman class, employees, a shortage of skilled labor for hand painting. • Strong tendency to target the low-cost and low-quality market. 	<p>trol know-how for gypsum molds.</p> <ul style="list-style-type: none"> • Introducing productive industrial designs, decoration methods other than hand painting, and division of labor in the decoration process. • Improve operation technology to cover the kiln defects. Pursuit of causes of defects after firing. • Introducing industrial designs and production control techniques aimed at higher productivity. • Expansion of opportunities for contacting sales channels in the export market. Expansion of the number of manufacturers able to produce export products.
6. Raw Materials	<ul style="list-style-type: none"> • Unstable quality of the Lampang stone which is shipped to the ceramic manufacturers. 	<ul style="list-style-type: none"> • Introducing quality control techniques and equipment for quality testing.
7. Supporting Industries	<ul style="list-style-type: none"> • The production machinery producers are in an early stage of development. 	<ul style="list-style-type: none"> • For the present, promotion of imports of production machinery.