## 3-5 Mould and Die Industry in Japan

### (1) History of the Industry

Japan was first able to manufacture moulds and dies industrially in the latter half of the 19th Century when machine tools began to be imported from the United States and Europe. Then, during the Second World War, the mould and die industry developed primarily with the munitions industry, and after the war, it experienced rapid growth as mass production systems were introduced during the period of rapid economic growth during the late 1950s.

In 1956 the mould and die industry was included among the industries specified by the 1956 Law on Extraordinary Measures Machining Industry, and then later in 1965, it was one of the industries to come under the Small- and Medium-Enterprise Modernization Promotion Law.(Notes 1 & 2) These moves contributed to promoting the rationalization and modernization of the industry.

Notes:

1) The 1956 Law on Extraordinary Measures Machining Industries involved policies for low-interest loans and special depreciation on machinery and equipment provided by the government.

2) The Small- and Medium-Enterprise Modernization Law entailed low-interest loans by the Medium and Small Enterprise Finance Corporation.

### (2) The Industry Today

The full-scale development of the Japanese mould and die industry occurred during the latter part of the 1950s during the period of rapid economic growth. Even since the economy entered the period of steady growth which followed the first oil crisis in 1973, the industry has continued to expand. During the period from 1975-1983 when ex-factory value of whole industries increased 1.87 times, that of the mould and die industry increased 3.74 times. The reason for this high rate of growth for the mould and die industry at a time when most industries were slowing down was a higher demand for moulds and dies brought about by the development of new products and model changes in most industries.

The mould and die industry has developed in metropolitan areas where there is a concentration of machining industries, the main users of moulds and dies.

**Table IV. 3-27 Mould and Die Manufacturers Classified According to Type of Product and Location**

(Unit: ¥ 1 million)

| Area \ Type of Product | Press Dies | Forging Moulds | Casting Moulds (Includes Die Casts) |
|---|---|---|---|
| Whole country | 382,438 | 17,046 | 95,112 |
| Osaka | 43,990 | 3,603 | 8,994 |
| Tokyo | 27,322 | 766 | 5,893 |
| Kanagawa Pref. | 50,764 | 588 | 7,922 |
| Aichi Pref. | 43,781 | 2,214 | 16,770 |
| Saitama Pref. | 28,528 | 1,344 | 21,483 |

| | Plastic Moulds | Rubber,Glass | Other | TOTAL (%) |
|---|---|---|---|---|
| Whole country | 417,090 | 50,252 | 143,253 | 1,105,191 (100.0) |
| Osaka | 59,755 | 7,632 | 13,027 | 137,001 ( 12.4) |
| Tokyo | 55,563 | 10,901 | 16,473 | 116,918 ( 10.6) |
| Kanagawa Pref. | 37,633 | 4,656 | 11,389 | 112,952 ( 10.2) |
| Aichi Pref. | 53,348 | 4,845 | 11,878 | 132,836 ( 12.0) |
| Saitama Pref. | 32,229 | 4,593 | 10,153 | 98,330 ( 8.9) |

Notes: 1- Based on a survey taken of 7,630 companies with more than 4 employees;
2- The category of "Other" includes other types of molds and their parts and accessories.
Source: "Industrial Statistics Tables- Product Items Edition", MITI, 1984.

Another feature of the mould and die industry is the high proportion of medium- and small-scale companies. As of 1986 there were 12.200 mould and die factories around the country, and 91.2% of this number were small-scale manufacturers with a work force of 19 or fewer. There were only 63 factories which employed more than 100 employees. The reason why there are many small manufacturers is that, in general, a wide variety of moulds and dies are produced in small lots such that there is little room for expanding the profit scale.

In recent years the industry has been actively introducing the latest machinery and equipment such as NC machine tools, machining centers, electric discharge machines, and 3-dimensional measuring machines. In addition, CAD/CAM systems are being widely adopted among companies which rank at the higher end of the industry. The reason for the greater use of mechatronics in the mould and die industry is that automobile and home appliance manufacturers etc, the users of moulds and dies, are making more rigid requests for higher quality, lower costs, and a shortening of delivery time. As a result, the mould and die industry is changing over to becoming a capital- and technology-intensive industry which is reliant on mechatronics.

Of those manufacturers which are increasing production and introducing mechatronics machinery and equipment, an increasing number are faced with the problem of a lack of space in their factories. Also, among manufacturers which are situated in metropolitan areas, there are some whose locational conditions are becoming worse as the surrounding area becomes commercial or is turned into residential housing. Due to the relationship with their customers, such manufacturers are seeking sites which are not far away from their customers and which permit work to be carried out at night. Finding land which meets such requirements is difficult for mould and die manufacturers, however, and there have been calls for the creation of "metropolitan industrial sites" in disused industrial areas in the cities.

### (3) Mould and Die Production

1) Production Scale

According to the Ministry of Trade and Industry's "Industrial Statistics" (Industry edition), in 1982 the value of mould and die production was approximately ¥865.0 billion.

**Table IV. 3-28 Production Value of Moulds and Dies in Japan**

(Unit: ¥ 1 million, %)

| Year | Machinery Statistics | Rate of Increase | Census of Manufacturers | Rate of Increase |
|---|---|---|---|---|
| 1972 | 86,120 | — | 191,908 | — |
| 1973 | 109,197 | 26.8 | 245,290 | 27.8 |
| 1974 | 110,703 | 1.4 | 276,163 | 12.6 |
| 1975 | 95,361 | Δ13.9 | 272,056 | Δ 1.5 |
| 1976 | 121,559 | 27.5 | 326,760 | 20.1 |
| 1977 | 159,001 | 30.8 | 406,423 | 24.4 |
| 1978 | 174,098 | 9.5 | 492,419 | 21.2 |
| 1979 | 201,049 | 15.5 | 566,554 | 15.1 |
| 1980 | 232,464 | 15.6 | 674,110 | 19.0 |
| 1981 | 271,309 | 16.7 | 785,924 | 16.6 |
| 1982 | 297,084 | 9.5 | 865,121 | 10.1 |
| 1983 | 322,574 | 8.6 | 1,012,718 | 17.1 |
| 1984 | 352,650 | 9.3 | 1,121,367 | 10.7 |
| 1985 | 386,710 | 9.7 | 1,361,310 | 21.3 |
| 1986 | 375,498 | Δ 2.9 | 1,304,201 | Δ 4.2 |
| 1987 | 356,477 | Δ 5.1 | — | — |

Note: "Machinery Statistics" cover manufacturers with more than 20 employees and "Census of Manufacturers" include all manufacturers.
Δ means minus.
Source: Machinery Statistics Annual Reports, Census of Manufacturers by Industries, MITI.

2 factors behind this growth experienced by the mould and die industry are the switch to the product variety, small lot production system by the Japanese economy as a result of the 2 oil crises in 1973 and 1979, and also the development of new products and the shortening of the period of time for model changes.

A look at moulds and dies according to type shows that moulds for plastic goods form the largest group, followed by press dies. Added together, these 2 types of moulds account for more than 75% of total mould and die production.

**Table IV. 3-29 Types of Mould and Dies and Value of Production**

(Unit: ¥1 million, % )

| Type \ Year | 1983 | | 1984 | | 1985 | | 1986 | |
|---|---|---|---|---|---|---|---|---|
| | Value | % of Total | Value | % of Total | Value | % of Total | Value | % of Total |
| Press | 137,667 | 42.7 | 135,913 | 38.5 | 155,335 | 39.6 | 154,911 | 41.3 |
| Forging | 11,108 | 3.4 | 11,517 | 3.3 | 13,157 | 3.4 | 15,099 | 4.0 |
| Casting | 9,028 | 2.8 | 10,997 | 3.1 | 11,786 | 3.0 | 10,706 | 2.9 |
| Die Cast | 31,398 | 9.7 | 18,826 | 5.3 | 19,512 | 5.0 | 19,656 | 5.2 |
| Plastic | 106,152 | 32.9 | 142,659 | 40.5 | 156,063 | 39.8 | 140,031 | 37.3 |
| Glass | 10,618 | 3.3 | 11,529 | 3.3 | 13,178 | 3.4 | 12,952 | 3.4 |
| Rubber | 11,258 | 3.5 | 14,130 | 4.0 | 15,205 | 3.8 | 13,699 | 3.6 |
| Powder Metallurgy | 5,345 | 1.7 | 7,079 | 2.0 | 7,962 | 2.0 | 8,415 | 2.3 |
| TOTAL | 322,574 | 100.0 | 352,650 | 100.0 | 392,097 | 100.0 | 375,469 | 100.0 |

Source: "Machinery Statistics", MITI.

As is shown in the table, up until 1983 press dies accounted for the largest percentage of total production, with moulds for plastic in second place. But since then the rate of increase of press dies has slowed down while plastic moulds have continued to increase considerably, so that in 1984 and 1985 moulds for plastic accounted for approximately 40% of total production. There are two reasons for this: first, the durability of plastic has improved and its life has been increased, and second, due to the trend of making parts lighter for cars and other products, a switch over has been seen from metal to plastic.

A look at the value of production for moulds and dies shows that manufacturers with less than 20 employees produced 45.9% of the total. Companies with more than 20 but less than 100 employees produced 38.6%, and those with more than 100 employees produced 15.5% of total production value.

**Table IV. 3-30 Mould and Die Manufacturers Classified According to Size and Production Values**

(Unit: ¥1 million)

| | Companies | | Production Value | |
|---|---|---|---|---|
| No. of Employees | Number | % | Number | % |
| 1-9 | 9,725 | 79.7 | 360,411 | 27.6 |
| 10-19 | 1,401 | 11.5 | 238,579 | 18.3 |
| 20-29 | 549 | 4.5 | 174,338 | 13.4 |
| 30-49 | 274 | 2.3 | 148,500 | 11.4 |
| 50-99 | 183 | 1.5 | 180,069 | 13.8 |
| 100- | 63 | 0.5 | 202,308 | 15.5 |
| TOTAL | 12,200 | 100.0 | 1,304,201 | 100.0 |

Source: "Industrial Statistcis- Industry Edition", MITI, 1986

2) Structure of the Industry

The manufacture of moulds and dies is carried out by manufacturers which have a small number of employees. According to the 1984 "Industrial Statistics Tables", among the 11,181 manufacturers included in the statistics, those with less than 10 employees accounted for 80.7% of the total, and those with more than 10 but less than 20 employees accounted for 11.3%. Consequently, companies with less than 20 employees accounted for 92.0% of the total. Companies with more than 100 employees accounted for only 0.52%.

However, although the number of companies with few employees increased up until 1978, it has shown a slight decrease since 1979.

**Table IV. 3-31 Number of Small-scale Factories in the Industry**

| | No. of Factories | Factories with under 10 employees (%) | Factories with under 20 employees (%) |
|---|---|---|---|
| 1972 | 5,950 | 77.7 | 91.4 |
| 1973 | 6,090 | 79.0 | 91.9 |
| 1974 | 6,243 | 81.3 | 92.5 |
| 1975 | 7,144 | 83.2 | 93.5 |
| 1976 | 7,409 | 83.9 | 93.8 |
| 1977 | 7,684 | 83.8 | 93.5 |
| 1978 | 8,709 | 84.3 | 93.7 |
| 1979 | 8,977 | 83.8 | 93.7 |
| 1980 | 9,231 | 83.7 | 93.3 |
| 1981 | 9,934 | 82.4 | 92.8 |
| 1982 | 9,874 | 80.9 | 92.0 |
| 1983 | 11,494 | 82.4 | 92.6 |
| 1984 | 11,181 | 80.7 | 92.0 |

Source: "Industrial Statistics Tables-Industry Edition", MITI.

The different types of mould and die manufacturers include specialist manufacturers who make moulds and dies upon request from their customers, those which produce moulds in-house for their own us, and those which fall somewhere between these two types. It is estimated that on average, companies which produce moulds and die in-house rely on their own moulds for roughly half of their needs. According to the annual reports of Machine Statistics (Table IV. 3-32), the proportion of total mould and die production comprised by in-house production has gradually decreased since 1976 and 1977 when it accounted for 29% of the total so that by 1985 it had dropped to 22.6%. This is a significant decrease from the period in the late 1950s when in-house production accounted for 65% of total production.

As for the types of moulds produced in-house, forging moulds comprise the largest group followed in order by press dies, die cast moulds, and powder metallurgy moulds. Compared with these kinds of moulds for shaping metals, the ratio of in-house production for moulds for shaping non-metal materials, such as plastic and rubber, is low.

**Table IV. 3-32 In-house Production Ratios According to Type of Mould**

(Unit: %)

| Type of Product \ Year | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|
| Press | 33.8 | 33.3 | 33.3 | 26.9 | 30.5 |
| Forging | 67.7 | 60.3 | 64.3 | 64.0 | 64.6 |
| Casting | 29.5 | 29.4 | 33.6 | 38.5 | 33.5 |
| Die Cast | 25.0 | 20.3 | 20.4 | 34.2 | 29.9 |
| Plastic | 13.6 | 12.3 | 14.9 | 11.2 | 11.8 |
| Glass | 0.4 | 0.7 | 0.3 | 0.0 | 0.6 |
| Rubber | 10.9 | 9.7 | 12.5 | 12.6 | 14.1 |
| Powder Metallurgy | 26.9 | 26.3 | 26.3 | 24.8 | 26.0 |
| Overall Average for In-house Production | 26.1 | 24.1 | 25.1 | 21.0 | 22.6 |

*Source: Machinery Statistics Annual Reports, MITI.*

3) Comparison of Productivity for Moulds and Dies

Compared with the mould and die industries in other countries, the productivity of the Japanese mould and die industry is high. Table IV. 3-33 shows a comparison of the sales value per individual employee of the 12 member countries of the ISTA (International Special Tooling Association) (as of 1981). The table shows that Japan, which was situated in the middle group in 1976 had become the country with the highest rate of productivity 5 years later in 1981. One of the reasons why the sales value per individual worker is high in Japan is that compared with other countries, Japanese employees work longer hours. Compared with Great Britain and the United States, where employees work approximately 40 hours a week, and European countries, where employees work approximately 35 hours a week, employees work 48 hours per week in Japan. Of course, this does not include overtime hours, which are worked in order to meet the production schedules of customers. This is one reason why the delivery time for moulds and dies in Japan is short.

Whereas the ratio of annual sales value to investment value in plant and equipment is 13.1% in the United States, 12.2% in Britain, and 10.1% in Italy, in Japan, it is rather low at 6.2%. (refer Table IV. 3-34) However, if one takes into account the recent high sales value for Japan, the ratio of machinery and equipment per individual employee is among the highest in the world.

Table IV. 3-33 Average Sales per Individual Employee

(Unit: $US )

| Country \ Year | 1974 | 1976 | 1978 | 1981 |
|---|---|---|---|---|
| Japan | 24,500 | 21,000 | 44,000 | 58,836 |
| USA | 33,000 | 30,000 | 43,500 | 50,933 |
| Switzerland | N.A. | 32,000 | 51,949 | 44,737 |
| Italy | 15,000 | 19,000 | 27,776 | 41,992 |
| Finland | 20,000 | 19,000 | 21,250 | 39,166 |
| France | 23,500 | 22,500 | 31,730 | 38,758 |
| West Germany | 21,000 | 22,500 | 33,997 | 37,198 |
| Sweden | 22,000 | 19,000 | 24,928 | 35,615 |
| Netherlands | 22,000 | 20,000 | 35,000 | 34,000 |
| Belgium | 31,000 | 27,000 | 33,333 | 33,800 |
| Denmark | N.A. | N.A. | N.A. | 30,933 |
| Great Britain | 17,500 | 13,500 | 19,141 | 30,301 |
| Average | 22,900 | 22,320 | 33,328 | 39,647 |

Source: ISTA

Table IV. 3-34 Ratio of Investment in Equipment to Sales

(Unit: % )

| Country \ Year | 1978 | 1979 | 1980 | 1981 | Average |
|---|---|---|---|---|---|
| USA | 21.5 | 17.5 | 6.0 | 7.4 | 13.1 |
| Great Britain | 15.3 | 19.4 | 7.9 | 6.2 | 12.2 |
| Italy | 12.0 | 8.3 | 11.0 | 9.0 | 10.1 |
| Switzerland | 17.2 | 7.4 | 5.7 | 6.0 | 9.1 |
| Sweden | 12.0 | 6.6 | 7.8 | 9.7 | 9.0 |
| France | 11.0 | 7.9 | 4.8 | 3.4 | 6.8 |
| Netherlands | 8.0 | 5.0 | N.A. | N.A. | 6.5 |
| Denmark | N.A. | N.A. | 5.0 | 8.1 | 6.5 |
| Finland | 7.0 | 5.0 | 3.0 | 10.0 | 6.3 |
| Japan | 6.0 | 5.7 | 6.5 | 6.7 | 6.2 |
| West Germany | 4.9 | 4.0 | 7.3 | 4.2 | 5.1 |
| Belgium | 2.5 | 3.0 | 4.5 | 6.0 | 4.0 |
| Average | 10.7 | 8.2 | 6.3 | 7.0 | 8.0 |

Source: ISTA

## (4) Level of Technology and Future Outlook

1) Production Equipment

Table IV. 3-35 shows the machinery and equipment used by the mould and die industry. As shown in the table, 85.7% of manufacturers in the industry have multi-purpose milling machines, 97.9% have surface grinders, 92.1% have lathes, and 90.7% have drilling machines. This shows that the majority of manufacturers have introduced multi-purpose machines. As for measuring machinery and instruments, whereas a relatively high proportion of 65% have optical projectors, the ratio of introduction is not so high for tool scopes and 3-dimensional measuring machines. The rapid increase in NC machine tools has greatly influenced the growth of the Japanese mould and die industry. Because mould and die manufacture involves does not involve only the production of a wide variety of single products, NC machine tools have an undeniably strong impact.

### Table IV. 3-35 Introduction of Production Equipment by Japanese Mould and Die Manufacturers

(1) NC electric discharge machine (16.4%)
(2) Wire cut electric discharge machine (66.4%)
(3) Multi-purpose electric discharge machine (51.5%)
(4) NC milling machine (17.9%)
(5) Multi-purpose milling machine (85.7%)
(6) Surface grinding machine (97.9%)
(7) Forming grinding machine (90.7%)
(8) Lathe (92.1%)
(9) NC lathe (7.1%)
(10) Horizontal milling machine (20.0%)
(11) Drilling machines(90.7%)
(12) Machining center (27.9%)
(13) Transfer press (25.7%)
(14) Three dimensional measuring machine (24.3%)
(15) Universal tool scope (25.0%)
(16) Optical projector (65.0%)

Source: "Japan Mold and Die Journal", 10 May, 1984

The use of NC machine tools, which started in the first half of the 1970s, increased dramatically in the latter half of the decade. According to machinery statistics, there were only 3,312 NC machine tools, which produced ¥51.3 billion worth of moulds in 1976 (NC machine tools accounted for 22% of total machine tools), but by 1978 this figure had increased so that there were 7,342 machines producing ¥107.6 billion (29% of total). This increase continued so that in 1979 there were 14,317 machines producing ¥205.5 billion (42% of total), and in 1981 there were 25,926 machines in operation which produced ¥434.1 billion worth of moulds (51% of total). Although during the 2-year slump in the economy which occurred in 1982 and 1983 the total for machine tools decreased at a yearly rate of about 10%, the decrease was smaller in the case of NC machine tools. In 1983 there were 26,398 machines which produced ¥426.2 billion worth of moulds and the percentage of NC machine tools which were numerically controlled exceeded 60%.

Even though there have been increases and decreases in the most commonly used machines for manufacturing moulds, electric discharge machines, and machine tools, they have generally continued to increase along with the increase in production in moulds and dies.

The trend towards NC machine tools increased sharply so that by 1983 they accounted for more than 90% of all machine tools.

In the May 10 edition of the Japan Mould and Die Journal, it was reported that the wire cut electric discharge machine is the machine which the greatest number of manufacturers intend to introduce in the future. It was followed by machining centers and then, among measuring machinery, 3-dimensional measuring machines. This shows that Japanese manufacturers are not satisfied with their present equipment and so intend to introduce the latest type of machinery, such as NC machines, in the future.

2) Design and Processing Technology

The Japanese mould and die industry, an industry which is said not to have experienced bad times, is presently undergoing change. Compared to past performances, the rate of increase in the value of mould and die production is slowing down, and mould and die manufacturers are subject to rigid requests to raise the standard of quality, shorten delivery time, and decrease costs from the companies which use their products. In order to meet such requests, technological changes are being seen in mould and die factories where new technologies such as mechatronics are beginning to be introduced. These new developments are occurring in order to bring about the rationalization of mould and die manufacture, and the various phases involved in this process can be summarized as follows:

Emphasis on finishing → Emphasis on machines → Making machines numberically controlled → CAD/CAM systems → Unmanned operations

In the past, the method for manufacturing moulds and dies has mainly involved the manual processing and assembly of parts which have been processed beforehand. But instead of this, most workers now carry out machining by using gauges, and in the case of copy-milling, they machine by making punch and die models. However, this process leads to an increase in manufacturing costs because some time is required for the finishing off process due to a decrease in precision because of errors caused by changes in the temperature of the models and also changes brought about by the passage of time. In order to resolve such problems, methods are now beginning to be adopted which make use of NC functions (e.g. NC grinders, NC milling machines, NC electric discharge machines), and CAD/CAM systems. A list of the new developments in mould and die design and in processing is provided below:

1) development of electrodes which do not wear much when using electric discharge machines
2) development of an adaptable automatic control device for use in electric discharge machines
3) development of a NC milling machine
4) development of an automatic copy-milling machine and NC grinder
5) development of a NC wire cut electric discharge machine
6) development of an electrolytic polishing machine
7) manufacture of moulds and dies by using CAD/CAM

Automation is also affecting design. CAD/CAM systems have already begun to be introduced mainly among manufacturers who produce moulds related to automobiles. The key to using CAD/CAM is software. Although the most preferable situation is to have software made inside a company so that mould and die processing technology is not leaked outside, this poses a problem for small-scale manufacturers. It is because of this that in order to introduce CAD/CAM systems, mould and die manufacturers in Japan are standardizing the various parts which make up moulds, the manufacturing stages, and tools and metallurgical tools, as well as putting effort into developing the staff required for computers which use CAD/CAM systems.

3) The Use of Modern Technology and Future Outlook

The most significant change which is expected to take place in the Japanese mould and die industry is the automation of mould and die manufacture and design using the latest technological developments. On top of this, processing technology and machine tools are expected to become more sophisticated. An outline of expected changes is provided below.

First of all there are the advances in the automation of factories. The various types of general machines used for processing moulds and dies are gradually becoming automated in order to accommodate variety of small lot production, and in the same way NC machine tools are becoming more sophisticated. Along with the progress which has been made in microcomputers since the latter half of the 1970s, CNC machine tools which apply microcomputer technology are now being used more widely. It is expected that Flexible Manufacturing Systems which manage this will be expanded and will be used even more widely in the future. It is also considered that Factory Automation systems will develop even further and that computers will be used more widely so that they are not used in just the assembly and inspection stages, but used in every stage including the compilation of daily manufacturing schedules.

Second, there is the gradual increase in demand for ultra-precision processing. There is an endless flow of requests for high precision. These range from requests for the normally required degree of precision down to 10 micron units for the general machining industries to precision down to the degree of 1 micron unit for the aerospace and computer industries and even precision down to the degree of sub-micron units for laser mirrors, etc. And for the manufacturing of moulds and dies, as a result of increased demand for precision moulds, it is expected that the degree of precision of machine tools will increase and that comprehensive research will be carried out involving the development of basic technology for the machines themselves as well as other related technologies and also control technology.

Third, it is expected that technology related to the processing of new materials will be developed even further. One example is recent activity involving the use and development of new materials such as special alloys, ceramics, and composite materials. A new processing technology which is being used more and more in this area is the use of laser processing machines, and in the manufacture of metal moulds new technology for processing such as "lamination dies" are being used. It is expected that these new technologies will be applied to more areas in the future.

Fourth, there is the use of new structured materials for the machines which are used for manufacturing moulds and dies. Because the machine tool is the most important and fundamental piece of equipment for every industry, and because the machine tools are based upon the mould and die industry, industries cannot be expected to advance if progress is not made in machine tools. Recently, casting and steel plate welding materials which have been traditionally used for machine tools have been substituted more and more by new materials such as ceramics, concrete, and composite materials. In the case of materials made from concrete in particular, considerable research is being undertaken in this area, especially in Switzerland, and they have already been used for grinders and lathes.

## (5) Requirements for the Development of the Japan Mould and Die Industry

1) Cooperative Relationships with Customers

Above all, it is the great importance which is attached to the role of customers who buy moulds and dies which has contributed to the development of the Japanese mould and die industry to its present high level.

The first reason why mould and die users are involved in supporting and fostering mould and die manufacturers is the great importance which moulds play in the manufacture of their products. The development of new products and new technologies directly concerns moulds and dies, and the quality of the moulds affects the quality of the products which they produce. Manufacturers cannot manufacture products of a satisfactory quality unless they pay particular attention to moulds and dies.

The second reason is that in order to escape from the two oil crises, Japanese companies have put particular effort into developing new products. That is, not only has there been a sudden change over to energy-conserving models for automobiles and home appliances, areas which had constituted the demand sector for moulds and dies, but also considerable activity has been seen in the development of new products, largely in the area of electronics and communications.

Also, the consumer buying pattern of the products has shown increasing diversification, and the life cycle of products has been shortened. This has had the result of increasing demand for moulds and dies to unprecedented proportions.

As a consequence of these factors, mould and die users have had to put considerable effort into fostering mould and die manufacturers, and they have subsequently been providing all kinds of support, including technological support, financial support, and support in acquiring facilities and equipment. In addition, because mould and die manufacturers have uncomplainingly been supplying customers with moulds and dies to meet required delivery dates, a strong bond has been formed between the two.

A third reason is the growth of manufacturers which specialize in the production of moulds and dies. Since the end of the Second World War mould and die manufacturers who have continued to accumulate technology, experience and knowledge. This has made mould and die users recognize that unless they use specialized manufacturers, it will be difficult to procure supplies of good quality moulds. For example, even if a mould and die user were to establish its own mould and die division, they would not be able to catch up with the special skills of mould and die manufacturers, so they would have to rely on the mould and die manufacturers for their more important moulds and dies, and they would only have to produce moulds themselves when the workload of specialized mould and die manufacturers became too heavy.

As a result, the in-house production ratio of the Japanese mould and die industry (the percentage of the value of moulds and dies which users of moulds and dies actually supply among the total production value of moulds and dies) has been decreasing. Whereas in 1976 and 1977 it stood at 29%, it dropped to 26.1% in 1981, 24.1% in 1982, 25.1% in 1983, and then 21.0% in 1984. This is a significant decrease from the in-house production ratio around 1950, which stood at 65%.

The in-house production ratio in terms of the different types of moulds and dies used in forging, casting, and pressing are 64.6%, 33.5%, and 30.5%, respectively. The ratio for moulds for glass is particularly low at 0.6%.(refer Table IV. 3-32)

There are two reasons why the specialized skills of Japanese mould and die manufacturers are rated highly in this way. First, once technicians and skilled workers belonging to mould and die manufacturers are employed, they normally continue to work at the same company for a long time and accumulate experience in the process. The length of service for mould and die design specialists in Japan is approximately 10 years, and the length of service for skilled workers is nearly 10 years longer than this. What is more, there are many cases where skilled workers stay with one employer for over than 30 years. Such records for length of service also apply for small-scale manufacturers which employ between 5 and 10 workers.

The second reason is that in the early 1970s, assembly industries such as the automobile industry began to grow rapidly, which resulted in a rapid increase in demand for moulds and dies. The growth of the automobile industry brought about the growth of the material industry which supplies materials such as special steel, etc., which are used in moulds and dies and also led to the growth in the areas of heat treatment and plating, technology which is fundamental for the machining industries. As a result, heat treatment and plating technology, both of which are vital for the growth of the mould and die industry, were resolved at the same time.

2) Growth of Mould and Die Standard Parts Industry

An important factor behind the high level of productivity which the Japan mould and die industry has built up is said to be the role of specialized mould and die parts manufacturers who produce and supply standard parts which make up more than 30% of the parts used in the manufacture of moulds and dies. This is because these parts are very useful for mould and die manufacturers who use standardized semi-manufactured goods and standard parts. The greater the range of standardized parts, the easier design becomes. Also, not only is the time required for design reduced, management of the production stages simplified, and the time required for delivery shortened, but it also makes higher quality possible. On top of this, it makes it possible to arrange and systematize the knowledge and experience which usually only technicians and skilled workers have. The use of standardized parts has also provided the opportunity for the introduction of automated equipment such as CAD/CAM, NC machines, machining centers, and robots in areas which were once said to be difficult to automate.

The primary objective of mould and die manufacturers in standardizing parts is to shorten delivery time, and the second is to introduce CAD/CAM (refer to Table IV. 3-36). Table IV. 3-37 shows that as standardization has taken place, the greatest change has been the standardization of the structure of moulds. This seems to suggest that whereas up until today standardization has largely centered around parts, from now on it will focus on software. This clearly shows that a change is taking place from the superficial to the more fundamental.

**Table IV. 3-36 Reasons for Standardization of Moulds and Dies**

(1) Reduces expenses resulting from variety of small lot production (19.8%);
(2) Shortens delivery time (40.7%);
(3) Accommodates changes in design (3.7%);
(4) For the introduction of NC machine tools (7.4%);
(5) For bringing in CAD/CAM (24.7%);
(6) Enables QDC (3.7%).

Source: "Metal Press", January, 1983.

**Table IV. 3-37 Standardization Process**

(1) Use of standardized moulds and dies (32.1%);
(2) Standardization of structure of moulds and dies (39.5%);
(3) Standardization of processing (17.3%);
(4) Standardization of data (3.7%);
(5) Making units (7.4%)

Source: "Metal Press", January, 1983

Today, when the mould and die manufacturing industry is becoming a technology-intensive industry, if the process of achieving standardization itself is regarded as technology, the necessity for each manufacturer to standardize can be expected to increase from now on. What will happen is that standardization will change from setting criteria and patterns over to the standardization of processes and information.

3) Management Improvement and its Direction

Since 1955, when Japan entered its period of real economic growth, demand has increased for goods, particularly for durable consumer goods such as home appliances and automobiles. The raising of productivity has been the primary objective of Japanese mould and die manufacturers, and in order to achieve this they having been putting all their energy into 2 areas.

The first involves raising technical levels through the introduction of the latest types of equipment such as machining centers, NC processing machines, etc., and also by making use of modern technology such as CAD/CAM and robots. At the present time, the ratio of machinery and equipment per individual worker in the Japanese mould and die industry is around $US9,000, or the highest in the world. The percentage of manufacturers using NC machine tools is also fairly high. While the labour costs of mould and die manufacturers have been increasing significantly, the relative price of NC machine tools has been decreasing, with the result that more and more manufacturers are becoming interested in using NC machine tools. Recently, requests from mould and die users for shortened delivery times and increased precision have become more severe so that the mould and die manufacturers have had no choice but to increase their investment in plant and equipment to raise technical levels.

The increasing use of devices involves the creation of production systems using mechatronics, and the higher the investment in mechatronics becomes, the more important each enterprise's financial capacity will become. Relatively large-scale mould and die manufacturers are making investments in order to put CAD/CAM systems to practical use, and they are aiming at systematizing their operations through the introduction of large NC processing machines. Medium- and small-scale manufacturers who have turned to specializing in particular processing areas are also introducing NC electric discharge machines, wire cut electric discharge machines, and NC machine tools on a large scale. Also, strategies aimed at the future are being set as, and while on the one hand NC machines are being introduced, on the other hand, in the area of manufacturing, higher precision is being sought, and effort is being put into the manufacture of electronic parts as a result of thorough automation.

Second, the Japanese mould and die industry has a good record in regard to delivery and quality because of its sophisticated production-management systems. Production-management systems can broadly be divided into two types: the integrated system and the division of labour system. The integrated system involves a number of workers making one thing. In this system, the workers produce a mould from the initial to the final stage. The division of labour system entails specializing operations by placing workers at particular production stages or machines.

As for the special features of both of these systems, the division of labour system is a system which enables the continual production of moulds and dies at individual stages and also makes it possible for large companies to raise their level of production efficiency. However, if this system were to be adopted by small manufacturers, work would not run smoothly and therefore result in a waste of time. Consequently, small manufacturers are adopting the integrated system which allows for more flexible operations.

Viewed from the perspective of production equipment, because the companies which adopt the integrated system generally have a number of multi-purpose machines, they have to rely on manual work in order to attain a high level of precision and the processing of minute surfaces. On the other hand, manufacturers which have adopted the division of labour system have introduced a relatively large number of high performance machines, such as machining centers, and forming grinders to achieve a high level of precision. The larger the size of a manufacturer the more the integrated system has been replaced by the division of labour system, and the cut off point between these 2 systems is usually companies which have 10 workers.

4) Recent Trends

The steady appreciation of the yen caused mould and die users to become increasingly severe in their requests to reduce costs, resulting in a 30% drop in the sales price compared to two years earlier. The life cycles of automobiles and electric and electronic goods have been reduced as a result of the diversification and individualization of consumer tastes and this has led to a reduction in the delivery time for moulds and dies from 60 days to 45 days in average within a two-year period.

While it looks as though requests from users for a reduction in production costs and shorter delivery time, which have been exacerbated by the appreciation of the yen, will continue, those manufacturers which have managed to keep going by using up their internal reserves and reducing plant and equipment have reached the stage where they can make no more rationalizations. Added to this there are problems concerning personnel as number of young workers entering the mould and die industry has dropped sharply. There are more than a few manufacturers which have gone bankrupt or have entered new industries. They have been put in a position where they have been forced to make new moves in order to stay in business.

One such move is the international division of labour. The setting up of operations overseas by companies within the automobile and electric and electronic industries has been accompanied by increased requests for mould and die production to be carried out overseas. Seeing that there will be further requests for reduced costs and moves to import moulds and dies and to shift production bases overseas, mould and die manufacturers will have to take appropriate steps to match such moves.

### (6) Export and Import Trends

1) Exports

The export values for the years from 1983 to 1987 recorded healthy increases and are shown in Table IV. 3-38.

In the period from 1983 to 1987 press and forging dies (85.05-041) increased 55% (from ¥29.95 billion to ¥46.4 billion), casting moulds and parts (84.60-010) increased 72% (from ¥6.9 billion to ¥11.85 billion), and moulds for glass, rubber and plastic recorded an increase of 96% (from ¥27.7 billion in 1983 to ¥54.27 billion in 1987).

However, the order of the main countries to which these products are exported changes from year to year and there have been sharp fluctuations in the value of these exports. This is due to the production and sale of moulds and dies in single units and small lots which prevents continuity.

A comparison of exports of press and forging dies for 1986 and 1987 shows that exports to South Korea decreased dramatically from ¥12.64 billion in 1986 to ¥4.533 billion in 1987. In contrast to this, exports to the United States increased from ¥7.57 billion to ¥14.49 billion during the same period so that they accounted for one-fourth of total exports and made the U.S. the largest importer of Japanese-made press and forging dies. Another increase was recorded in exports to Australia which increased significantly from ¥4.976 billion in 1986 to ¥9.026 billion in 1987, and which made Australia the second largest importer behind the United States. Exports to Malaysia increased from ¥880 million in 1986 to ¥2.11 billion in 1987, putting it in fifth place.

**Table IV. 3-38 Japan's Exports of Moulds and Dies**

(Unit: ¥1,000)

| | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|
| 82.05-041 Dies for press or for forging, n.e.s. | 29,949,123 | 34,988,071 | 45,417,941 | 51,859,269 | 46,489,762, |
| 84.60-010 Moulding boxes for foundry, moulds of a type used for metal, and parts thereof | 6,898,536 | 6,396,397 | 9,802,774 | 10,602,933 | 11,850,753 |
| 84.60-090 Moulding boxes for metalcarbides, for glass, for mineral materials or for rubber or artificial plastic materials and parts tereof | 27,701,598 | 30,699,404 | 42,601,362 | 47,333,162 | 54,269,792 |
| Moulds & Dies | 64,549,257 | 72,083,872 | 97,822,077 | 109,795,364 | 112,610,307 |

Source: Japan Export & Imports

2) Imports

Imports for the years from 1983 to 1987 are shown in Table IV. 3-39 and show an increase in imports of moulds and dies during that period. Imports classified according to type and to country of origin for 1985, 1986 and 1987 are shown in Table IV. 3-41.

In the case of CCN. No.84.60-010 (casting moulds, moulding boxes and parts for use in metal casting), while these were mainly imported from advanced countries such as the United States and West Germany, the percent of these imports from Taiwan and South Korea increased. What is more, in the case of CCN.No.84.60-090 the ratios for imports from Taiwan and South Korea exceeded those of advanced countries.

Table IV. 3-39 Japan's Imports of Moulds and Dies

(Unit: ¥1,000)

| | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|
| 84.60-010 Moulding boxes for foundry, moulds of a type used for metal, and parts thereof | 301,969 | 334,293 | 449,241 | 426,436 | 677,550 |
| 84.60-090 Moulding boxes for metalcarbides, for glass, for mineral materials or for rubber or artificial plastic materials and parts tereof | 3,659,066 | 3,547,824 | 4,301,395 | 4,622,931 | 6,160,844 |
| Moulds & Dies | 3,961,035 | 3,882,117 | 4,750,636 | 5,049,394 | 6,838,394 |

Source: Japan Export & Imports

## Table IV. 3-40 Exporting Countries of Moulds and Dies

### (Stamping and Forging Dies)

(Unit ¥1,000)

| 1985 | | | 1986 | | | 1987 | | |
|---|---|---|---|---|---|---|---|---|
| | Total Amount | 45,417,941 | | Total Amount | 51,859,269 | | Total Amount | 46,489,762 |
| 1. | U.S.A | 8,866,737 | 1. | South Korea | 12,647,179 | 1. | U.S.A. | 14,496,467 |
| 2. | South Africa | 7,016,794 | 2. | U.S.A. | 7,570,789 | 2. | Australia | 9,026,251 |
| 3. | South Korea | 5,784,686 | 3. | Australia | 4,976,650 | 3. | South Korea | 4,533,129 |
| 4. | Malaysia | 4,301,273 | 4. | U.S.S.R. | 4,623,486 | 4. | China | 3,886,009 |
| 5. | Indonesia | 2,645,237 | 5. | Mexico | 3,997,081 | 5. | Malaysia | 2,114,350 |
| 6. | Mexico | 2,307,592 | 6. | China | 3,328,317 | 6. | Singapore | 1,713,449 |
| 7. | United Kingdom | 2,245,438 | 7. | South Africa | 3,233,793 | 7. | Taiwan | 1,674,292 |
| 8. | Algeria | 1,934,797 | 8. | Indonesia | 2,712,788 | 8. | Sweden | 1,429,861 |
| 9. | China | 1,906,561 | 9. | Taiwan | 1,534,559 | 9. | Brazil | 1,248,474 |
| 10. | Taiwan | 1,534,559 | 10. | India | 1,529,439 | 10. | U.S.S.R. | 925,786 |
| | | | 11. | Malaysia | 881,720 | | | |

### Moulds Used for Metallic Carbides, Glass, Rubber, Artificial Plastic Materials or for Mineral Materials, and Parts Thereof

(Unit ¥1,000)

| 1985 | | | 1986 | | | 1987 | | |
|---|---|---|---|---|---|---|---|---|
| | Total Amount | 9,802,774 | | Total Amount | 10,602,933 | | Total Amount | 11,850,753 |
| 1. | South Korea | 2,633,836 | 1. | South Korea | 2,301,462 | 1. | U.S.A. | 2,963,215 |
| 2. | China | 1,432,718 | 2. | U.S.A. | 2,234,011 | 2. | South Korea | 1,657,421 |
| 3. | U.S.A. | 1,290,927 | 3. | China | 875,605 | 3. | China | 1,267,453 |
| 4. | Taiwan | 861,950 | 4. | Taiwan | 729,301 | 4. | Taiwan | 1,035,629 |
| 5. | Singapore | 571,671 | 5. | Singapore | 653,873 | 5. | Singapore | 885,565 |
| 6. | Thailand | 406,507 | 6. | Mexico | 545,099 | 6. | U.K. | 579,287 |
| 7. | Algeria | 387,320 | 7. | Hong Kong | 447,900 | 7. | Thailand | 406,618 |
| 8. | Malaysia | 367,743 | 8. | India | 379,452 | 8. | Australia | 366,289 |
| 9. | Brazil | 218,209 | 9. | Australia | 363,382 | 9. | U.S.S.R. | 295,475 |
| 10. | Mexico | 159,411 | 10. | Thailand | 249,511 | 10. | Brazil | 233,386 |
| | | | (19. | Malaysia | 83,902) | (11. | Malaysia | 212,117) |

<Moulds of a Type Used for Metallic Carbides, Glass, Rubber, Artificial Plastic Materials or for Mineral Materials, and Parts thereof>

(Unit ¥1,000)

| | 1985 | | | 1986 | | | 1987 | |
|---|---|---|---|---|---|---|---|---|
| | Total Amount | 42,601,362 | | Total Amount | 47,333,162 | | Total Amount | 54,269,792 |
| 1. | U.S.A. | 9,039,259 | 1. | U.S.A. | 10,845,651 | 1. | U.S.A. | 15,805,418 |
| 2. | China | 6,231,590 | 2. | South Korea | 6,640,700 | 2. | South Korea | 6,372,798 |
| 3. | South Korea | 5,112,934 | 3. | China | 4,810,824 | 3. | Singapore | 5,988,215 |
| 4. | Singapore | 4,399,317 | 4. | Singapore | 4,462,513 | 4. | Taiwan | 4,442,229 |
| 5. | Taiwan | 4,305,906 | 5. | Taiwan | 4,381,011 | 5. | Hong Kong | 3,962,334 |
| 6. | Hong Kong | 1,924,387 | 6. | Hong Kong | 2,664,928 | 6. | China | 3,465,989 |
| 7. | Malaysia | 1,359,978 | 7. | United Kingdom | 1,832,897 | 7. | United Kingdom | 1,843,096 |
| 8. | United Kingdom | 1,266,650 | 8. | Malaysia | 1,708,664 | 8. | Malaysia | 1,803,217 |
| 9. | Indonesia | 1,250,852 | 9. | Thailand | 1,241,742 | 9. | Thailand | 1,533,334 |
| 10. | Thailand | 1,206,351 | 10. | Australia | 1,163,209 | 10. | Brazil | 1,115,295 |

Source: Japan Export & Imports

Table IV.3-41 Imports by Country of Moulds and Dies
(Stamping and Forging Dies)

(Unit ¥1,000)

| 1985 | | | 1986 | | | 1987 | | |
|---|---|---|---|---|---|---|---|---|
| | Total Amount | 449,241 | | Total Amount | 426,463 | | Total Amount | 677,550 |
| 1. | U.S.A. | 233,054 | 1. | U.S.A. | 137,394 | 1. | Taiwan | 200,649 |
| 2. | Taiwan | 67,530 | 2. | Taiwan | 89,524 | 2. | U.S.A. | 150,666 |
| 3. | West Germany | 59,018 | 3. | West Germany | 73,872 | 3. | South Korea | 141,396 |
| 4. | South Korea | 43,035 | 4. | South Korea | 52,239 | 4. | West Germany | 67,189 |
| 5. | Singapore | 11,783 | 5. | Canada | 32,771 | 5. | Switzerland | 43,378 |
| 6. | Switzerland | 8,921 | 6. | Italy | 26,815 | 6. | Singapore | 24,969 |
| 7. | Denmark | 6,688 | 7. | Singapore | 7,133 | 7. | United Kingdom | 16,298 |
| 8. | Sweden | 5,331 | 8. | Denmark | 1,746 | 8. | Italy | 6,263 |
| 9. | United Kingdom | 5,273 | 9. | Philippine | 1,614 | 9. | Australia | 6,001 |
| 10. | Italy | 3,836 | 10. | Hong Kong | 1,534 | 10. | U.S.S.R. | 3,813 |
| (16. | Malaysia | 261) | (13. | Malaysia | 287) | (13. | Malaysia | 2,949) |

<Moulds of a Type Used for Metallic Carbides, Glass, Rubber, Artificial Plastic Materials or for Mineral Materials, and Parts thereof>

(Unit ¥1,000)

| 1985 | | | 1986 | | | 1987 | | |
|---|---|---|---|---|---|---|---|---|
| | Total Amount | 4,301,395 | | Total Amount | 4,622,931 | | Total Amount | 6,160,844 |
| 1. | South Korea | 1,270,329 | 1. | South Korea | 1,522,821 | 1. | South Korea | 2,094,229 |
| 2. | Australia | 1,148,562 | 2. | Australia | 940,165 | 2. | Taiwan | 1,452,621 |
| 3. | U.S.A. | 722,943 | 3. | Taiwan | 746,089 | 3. | Australia | 1,131,027 |
| 4. | Taiwan | 386,233 | 4. | U.S.A. | 484,184 | 4. | West Germany | 437,794 |
| 5. | West Germany | 304,999 | 5. | West Germany | 347,202 | 5. | U.S.A. | 352,510 |
| 6. | Singapore | 140,662 | 6. | Singapore | 173,485 | 6. | Canada | 221,357 |
| 7. | Canada | 75,128 | 7. | Switzerland | 92,733 | 7. | Singapore | 136,241 |
| 8. | United Kingdom | 37,573 | 8. | Italy | 76,106 | 8. | Italy | 117,622 |
| 9. | Hong Kong | 24,823 | 9. | Canada | 60,413 | 9. | Austria | 29,012 |
| 10. | Austria | 21,923 | 10. | Denmark | 26,625 | 10. | Hong Kong | 23,084 |
| (23. | Malaysia | 1,782) | (18. | Malaysia | 4,020) | (16. | Malaysia | 4,466) |

Source: Japan Export & Imports

## (7) The Japan Die and Mould Manufacturers Association

In Japan manufacturers associations play an important role in the development of the respective industries. This also applies in the case of the mould and die industry. Accordingly, an outline of the Japan Die and Mould Manufacturers Association is provided below.

### 1) The establishment and organization of the association

The Japan Die and Mould Manufacturers Association is an industry group which was established in 1957 with the assistance of the Ministry of Trade and Industry.

After the Second World War the development of machinery industries became necessary for the survival of Japan, and the development of the mould and die industry was essential in order to achieve this end.

Although manufactured goods were in the beginning made for the local market when they started being exported a high level of precision for moulds and dies became necessary. It is because of this that plant and equipment and technology found in Japan's mould and die industry today ranks amongst the best in the world.

The Japan Die and Mould Manufacturers Association is the only organization of its type in Asia which belongs to the International Special Tool Association (ISTA).

The Japan Die and Mould Manufacturers Association has a chairman and board of directors under which there is its main office and also three regional offices (eastern office, central office, western office). A total of 1,000 companies belong to the association. This number consists of 700 specialist mould and die manufacturers which ar full members and a further 300 supporting members which comprise associated machine tool manufacturers, steel material manufacturers, tool manufacturers and trading companies, etc.

### 2) Outline of the activities of the association

The activities of the Japan Die and Mould Manufacturers Association are largely funded from the membership fees of its members. Its annual budget, including staff salaries, is in the region of ¥130 million.

Its main activities are as follows:

a) Activities undertaken in cooperation with the government

* Applications for changes and reports related to the various types of taxation laws

* Cooperation on various types of investigative studies undertaken for formulating policies

b) Activities for strengthening its organization

* Maintaining and promoting cooperative relations with associated groups
* Educating those outside the industry for the purpose of raising the industry's position

c) Activities related to improving business structure

* Research into changes in the business environment and ways to deal with such changes
* Formulation of basic contracts for mould and die transactions and the rationalization of the system for transactions
* Involvement in moves to establish operations overseas and internationalization
* Holding of meetings to study methods for modernizing business management

d) The improvement of personnel management

* Continuation of surveys into industry wages and a reevaluation of the retirement allowance system
* Study of business management by labor which accompanies advancements in process technology

e) Improvements in technology

* Establishment of standard specifications for moulds and dies
* Implementation of training and specialized education in relation to technology and skills
* Establishment of international standards

f) Public relations for the industry

* Undertake public relations activities through bulletins, reports, briefing sessions and lectures

g) Promotion of international exchanges

* International Special Tool Association

h) Outstanding Worker's Award

* Awards to outstanding workers in each member company

## 3-6 Mould and Die Production in Major Countries and the Status of Traue

Standardized statistics for the values and amounts of the world's mould and die production do not exist. Depending upon the country, various statistics focusing on moulds and dies may or may not exist, and even if they do, the extent of their item lists differ from country to country.

Given this set of circumstances, a look at the production and trade status of moulds and dies in the major nations is appropriate for the purpose of exploring the possibilities of export by Malaysia.

### (1) Production of Moulds and Dies in Major Nations

According to a presentation by the secretariat in the International Special Tooling Association (ISTA), the total value of production from the 15 member nations, listed immediately below, totalled ¥1,982.919 billion (figures converted to yen by the Japan Die and Mould Manufacturing Association; see Table IV. 3-42).

ISTA members as of 1986 were: The United States, Japan, West Germany, Italy, France, Great Britain, Spain, Switzerland, Holland, Canada, Belgium, Finland, Portugal, Sweden, and Denmark.

Ranked by country, the United States was first, with a production value of ¥940,815 million and occupying 47% of total production value. This was a decrease of 4.4% from the results of a 1983 survey. Japan was second, with an output of ¥375,498 million, which was 18.9% of total production value and a 16% increase over 1983. Next was West Germany with ¥208,517 million, which was 10.5% of the total and a 13.6% increase over 1983. Italy followed with a production value of ¥91.8 billion, which was 4.6% of the total and a 0.7% decrease from 1983. Finally, France had a production value of ¥67,575 million, 3.4% of the total and a 37.5% increase from 1983.

However, Japan uses machine statistics collected from 641 companies each with over 20 employees to calculate its manufacturing value. If a switch were made to industrial statistics based upon the total production value in all of Japan, value of output in 1986 becomes ¥1,225.042 billion, thus exceeding the United States' output. Furthermore, Japan's share of the value of the ISTA's entire production of ¥2,832.4 billion becomes 43.2%. The combined total share of production by Japan and the United States comprises an overwhelming 76.5% of ISTA's total.

## Table IV. 3-42 Annual Production (1986)

(Unit: Million Yen)

| | U.S. | Japan | West Germany | France | U.K. | Spain | Switzerland | Netherland | Canada | Belgium | Finland |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Punch and Press Dies | 334,847 | 150,228 | 101,325 | 17,304 [1] | 12,064 | 26,229 [1] | 13,536 | 30,656 | 9,417 | 4,154 | 3,592 |
| Plastic and Rubber Moulds | 295,998 | 161,148 [4] | 49,643 [4] | 43,527 [5] | 17,145 | 22,439 [1,4] | 19,600 | 7,648 | 21,353 | 17,512 [4] | 3,750 [3] |
| Diecast Dies | 68,912 | 21,287 | 8,777 | 6,744 | 2,343 | 3,794 [1] | 3,472 | | | 1,666 | 1,134 |
| Jigs and Fittings | 129,384 | | 33,184 | | 24,801 | | 8,816 | | 2,506 | 104 | 1,670 |
| Standard Tools and Parts | 111,674 | 42,775 [2] | 15,588 | | 6,328 | 2,006 [1] | 1,776 | | 3,532 | 13,316 | 189 |
| TOTAL | 940,815 | 375,498 [3] | 208,517 [6] | 67,575 | 62,681 [6] | 54,468 [1] | 47,200 | 38,304 | 36,808 | 36,752 | 10,335 |

| | Portugal | Sweden | Denmark | Sub Total | Italy | TOTAL |
|---|---|---|---|---|---|---|
| Punch and Press Dies | | 3,283 | | 706,675 | | |
| Plastic and Rubber Moulds | 6,080 [1] | 2,612 [4] | | 668,455 | | |
| Diecast Dies | 320 [1] | 491 | | 118,940 | 91,200 | |
| Jigs and Fittings | | | | 200,465 | | |
| Standard Tools and Parts with less than 25 workers. | | | | 197,184 | | |
| TOTAL | 6,400 [1] | 6,366 [3] | - [8] | 1,891,719 | 91,200 [1] | 1,982,919 |

Note:
1. Estimate
2. Including other moulds, dies, and special tools not mentioned in these statistics.
3. Including in-house production by shops in automobile and plastic industries.
4. Including tire moulds. 5. Including glass moulds.
6. Not including figures for business establishments which are less than 25 workers.
7. 1985 figures. 8. Not yet submitted.

GRAND TOTAL 1,982,919

Excluding Denmark, which reported no statistics to ISTA, and Italy, which only reported total value, the values of different mould and die types for the other 13 nations are as follows: Moulds and dies for punch press use had the greatest value at ¥706,675 million and occupied 37.4% of total production value. Next was the value of moulds and dies for plastics and rubber use, totalling ¥668,455 million or 35.3% of the total value; then jig fixtures at ¥200,465 million or 10.6%; standard tool parts at ¥197,184 million or 10.4%; and moulds and dies for die cast use at ¥118,940 million or 6.3%. Divided by product and by country, again excluding Denmark and Italy, the United States was first in production value of moulds and dies for punch press use at ¥334,847 million, 47.4% of ISTA's total value of ¥706,675 million; Japan was second at ¥150,288 million or 21.3%; third was West Germany at ¥101,325 million or 14.3%. For moulds and dies for plastics and rubber, the United States was first at ¥295,998 million or 44.3% of the ISTA's total ¥668,455 million; Japan was second at ¥161,148 million or 24.1%; and third was West Germany at ¥496,643 million, or 7.4%. For moulds and dies for die cast use, the United States was first at ¥68,912 million or 58.0% of the ISTA's ¥118,940 million total; Japan was second at ¥21,287 million or 17.9%; West Germany was third at ¥8,777 million or 7.4%. Since some of the countries did not report statistics for jig fixtures, those figures will not be mentioned. In standard tool parts, the United States ranked first at ¥111,674 million or 56.6% of the total ISTA production value; Japan was second at ¥42,775 million or 21.7%; and West Germany was third at ¥15,588 million or 7.9%.

### (2) Exports

The total export value for the ISTA member nations in 1986 was ¥383,056 million. This was ¥107,869 million, or 39.2%, above the 1983 output level.

Ranking each country by the value of its exports, Japan was first at ¥109,795 million, which was an increase of ¥45,246 million, or 70.1%, over its 1983 level; second was West Germany at ¥68,793 million, a decrease of ¥2,324 million, or 3.3%, from 1983; next was the United States at ¥40,650 million, a decrease of ¥3,681 million, or 8.3%, from 1983; Holland displayed an enormous gain of ¥18,510 million, or 221.20%, over its 1983 level to ¥26,864 million; and Belgium had an export value of ¥23,621 million, thus increasing ¥12,273 million, or 108.2%, above its 1983 level (Table IV. 3-43).

## Table IV. 3-43 Exports (1986)

(Unit: Million Yen)

| | Japan | West Germany | U.S. | Netherlands | Belgium | Italy | Switzerland | Canada [6] | France | U.K. | Spain | Portugal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Punch Press Dies | 51,859 [4] | 22,887 | 5,991 | 9,360 | 2,807 | 8,323 | 9,440 | 2,632 | 1,643 [1] | 3,306 | 3,374 | |
| Plastic and Rubber Moulds | 47,333 [3] | 34,576 | 29,551 | 16,304 | 10,613 [2] | 11,032 | 8,992 | 12,705 | 12,985 | 5,211 | 6,993 [2] | 5,587 [1] |
| Diecast Dies | 10,603 [5] | 2,961 | 1,871 | 1,200 | 1,009 | 1,831 | 528 | 3,384 | 1,090 | 1,695 | 311 | 621 [1] |
| Jigs and Fittings | | 4,051 | 959 | | 71 | | 896 | 810 | | 552 | | |
| Standard Tools and Parts | | 4,318 [1] | 2,233 | | 9,121 | | 704 | 778 | | 777 | | |
| TOTAL | 109,795 | 68,793 | 40,605 | 26,864 | 23,621 | 21,186 | 20,560 | 20,309 | 15,718 | 11,541 | 10,698 | 6,208 |

| | Sweden | Denmark | Finland |
|---|---|---|---|
| Punch Press Dies | 2,024 | 432 | 38 |
| Plastic and Rubber Moulds | 1,175 | 2,368 | 787 |
| Diecast Dies | 105 | 128 | 69 |
| Jigs and Fittings | | | 22 |
| Standard Tools and Parts | | | 10 |
| TOTAL | 3,304 | 2,928 | 926 |

GRAND TOTAL 383,056

NOTE:
1. Estimate
2. Including tire moulds.
3. Including inorganic material moulds.
4. Including casting moulds.
5. Including other casting moulds.
6. 1985 figures.

### (3) Imports

The total value of imports in 1986 for ISTA member nations was ¥258,322 million. This was a large increase of ¥116,276 million, or 81.9%, over the 1983 figure.

Ranked by country, the United States was first at ¥75,909 million, displaying a marked increase of ¥41,153 million, or 118.4%, from 1983. Second was West Germany at ¥42,143 million, an increase of ¥5,987 million, or 16.6%, from 1983. Next was Holland at ¥33,792 million, a large increase of ¥23,928 million, or 242.6%, over 1983. Finally, France had an import value of ¥20,024 million, a significant increase of ¥776 million, or 67.6%, over 1983 (Table IV. 3-44).

### (4) The Outlook for the International Division of Labor in the Mould and Die Industry

Next is a look at trade values in order to determine to what extent a horizontal division of labor had advanced among the major nations in the mould and die industry. Table IV. 3-45 shows the "Horizontal Division of Labor of Main Countries in 1986." A high degree of horizontal division of labor exists in the countries with large numbers. Accordingly, the highest degree exists in Finland, which registered 99.9; next was Belgium at 99.2; Denmark at 93.1; and Spain at 91.8. On the other hand, Japan had the smallest number, 8.8; Italy next at 30.7; then the United States at 69.7. From this information, it can be concluded that an advanced degree of horizontal division of labor exists mainly in a few of the European countries. Despite Japan's quick development in recent years in the horizontal division of labor, due in part to both pressure from the appreciation in the value of the yen and to an increase in imported goods, the division of labor in 1986 for the mould and die industry was exceedingly low.

Next, comparing this with Table IV. 3-46's "Horizontal Division of Labor of Major Countries in 1983", the degree of division of labor in the United States, Holland, France, Great Britain, and Italy is decreasing, but the overall degree of horizontal division of labor for all countries is advancing, as is indicated by the number for all countries mentioned earlier, which was 84.1 in 1986 and 68.1 in 1983.

Table IV. 3-47 shows the export and import coefficients in relation to trade scale.

In 1986, Portugal had the largest export coefficient of 0.970; next was Holland at 0.701; then Belgium at 0.643; Canada at 0.552; and Sweden at 0.519. The lowest coefficients belonged to the United States at 0.043, then Finland at 0.090, with Japan at 0.138. The values of exports from Japan and the United States were high, but because production values were high, their import coefficients were low. Comparing this to 1983

## Table IV. 3-44 Imports (1986)

(Unit: Million Yen)

| | U.S. | West Germany | Netherlands | Belgium | France | U.K. | Canada [5] | Spain | Sweden [5] | Japan | Italy | Denmark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Punch and Press Dies | 11,169 | 12,307 | 8,176 | 7,028 | 4,168 [1] | 3,183 | 4,454 | 1,316 | 1,894 | | 1,489 | 864 |
| Plastic and Rubber Moulds | 50,770 | 22,015 | 23,472 | 6,867 [2] | 14,040 | 10,371 | 2,336 | 7,503 [2] | 3,374 | 4,623 [3] | 1,973 | 2,384 |
| Diecast Dies | 3,096 | 3,700 | 2,144 | 916 | 1,816 | 1,825 | 532 | 228 | 467 | 426 [4] | 383 | 112 |
| Jigs and Fittings | 5,813 | 1,557 | | 166 | | 879 | 3,949 | | | | | |
| Standard Tools and Parts | 5,061 | 2,564 [1] | | 9,030 | | 2,553 | 4,404 | | | | | |
| TOTAL | 75,909 | 42,143 | 33,792 | 24,007 | 20,024 | 18,811 | 15,675 | 9,047 | 5,735 | 5,049 | 3,843 | 3,360 |

| | Finland | Portugal | Switzerland |
|---|---|---|---|
| Punch and Press Dies | 94 | | |
| Plastic and Rubber Moulds | 504 | | |
| Diecast Dies | 10 | | |
| Jigs and Fittings | 13 | | |
| Standard Tools and Parts | 306 | | |
| TOTAL | 927 | - | - |

GRAND TOTAL 258,322

NOTE:
1. Estimate
2. Including tire moulds.
3. Including glass moulds.
4. Including other casting moulds.
5. 1985 figures.

## Table IV. 3-45 Horizontal Division of Labor of Main Countries in 1986

(Unit: Million Yen)

| | U.S. | West Germany | Netherlands | Belgium | France | U.K. | Canada | Spain | Sweden | Japan | Italy | Denmark | Finland | Portugal | Switzerland |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Punch and Press Dies | 69.8 | 69.9 | 93.2 | 57.1 | 56.5 | 98.1 | 74.3 | 71.9 | 96.7 | 0 | 30.4 | 66.7 | 57.6 | - | - |
| Plastic and Rubber Moulds | 73.6 | 77.8 | 82.0 | 78.6 | 96.1 | 66.9 | 31.1 | 96.5 | 51.7 | 17.8 | 30.3 | 99.7 | 78.1 | - | - |
| Diecast Dies | 75.3 | 88.9 | 71.8 | 95.2 | 75.0 | 96.3 | 28.1 | 81.6 | 36.7 | 7.7 | 34.6 | 93.3 | 25.3 | - | - |
| Jigs and Fittings | 28.3 | 55.5 | - | 64.4 | 0 | 77.4 | 34.0 | - | - | - | - | - | 74.3 | - | - |
| Standard Tools and Parts | 61.2 | 74.5 | - | 99.5 | 0 | 46.7 | 30.0 | - | - | - | - | - | 6.3 | - | - |
| TOTAL | 69.7 | 76.0 | 88.6 | 99.2 | 88.0 | 76.0 | 87.1 | 91.8 | 73.1 | 8.8 | 30.7 | 93.1 | 99.9 | - | - |

Note:
1. Horizontal division of labor is expressed by $(1 - \frac{\text{Exports - Imports}}{\text{Exports + Imports}}) \times 100$.
2. Exports and imports are according to Tables IV. 3-43 and IV. 3-44.
3. - mark indicates statistics not yet reported or unavailable.

figures in Table IV. 3-48, the coefficients of the United States, West Germany, Holland, France, and Great Britain decreased, and those of Belgium, Sweden, Japan, Italy, and Finland increased. Excluding those countries for which statistics were lacking, the coefficient for all countries was 0.192 in 1986 and 0.140 in 1983, thus showing a growing trend overall.

The largest importing coefficient belonged to Sweden at 0.901; then Holland at 0.882; Belgium at 0.643; Canada at 0.426; and Great Britain at 0.300. In contrast, the lowest belonged to Japan at 0.013; then Italy at 0.042; and the United States at 0.081. Comparing this to 1983 levels and excluding Denmark and Switzerland, which lacked statistics, and Canada and Portugal, which were not ISTA members, import coefficients decreased in all the countries except the United States and Italy. However, again excluding Denmark, Switzerland, Canada, and Portugal, the import coefficients for all countries combined rose from 0.079 in 1983 to 0.132 in 1986.

Next is a comparison of growth and decline in imports and exports in each country between 1983 and 1986.

In this area, the United States and West Germany showed decreases of -8.3% and -3.2%, respectively, in exports. The other countries showed increases in the following order: Sweden, 375.4%; Holland, 172.3%; Belgium, 108.2%; Japan,70.1%; Denmark, 54.0%; Spain, 40.3%; France, 34.4%; Great Britain, 26.3%; Finland, 21.0%; and Italy, 19.3%. The overall growth rate for all countries studied was 31.2%.

For imports, on the other hand, Great Britain and Italy showed respective decreases of -3.3% and -24.6%. The increases occurred in the following order: Sweden, 277.6%; Holland, 242.6%; Spain, 150.5%; the United States, 118.4%; France, 95.0%; Belgium, 94.5%; Finland, 52.5%; Denmark, 42.6%; Japan, 27.5%; and West Germany, 16.6%. The overall growth rate for all countries studied was 68.5%.

It is said that the mould and die industry is structured so that the manufacturers locate themselves in the vicinity of their customers; however, imports and exports of moulds and dies are increasing. Looking at the position of the major mould and die producing countries of the world, it is possible to say that an international horizontal division of labor is advancing based on the existence of the following: 1) A change toward horizontal division of labor within those countries; 2) A greater reliance on imports and exports in production; and 3) A trend toward increase in the absolute value of imports and exports.

## Table IV. 3-46 Horizontal Division of Labor of Main Countries in 1983

(Unit: Million Yen)

| | U.S. | West Germany | Netherlands | Belgium | France | U.K. | Spain | Sweden | Japan | Italy | Denmark | Finland | Switzerland |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Punch and Press Dies | 87.7 | 56.8 | 86.9 | 64.9 | | 87.8 | 29.7 | 42.7 | - | 49.3 | 49.0 | 52.3 | - |
| Plastic and Rubber Moulds | 87.7 | 75.4 | 96.9 | 72.7 | 99.0 | 75.4 | 90.1 | 66.2 | - | 43.6 | 99.7 | 53.0 | - |
| Diecast Dies | 87.7 | 90.5 | 62.7 | 98.9 | 83.7 | 95.7 | 49.9 | | - | 31.0 | 56.3 | 0 | - |
| Jigs and Fittings | 89.1 | 50.1 | | 70.5 | | 69.2 | | | - | - | | | - |
| Standard Tools and Parts | 87.7 | 77.7 | | | | 83.3 | | 70.6 | - | - | | 88.4 | - |
| TOTAL | 87.9 | 67.4 | 91.8 | 95.8 | 97.4 | 85.6 | 64.3 | 62.8 | 11.6 | 44.6 | 89.3 | 88.6 | - |

Note: 1. Horizontal division of labor is expressed by $(1 - \frac{\text{Exports - Imports}}{\text{Exports + Imports}}) \times 100$.

2. Exports and imports are according to Tables IV. 3-49.

3. - mark indicates statistics not yet reported or unavailable.

## Table IV. 3-47 Coefficient of Exports and Imports of Main Countries in 1986

(Unit: Million Yen)

| | U.S. | West Germany | Netherlands | Belgium | France | U.K. | Canada | Spain | Sweden | Japan | Italy | Denmark | Finland | Portugal | Switzerland |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Export Coefficient | 0.043 | 0.330 | 0.701 | 0.643 | 0.233 | 0.184 | 0.552 | 0.196 | 0.519 | 0.138 | 0.232 | - | 0.090 | 0.970 | 0.436 |
| Import Coefficient | 0.081 | 0.112 | 0.882 | 0.653 | 0.296 | 0.300 | 0.426 | 0.166 | 0.901 | 0.013 | 0.042 | - | 0.090 | - | - |

Note: 1. Export coefficient is Export value/Production value.

2. Import coefficient is Import value/Production value.

3. - mark indicates statistics not yet reported or unavailable.

## Table IV. 3-48 Coefficient of Exports and Imports of Main Countries in 1983

(Unit: Million Yen)

| | U.S. | West Germany | Netherlands | Belgium | France | U.K. | Spain | Sweden | Japan | Italy | Denmark | Finland | Switzerland |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Export Coefficient | 0.045 | 0.387 | 0.863 | 0.634 | 0.286 | 0.263 | - | 0.022 | 0.200 | 0.193 | 0.182 | 0.068 | - |
| Import Coefficient | 0.035 | 0.197 | 1.017 | 0.690 | 0.301 | 0.351 | - | 0.049 | 0.012 | 0.055 | 0.225 | 0.054 | - |

Note: 1. Export coefficient is Export value/Production value.
2. Import coefficient is Import value/Production value.
3. - mark indicates statistics not yet reported or unavaiabale.

## Table IV. 3-49 Comparison of Imports and Exports by Country in 1983/1986

(Unit: Million Yen)

| | U.S. | FRG | Netherlands | Belgium | France | U.K. | Spain | Sweden | Japan | Italy | Denmark | Finland | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1983 Exports | 44,286 | 71,117 | 9,864 | 11,348 | 11,698 | 14,572 | 7,624 | 695 | 64,549 | 17,765 | 1,901 | 765 | 256,175 |
| 1986 Exports | 40,605 | 68,793 | 26,864 | 23,621 | 15,718 | 11,541 | 10,698 | 3,304 | 109,795 | 21,186 | 2,928 | 926 | 335,979 |
| Growth Rate (%) | -8.3 | -3.3 | 172.3 | 108.2 | 34.4 | 26.3 | 40.3 | 375.4 | 70.1 | 19.3 | 54.0 | 21.0 | 31.2 |
| 1983 Imports | 34,756 | 36,156 | 9,864 | 12,343 | 12,318 | 19,455 | 3,612 | 1,519 | 3,961 | 5,097 | 2,357 | 608 | 144,046 |
| 1986 Imports | 75,909 | 42,143 | 33,792 | 24,007 | 20,024 | 18,811 | 9,047 | 5,735 | 5,049 | 3,843 | 3,360 | 927 | 242,647 |
| Growth Rate (%) | 118.4 | 16.6 | 242.6 | 94.5 | 95.0 | -3.3 | 150.5 | 277.6 | 27.5 | -24.6 | 42.6 | 52.5 | 68.5 |

Source: Materials of International Special Tooling Association

## 4. Cost Analysis

### 4-1 Comparison of Production Cost in Malaysia and Japan

#### 4-1-1 Major Unit Costs Comparison

Here the comparison is based on the data related only to mould and die production. the exchange rate used is 1M$=J¥50. The following figures are based on field interviews. A variation of figures can be found depending on the type of industry or the location of the industries in Malaysia. In the Japanese case, there are also figure variations. In spite of these variations, average base salaries can be calculated as follows.
<Monthly Base Salary>

**Monthly Base Salary**

Unit M$ (1M$ = ¥50)

| Major Items | Malaysia | Japan |
|---|---|---|
| Junior high school graduates | 250- 300 | N.A. |
| Technical high school graduates | 300- 400 | 2,200-2,500 |
| Graduates of university, designer | 500- 800 | 2,700-3,000 |
| Workers with 1-5 years experience | 500- 700 | 3,500-4,000 |
| Designers of with 3-10 years experience | 900-1,500 | 4,500-5,000 |
| Factory managers or foremen with over 10 years experience | 1,500-2,800 | 6,000-8,000 |

In Malaysia, the portion of allowance fees in the salary is very large. Normal overtime allowance fee per hour is 1.5 times the base salary per hour. The Sunday work allowance fee is 2 times, and that of holiday work is 3 times.

These allowance fees in Malaysia are considerably high compared to those of Japan, where the overtime allowance fee, for example, is from 1.25 to 1.5 times the base salary.

The salary totaled with overtime fees in Malaysia can easily reach twice the level of the base salary. In addition, because of the continuous good performance in the mould and die industry in Malaysia, the base salary in this industry has a tendency to rise further. Taking a certain company as an example, the monthly base salary has already increased from M$800 to M$1,300. At a factory of another company, the average monthly salary reaches M$2,000. Therefore, the estimated average monthly salaries could actually be from 1.3 to 1.6 times the monthly base salaries mentioned for each major item shown above. For skilled workers however, their salary seems to have already reached a high enough level so that it will increase no more. as a result, in a production programme, a strict policy must be established to avoid overtime work. In Japan also, the system of salaries in the mould and die industry differs greatly according to types and locations of companies and overtime work is often seen.

Recently, a movement to change the salary system from a system based on seniority to a system based on efficiency and performance can be frequently seen. This movement is concerned especially with the introduction of high quality machining equipment. There appears to be a tendency to replace highly paid aged workers by younger workers who are capable of using their knowledge in software, enabling them to use efficiently the precise metal working machinery.

Judging from the above figures, if simply compared, the salary in Malaysia ranges from 0.16 to 0.3 times and averages 0.25 times that of Japan.

The personnel cost in the Malaysian mould and die industry plays an important role because it is very high compared to the production cost. In personnel cost, an important factor is the inflation rate in Malaysia, which, however, is said to be at a low level at present at about 5% per year. The problem of personnel cost might be worsened by the job-hopping trends which would accompany the recovery of economy. The high increase of wages of skilled workers is especially feared.

Under the circumstances of the present expansion of market, the supply of skilled workers seems not sufficient to catch up with the demand. This would be the reason that the creation of a personnel development programme is urgently required.

<Comparison of Hourly Charge for Major Machine Tools>

**Comparison of Hourly Charge for Major Machine Tools**

Unit: M$

| Major items | Malaysia | Japan |
|---|---|---|
| Multipurpose machine tools | M$10-20/h | M$80-90/h |
| EDM | 30-36 | 100 |
| CNC wire cutting EDM | 40-45 | 120 |
| CNC machining center | 40-50 | 120 |

In the field survey, most of the companies seemed not to have calculated this cost and were unable to provide the data. Therefore, the following figures are assumed mostly based on the data drawn from Japanese affiliated companies in Malaysia.

The comparison simply shows that the Malaysian cost is considerably cheap at less than half of the Japanese cost. But these figures do not have much importance because of the difference in the types of machining equipment between Japanese firms and Malaysian. Many Malaysian firms use machine tools imported from Taiwan.

As to high-quality machines used in Malaysia such as CNC machine tools, those are made in Japan, Europe and the Unite States of America, and the purchase price is very high. Naturally, the depreciation cost of the machine tools also becomes high. Consequently the cost of machine tools is at a relatively high level in relation to the wages in Malaysia. For this reason, in Malaysia, the machine tools imported from Taiwan or Japanese joint venture companies in Singapore are used in order to reduce the initial costs. Their machine tools are either without convenient attachments or are simple NC machine tools and not CNC machine tools.

But according to the demand projections, a 30 to 40% increase of demand is expected. High quality machines would be increasingly used, and high precision and low-priced machines are appearing in the market. The age of continuous 24 hour operation of machine tools to yield cost savings will soon arrive. Because of the lack of skilled workers, dependence on high quality machine tools will surely and rapidly increase. Regarding this point, the cost of machine tools will bear a significant importance. Therefore, it is urgently required to establish the calculation of machine tool cost according to each genre of the machines. The operation rate of the machines in relation to the cost calculation is also important.

In Japan, the increase of personnel cost has induced the introduction of high priced machines for the purpose of cost reduction. Profits can not be expected without an increase of the machinery working rate of high priced and high quality machines. In the case of high priced CNC machine tools, the break-even point would be attainable only at the operation rate of the machine over 80%.

<Comparison of Cost Composition>

**Comparison of Cost Composition**

| Major items | Malaysia | | Japan |
|---|---|---|---|
| Materials | 15-25% | | 15-25% |
| Personnel | 20-55 | | 45-50 |
| Administration & design | 10-25 | (estimate) | 15-20 |
| Depreciation | 5-30 | | 10-20 |
| Profit | 10-20 | (estimate) | 8-10 |

The structure of costs in Malaysia were compared to those in Japan based on the results of interviews as per one unit of mould based on the results of the interviews. Sales value is assumed as 100%.

Not much difference can been seen in the composition of the cost in both countries. However, the accelerated depreciation cost of the machines on a company basis differs largely according whether the companies possess high quality machine tools or not.

In Malaysia, 4 year depreciation of high quality machines could be probable instead of the actual 10 year depreciation. This probability may make the profit appear to be lowered for short periods of time. But the profit in reality would be more than it appears.

In Malaysian companies, personnel cost occupies the main portion of the administration cost. Meanwhile in Japanese companies, software costs such as designing, computers, office automation, etc., occupy the main portion of the administration cost. The administration cost is assumed from the level of salary and the personnel structure of the Malaysian industries.

The rate of profit would be judged to be rather on the conservative side. The exact data for judgement was not obtained in the field survey. There is a difficulty of calculation due to the difference in the manner of depreciation and technology between Malaysia and Japan.

Though not shown in this table, there are other rates such as the attrition rate of tools, the yield rate, the rate of frequency of final trial and arrangement which would affect the comparison. These rates could not be clarified unless more detailed analysis of cost structure were be achieved.

These rates are not less important in relation to the rate of profit. In reality, problems with these elements could sometimes lead to no profitability. But in order to solve the problems, quality control systems and improved technology are required though not easily achieved, but remain to be solved in the future.

The variation in personnel costs is related to the problems of automation and efficiency. Personnel costs are low-rated when the efficiency dominates due to NC or other high quality machine tools.

Thus, the rate of personnel cost will be a decisive factor for the rate of profit.

<Sales Value Per Man>

Sales values based on the field survey of Malaysian companies of each group in 1987 are as follows. figures vary according to each company. Thus annual sales value per man is assumed to be M$38,000 (¥1.9 million). There is quite a difference between the best sales value (M$58,000=¥2.9 million) and the worst one (M$15,000=¥750 thousand).

This seems to be due to the difference in mechanization and technology. It is also noted that there is a difference of sales value per unit mould and die raging from M$5,000 to M$20,000.

Sales Value per Man

Unit M$

| Company | Number of Employees | Sales value in 1987 |
|---|---|---|
| A Company | 20 men | 1,000 thousands |
| B Company | 9 men | 450 thousands |
| C Company | 9 men | 250 thousands |
| D Company | 10 men | 150 thousands |
| E Company | 33 men | 800 thousands |
| F Company | 30 men | 1,200 thousands |
| G Company | 17 men | 1,000 thousands |

Sorce: Field survey of representative companies belonging to 2nd and 4th group.

Annual sales value per man in Japanese companies is said to be from about M$240,000 (¥12 million) to M$400,000 (¥20 million) per annum and the break even point is about M$200,000(¥10 million) per annum. In other words, if the precessing value (sales value minus cost of materials, subcontracted orders, and consumables) is under ¥6 million per annum, it could be assumed to be under the break-even point. In this comparison, the rate of sales value of Malaysian companies is about one fifth (1/5) that of Japanese companies. That sales value per one unit mould and die will inevitably increase, so the mould and die should be of a value-added type in the future.

In 1988, sales value is expected to increase by 30% or 40% compared to that of 1987.

It seems impossible to increase workers so rapidly and it is necessary to use existent workers to cope with the problem of productivity. At present, the delivery term is about 3 months, but if the delivery term should deteriorate further because of the weak productivity, the whole industry would be affected badly.

To alleviate this problem, there will be no other alternative but to increase the productivity.

From the above points, it could be said that it is necessary to increase the annual sales value of Malaysia to the value ranging from M$20,000 (¥1 million) to M$70,000 (¥3.5 million) which is equivalent to one fourth (1/4) of that of Japan.

<Material Cost>

In Malaysia, standard material is that of ASSAB. The prices of the representative materials are compared as follows.

**Material Cost**

| | Malaysia | Japan |
|---|---|---|
| ASSAB 760 (Equiv: JIS S50C): | M$4.6 – 5.5/kg | M$5.0 ± 10% |
| ASSAB 718 (PD555): | 8.8 – 10.8/kg | 26.0 ± 10% |
| ASSAB XW – 41 (SKD11): | 15.5 – 18.3/kg | 12.0 ± 10% |
| ASSAB STABAX(SUS53B): | 13.3 – 16.4/kg | 30.0 ± 10% |

In Japan the price of materials of ASSAB is 15% higher than Japanese materials. However the materials of SS50OC or SKD11 which are popular in Japan are relatively cheap in the Japanese market. In the Japanese market, prices will differ in each area and in different channels of the sales route. Sometimes the price is double that in other areas.

The price of materials in Malaysia could be said to be about half the Japanese price if some exceptions are neglected.

### 4-1-2 Comparison of Production Cost of Moulds and Dies

In this paragraph, we tried to take a sampling of plastic moulds as the object for the comparison. For this purpose, we have chosen 3 kinds of lens caps and knobs. These products require quality in precision in which the precision of grade goes as far as to 0.05mm. The reason we have chosen a precision-required product is that, for the development of the Malaysian mould and die industry, it is necessary to secure the Japanese market for sales. Thus, high quality products would be required and Malaysia should be up to the challenges of achieving this.

For the sampling survey, a request was made to a total of 3 companies belonging to the 2nd, the 3rd and the 4th groups respectively. The request was made for a cost estimate of the lens caps and its breakdown. Only the 2nd and the 3rd group companies could reply to our request and the 4th group company refused it because of their lack of confidence in their quality in precision. The 3rd group did not answer the request for the cost breakdown,

The comparison of the estimate prices compared to that of a Japanese plastic mould manufacturer (employee about 30) is shown in Table. The design drawings attached to this report is for reference. Malaysian makers use the hot unner system mould, while Japanese makers use the pin-gate-type mould to which they are accustomed. Pin-gate-type mould is cost saving but requires a certain level of processing technology to achieve good results in the moulding. But any type could be used so long as the request meets the requirement. The Japanese maker was requested to proceed according exactly to the instruction indicated in the design drawings.

Cavities in the lens caps were assumed at 2 and cavities in the knob were assumed at 4.

Unit M$

| | 2nd group | 3rd group | Japanese maker | % |
|---|---|---|---|---|
| Lens caps 58 mm dia: | 22,800 | 16,800 | 36,000 | 0.63 — 0.46 |
| Lens caps 67 mm dia: | 25,600 | 19,800 | 38,000 | 0.67 — 0.52 |
| Lens caps 77 mm dia: | 29,200 | 18,000 | 40,000 | 0.73 — 0.45 |
| Knob : | 20,000 | 16,000 | 35,000 | 0.57 — 0.46 |

There is an average price difference of 65% in the 2nd group and 47% in the 3rd group compared to the price of the Japanese maker. As these are estimated prices, actual prices might be lower than this but the rates are not so unreasonable. Estimate purchase costs of the moulds to make the products in other Japanese makers were surveyed. The result showed that the cost differences were within ±10%.

However a certain Japanese maker replied that they can manufacture at the same price as the Malaysian 2nd group. This means that when Japanese maker comes to compete in price to obtain the order, they may reduce the cost.

If they manufacture the moulds using an extremely high quality system like CAD or CAM, lens caps of 58mm could be made at M$30,000 (¥1.5 million). In addition, some local Japanese makers are said to be capable of making the caps at M$18,000 (¥0.9 million). This shows that Malaysian moulding cost is not necessarily lower than the cost in Japan. In order for Malaysian manufacturers to be competitive enough against the Japanese, at the current exchange rate, Malaysian manufacturers have to maintain their costs in the range of 35 to 40% difference compared to the Japanese.

In Japan, until the first half of last year (1987), Japanese makers suffered a scarcity of orders combined with hard competition in sales price. Thus the sales prices have lowered extremely, in some cases, to half of the price at the beginning of the year.

They have lowered the price to a losing point to obtain orders for the sake of plant operation. But as demand has increased recently, the prices have regained to their tendency to rise by an average of 5 to 6% per year.

Now the Malaysian mould and die makers have come to the point where they have to renew their equipment to increase their design capacity and complete the personnel development programme in the search for improving high technology in order to compete with Japanese makers in the international scale.

The following are the cost structures of the manufacturing moulds indicated by The 2nd group.

Unit: M$

| | Materials | Processing | Design | Others |
|---|---|---|---|---|
| Lens caps 58 mm dia: | 2,800 | 15,000 | 1,000 | 4,000 |
| | (12.3%) | (65.8%) | (4.3%) | (17.5%) |
| Lens caps 67 mm dia: | 3,100 | 16,500 | 1,000 | 5,000 |
| | (12.1%) | (64.4%) | (3.9%) | (19.5%) |
| Lens caps 77 mm dia: | 4,200 | 18,000 | 1,000 | 6,000 |
| | (14.4%) | (61.6%) | (3.4%) | (20.5%) |
| Knob : | 1,650 | 15,000 | 1,000 | 2,350 |
| | (8.2%) | (75.0%) | (5.0%) | (11.7%) |

Compared to the average Japanese cost of materials, Malaysian costs are most reasonable but the processing cost is high. The reduction of the cost of the processing cost should be pointed out to increase profit. In Japan, because of the high design cost, the introduction of CAD is being considered.

### 4-1-3 Cost of Plastic Moulding

A survey was conducted to find out the estimated cost in Malaysia of plastic moulding using the mould for the lens cap studied in the preceding paragraph. The estimate obtained from a company in the vicinity of Kuala Lumpur is compared with the Japanese cost. This comparison is based on a minimum quantity of 10,000 pieces per order.

Comparison was made on the assumption that the product made by using the Malaysian mould would be exported to Japan, because it would be better for Malaysia to gain added-value than exporting the mould itself to produce the same products.

The result shows a difference of only 14 to 26% in the cost comparison.

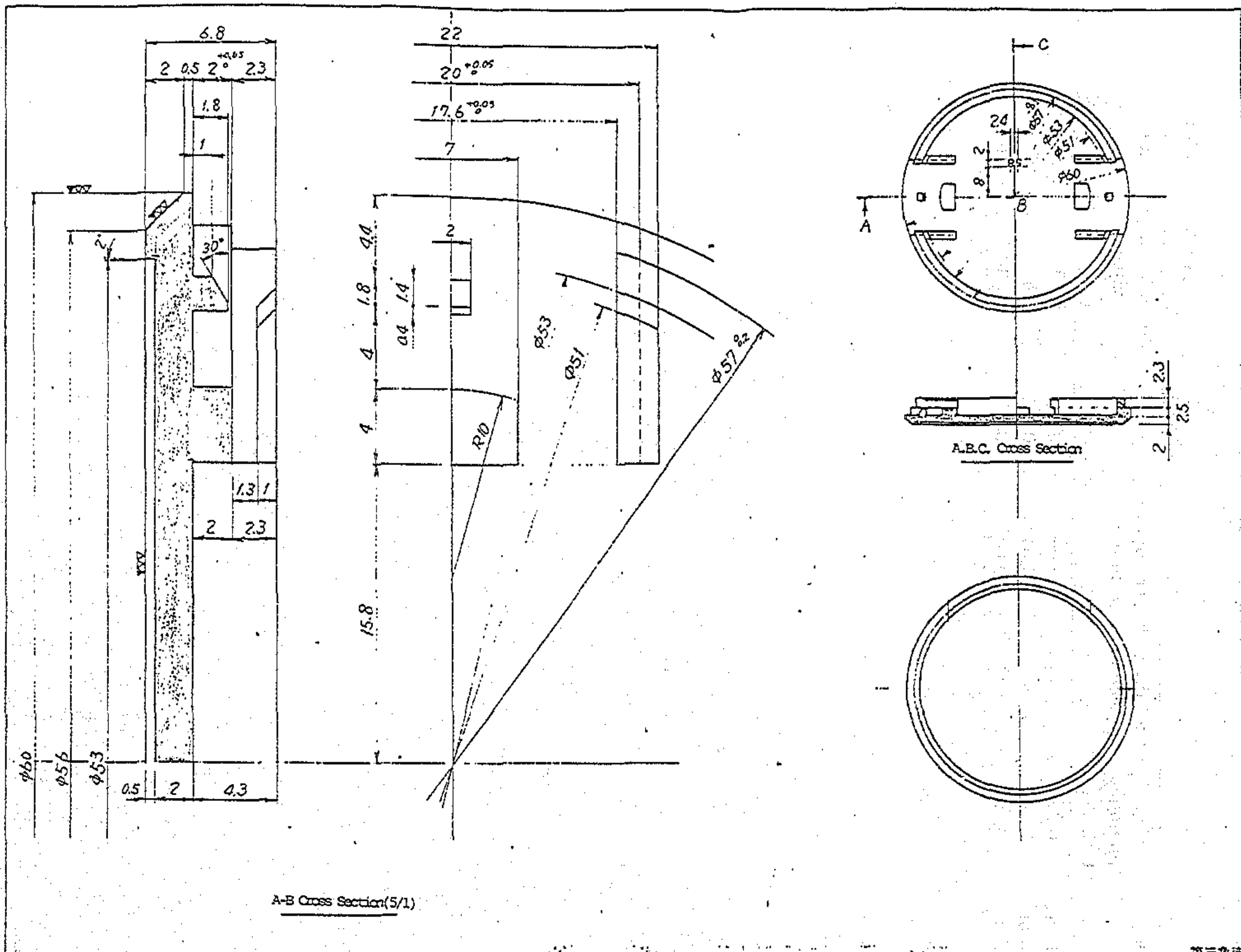
While Malaysian moulds are clearly 30 to 40% lower in price compared to those of Japan, Malaysian products imported to Japan, do not show much advantage in terms of cost, because of the additional cost of transportation costs. In the general view, it comes to a question of the moulds in the two countries.

Therefore in order to reduce the total cost of Malaysian plastic products, the cost of the mould should be reduced. Since the export of the Malaysian products to Japan is expected to increase, both the cost of the mould and the plastic moulding (or punching) should have enough competitiveness.

### Comparison of Moulding Prices

Unit M$ (1M$ = ¥50)

| Item | Caps moulding Unit Price | Unit Price of Knob | Transportation | Total | Purchase cost in Japan | Rate |
|---|---|---|---|---|---|---|
| 58 mm dia | 0.22 | 0.40 | 0.042 | 0.662 | 0.794 | 1:0.91 |
| 67 mm dia | 0.26 | 0.40 | 0.042 | 0.702 | 0.814 | 1:0.94 |
| 77 mm dia | 0.26 | 0.40 | 0.042 | 0.722 | 0.98 | 1:0.81 |




1. Appearances to be clean without scratches, thermal deflections, cutting remains
2. Gates to be made inside in the centre and cut clean
3. ▼▽▽ parts to be mirror lapped
4. "58" Letter inside
   (a) Font MLF No.9
   (b) Height 0.25
   (c) Line width 0.4

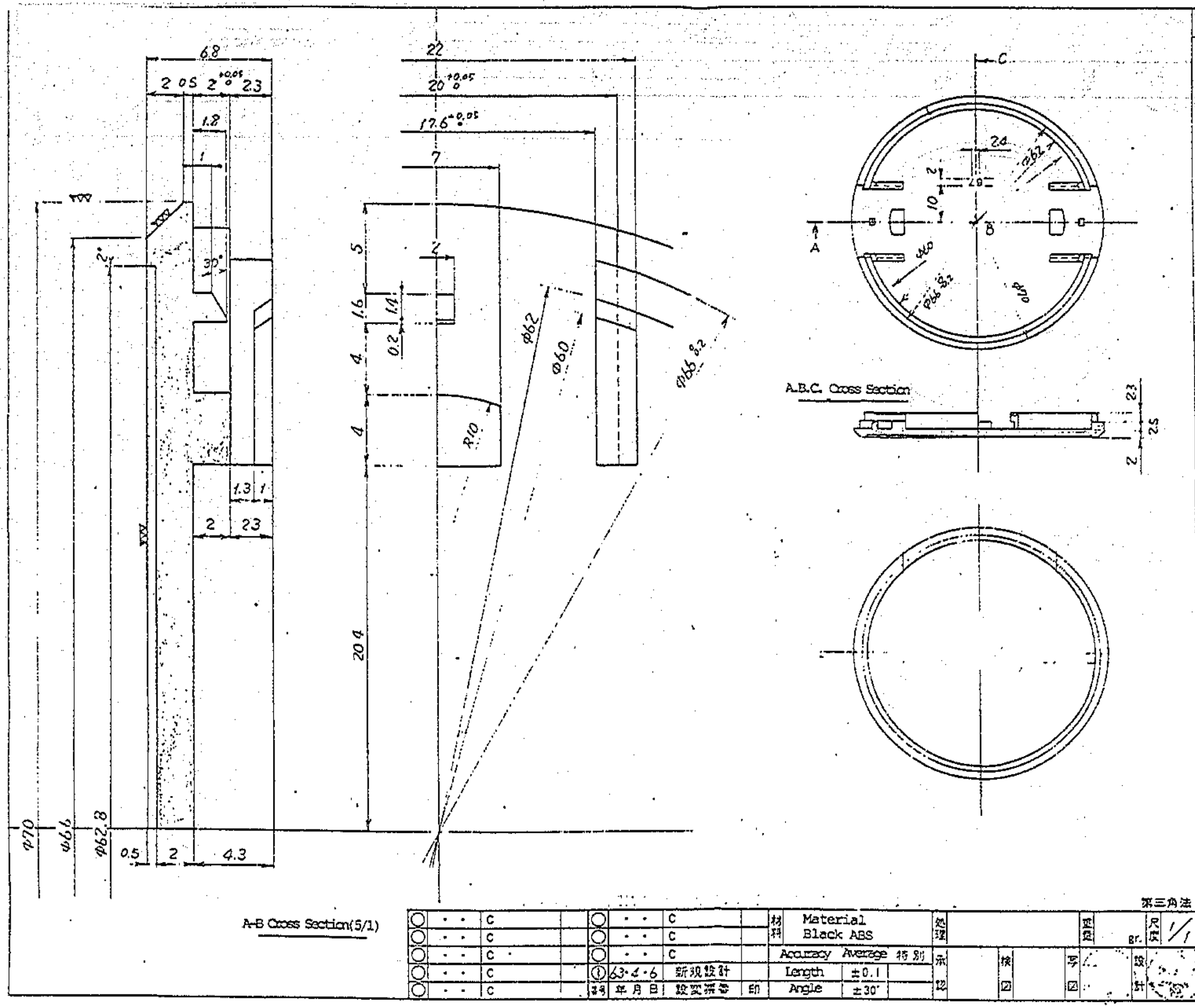
| | | |
|---|---|---|
| 材料 | Material | Black ABS |
| Accuracy | Average | 特別 |
| Length | ±0.1 | |
| Angle | ±30' | |

① 63・4・5 新規設計

番号 年月日 設変票番 印

第三角法

名称 LENS CAP 58



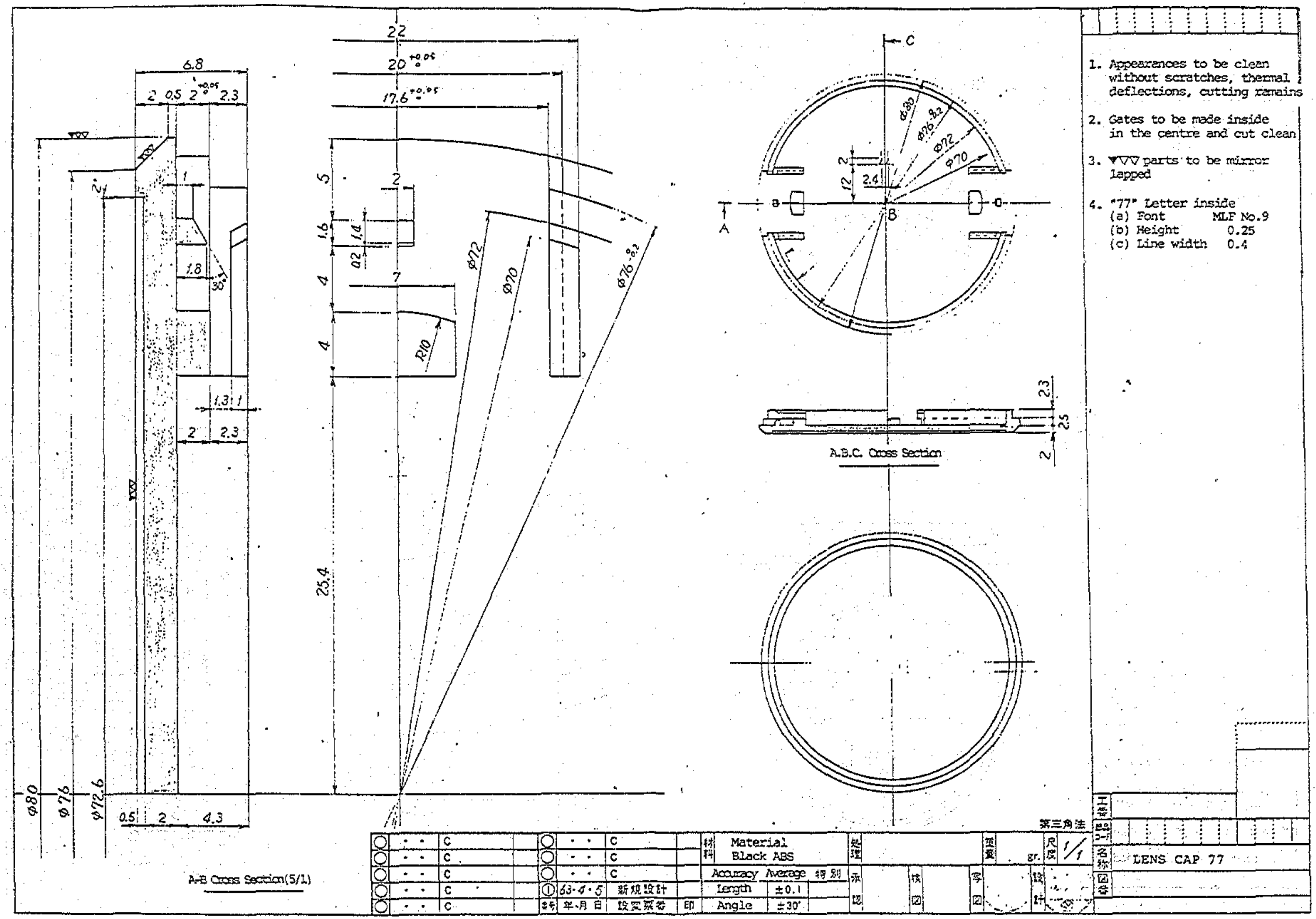

1. Appearances to be clean without scratches, thermal deflections, cutting remains
2. Gates to be made inside in the centre and cut clean
3. ▼▽▽ parts to be mirror lapped
4. "67" Letter inside
   (a) Font MLF No.9
   (b) Height 0.25
   (c) Line width 0.4

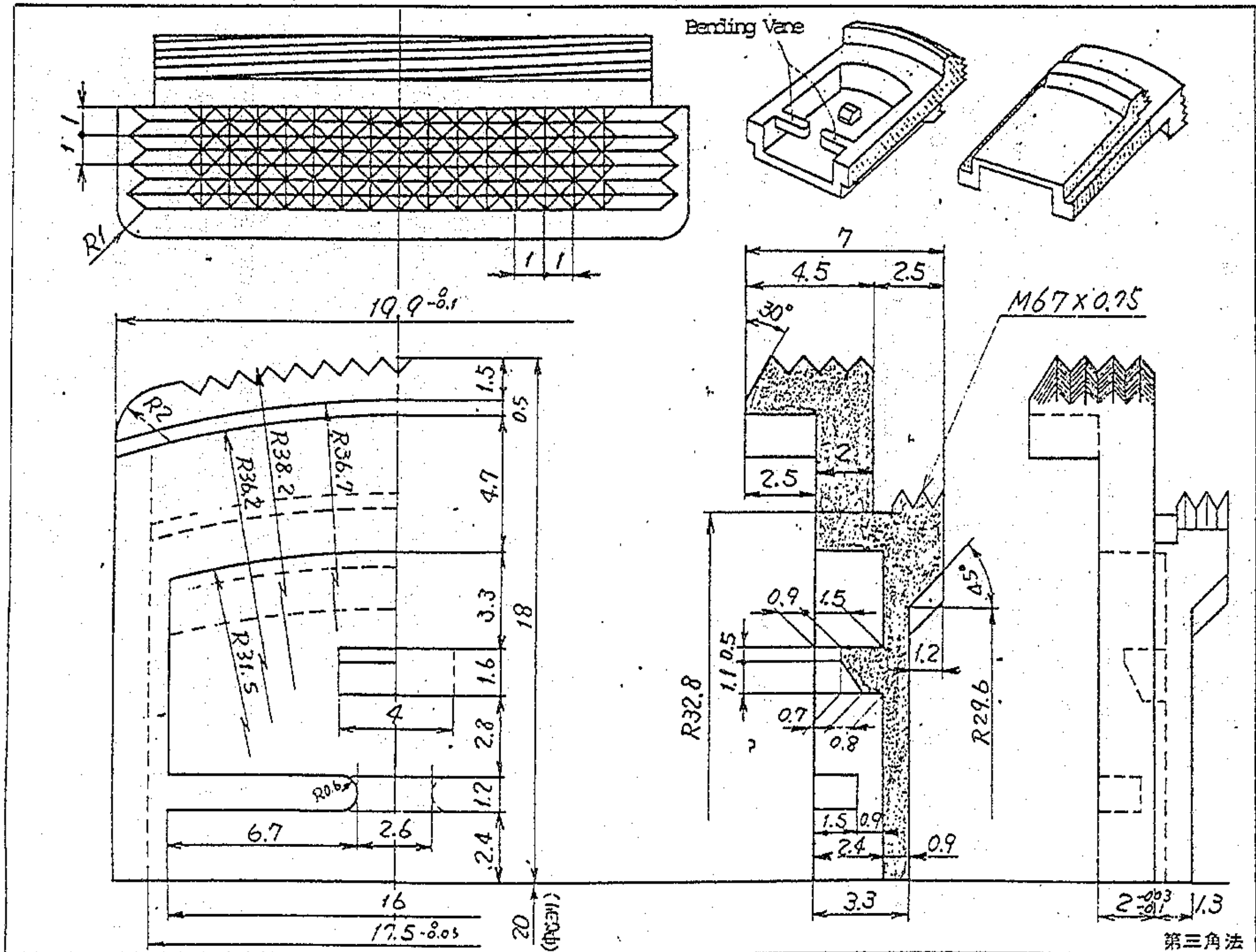
| | |
|---|---|
| 材料 | Material Black ABS |
| Accuracy | Average 特別 |
| Length | ±0.1 |
| Angle | ±30' |

① 63·4·6 新規設計

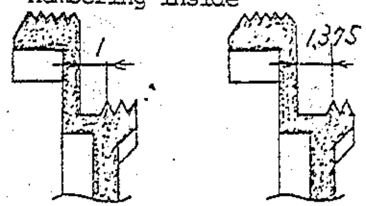
第三角法 尺度 1/1

名称 LENS CAP 67


1. Appearences to be clean without scratches, thermal deflections, cutting remains
2. Gates to be made inside in the centre and cut clean
3. ▼▽▽ parts to be mirror lapped
4. "77" Letter inside
(a) Font MLF No.9
(b) Height 0.25
(c) Line width 0.4
A-B Cross Section(5/1)
A.B.C. Cross Section
Material Black ABS
Accuracy Average
Length ±0.1
Angle ±30'
LENS CAP 77
第三角法
63·4·5 新規設計




1. Appearances to be clean
2. Sliding parts indicated by slant lines to be flat
3. Gates to be made inside in the centre
4. M67x0.75 screw parts to be made under-mentioned and to be distinguished by numbering inside




5. Vending vene(width 1.21 =6.7,two parts) not to be blow-holed and cracked

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 材料 | Material Black POM | | 処理 | | 重量 gr. | 尺度 | 5/1 |
| Accuracy | 普通 | 特別 | 承認 | 検図 | 写図 | 設計 | |
| Length | ±0.1 | | | | | | |
| Angle | ±30' | | | | | | |

| | | | |
|---|---|---|---|
| ① | 63·4·4 | 新規設計 | |
| 番号 | 年月日 | 設変票番 | 印 |

工番

部品コード

名称 LENS CAP KNOB

図番 [redacted]

# 5. Various Measures for Fostering the Growth of the Mould and Die Industry

## 5-1. The Current Problems

The major problem is found in the fact that most firms do not make full use of their present equipment and facilities. Even old machines are able to operate at their capacity as long as they are properly maintained, while even modern and efficient machines will not produce high precision moulds and dies, and even suffer shorter life spans if they are not used in a proper manner.

While these are the problems which the business managers should resolve, the shortage of skilled workers as the major bottleneck in this regard.

Although it is the government's policy to increase the domestic production of moulds and dies, because they depend on imports at the present time, the measure of primary importance for the production of these precision moulds and dies is the fostering of skilled workers including designers, and this will be instrumental also in improving the general technical level.

In the following, the problems which the mould and die industry in Malaysia faces are summarized in the order of their importance.

(1) Lack of Skilled Workers

All the companies are burdened with a lack of skilled workers. However, since moulds and dies are produced on the basis of single-item production to order, it takes a long time for workers to accumulate experience. As a matter of fact, it is said that even the Japanese mould and die workers need ten years to become skilled workers. Much more acute is a lack of the absolute number of skilled workers in Malaysia, partly because of the considerably shorter history of the mould and die industry in the country.

How considerable an improvement the most up-to-date equipment may achieve on production efficiency, the final polishing process such as scraping, as well as assembly and adjustment, will require skilled work by hand, and it is a fair statement that this manual work determines the ultimate quality of the finished product. In addition, it should be considered the most urgent task to overcome the lack of skilled workers also for the purpose of strengthening the on-the-job training (OJT) to be conducted within a business organization and inviting businesses from overseas regions.

(2) Lack of Designers

The majority of firms are of producing moulds and dies without any design drawing. As a result, the designer's instructions are not conveyed through to the workers, and this consequently causes a lack of stability in the quality of the finished product.

In order to deal properly with the production of moulds and dies, for which a progressively growing demand will develop in the coming years, it will be necessary to achieve greater accumulation of know-how than ever before. Hence, it is indispensable to accumulate know-how through the utilization of drawings and to make inquiries into new contrivances based on them.

Furthermore, since the designing work calls for overall knowledge of such items as the mould and die production process, products, and processing accuracy, it takes even more time to foster designers. The training of designers is of greater importance than the training of skilled mechanics.

(3) Low Level of General Techniques

There are many firms which fail to observe even the basic principles of metal processing as seen in instances such as a mistaken order of the processing steps for a hexahedron and a failure to perform polishing for lapping alternately in the right and left direction and in the up and down direction. Also they have been found to lack in the proper fundamental stance in favor of the elimination of wastefulness and product quality improvement; they use machine tools in excess of the processing capacity, or fail to use working oil for metal cutting, or neglect maintenance and inspection on machines, measuring instrument, and tools.

Although these are also the problems which the managers of the enterprises should resolve, such operating conditions will make it very difficult to fill orders placed by overseas users for precision moulds and dies in the context of the export business, which is estimated to grown hereafter. This is the reason that the improvement of the general technical level is more important than the training of personnel for improved skills.

(4) Outdated Business Management

Among the small scale firms there are some cases in which they manufacture moulds and dies only with drawings for the products, or in which they use machines in a poor maintenance condition without any accuracy inspection conducted on them, resulting in repeated demands by the users for rectifying faults in the products; such reworking eventually causing an increase of costs.

Also, there are many managers who are suspected of having no cost-consciousness in view of the fact that they fail to shorten the processing time because of their lack of knowledge about a new attachment to the machine or when it continues to produce a large number of inferior products.

Most of these enterprises are business entities operated under pre-modern management, without any cost accounting or employing any modern accounting systems.

(5) Outdated Machines and Facilities

Since many of the enterprises are medium- or small-scale businesses which have difficulty in obtaining loans from banks because of their need for securities, many of them use outdated machines. This, together with their low technical level accounts for their production of moulds and dies that show an extreme lack of accuracy in each case. For the production of precision moulds and dies for electronic and electrical component parts, apart from those to be used for the production of sundry goods for daily use, it is necessary to replace the existing machines with new and efficient machines. However, a preferential financing plan for that purpose is insufficient.

Also, there are many cases is which relatively new milling machines and grinding machines are employed but they suffer serious damages resulting in a reduced service life just because the work load is in excess of the machine's capacity.

(6) Lack of Technical Information

Many enterprises are not aware of slight contrivances, such as the ease realized in centering with a new attachment accessory put on the machine tool, or in using a vacuum apparatus mounted on a plastic mould to avoid burning by high pressure. Evidently, this indicates a lack of technical information.

It is thought that this is attributable primarily to the scarcity of exchanges with overseas mould and die industries or to the scarcity of inspections of the overseas market, but ordinary overseas technical information and market information are also insufficient.

(7) Insufficient Business Tie-up with Foreign Enterprises

For the production of precision moulds and dies, for which demand is increasing, it is most expedient to form a tie-up with a foreign enterprise. However, for the promotion of the formation of joint-ventures and technical cooperation with foreign enterprises, the industry itself is lacking in its active effort, and the activities by public organizations are also insufficient.

## 5-2 Measures for Fostering the Growth of the Mould and Die Industry in Malaysia

The following measures are conceived as measures for coping with the various problems summarized in the preceding section. The problems are presented here in the order of their respective priority in dealing with them.

(1) Training of Skilled Workers and Designers

For the moment, it is necessary to provide private-sector firms with on-the-job training and technical training by technical experts who go to plant to plant on an on-going basis. Yet, it will be important to formulate such training plans on a medium- and long-term basis.

In view of the urgency and efficiency of such programs, it will be the first priority to plan for the utilization of such existing organizations for research, development, and training, such as SIRIM, and such vocational training institutions as ITI. In consideration of the current state of affairs, efforts should be made at improving of these machines and equipment and also at expanding and strengthening the programs for training skilled workers and designers.

Along with these steps, it would be noted that the individual firms will be placed under considerable burden in dispatching their personnel to these organizations to take part in training programs.

Consequently, it is desired that programs be developed in such a way as to be suitable for training and that the Government will expand the incentive systems available towards this goal.

Furthermore, it will become necessary to develop programs also in consideration of the possible introduction of CAD and CAM.

(2) Expansion of Technical Education

It is a very serious matter for the metal mould industry, which need high precision, that workers have not acquired even basic cutting techniques, or do not perform any sufficient accuracy inspection or any satisfactory maintenance work on machines, or have not learned how to properly use tools, measuring instruments, or ultimately, machines.

The measures that would be taken at this moment are no more than on-the-job training (OJT), itinerant technical guidance and technical training. And yet, fundamentally, these basic techniques are matters to be taught in basic educational institutions, such as polytechnics (technical high schools) prior to the employment of workers by business firms. As can be seen in the cases of Taiwan and Korea, it can be said that the development of the mould and die industry has been fostered by the expansion and repletion of basic technical education through the establishment of a polytechnic school for specialization in moulds and dies and the establishment of a mould and die department in colleges and universities. For the present, it is necessary to achieve the repletion of machines and facilities at polytechnics and to develop curricula specifically addressed to metal mould. For the future, the establishment of a mould and die course or a mould and die department in such schools should additionally be considered.

Moreover, the mould and die industry in Penang is currently formulating a more practical plant o establish an on-the-job training center in government-private sector cooperation with the development public corporation of the state government, and the plan should be carried out in such a way that it materializes at an early time.

(3) Strengthening of Guidance on Management

The successful solution of technical problems concerning the management of a factory owes largely to the manager's guidance capabilities. Moreover, since it is indispensable to provide on-the-job training within a business organization, it is an urgent task to prepare work manuals (including visual materials), to introduce quality-control (QC) techniques, and to strengthen guidance on management covering cost accounting and so on, along with thorough-going workshop guidance to be offered by technical experts. Also, it important to foster a thorough understanding of the point that the designing of moulds and dies in anticipation of the customers' future needs will lead to an expansion of the markets, including those in overseas regions, in the coming years. Thus, it is necessary to promote training programs for managers and exchanges with overseas organizations through such institutions as the National Productivity Center (NPC) and industrial circles.

(4) Improvement in Mould and Die Factories

While firms of medium standing, which enjoy vigorous demand, introduce up-to-date and highly efficient machines and facilities owing to their fund-appropriating capabilities, the smaller enterprises keep using old machines and facilities because of their poor fund-procuring capabilities, and, consequently, the result is a lack of accuracy in the metal moulds which they manufacture. For the purpose of producing precision moulds and dies, which are expected to enjoy increasing demand in the years ahead, it is *indispensable to renew outdated machines*, and additionally it is essential to introduce modern and efficient equipment in order to deal properly with the lack of skilled workers. In view of these requisite conditions, it is suggested that it is feasible to make an attempt at introducing such systems as a special financing system, at a low interest rate, and a model factory recognition system, like the recognized JIS factory system, established in Japan.

(5) Strengthening of Activities by Industrial Organizations

For attaining a higher level in the capabilities of the industry as a whole and improving the quality of the products, autonomous efforts by the industry will be a prerequisite. Exchanges with mould and die industries in foreign countries will not merely lead directly to improvements on techniques, but also result in business tie-ups with foreign firms, serving as a key factor for speedily promoting technological transfers.

Efforts should be directed toward knowledge through management training, improving the technical level of workers through technicians' training programs, and also strengthening the activities of the industrial organizations for the collection of information. In addition, the government's subsidy system for these programs is also requested.

(6) Promotion of Tie-ups with Foreign Enterprises

For the production of precision moulds and dies, the formation of joint-ventures and technical tie-ups with foreign firms are the most readily available and effective measures. However, in order to invite such arrangements, it is necessary to provide an adequately prepared set of information on investments in mould and die firms in Malaysia as desired by the potential investors of foreign countries. In addition to efforts by industrial organizations, it will become necessary to unify investment information on such items as a list of interested firms and the latest information on the industrial estates in various districts, to store such information in MIDA, and to furnish if for the user's convenience.

# V. AUTOMOTIVE METAL PARTS

# V. AUTOMOTIVE METAL PARTS

## 1. Overview of the Industry

### 1-1. Product Items

#### 1-1-1. Product Definition

Since the range of automotive parts is diverse, the scope of products to be covered by this survey has been fixed as follows.

(1) Vehicles to be Covered

In Malaysia, no distinction is made between automotive parts and motorcycle parts; instead, both are placed under one category, "Auto Component Parts." In this survey, however, products are limited to automobile parts.

Automobiles are classified into passenger cars, commercial vehicles and others. The subject of this survey is limited to passenger cars and commercial vehicles. The latter category includes vans, pickups, 4WD vehicles, trucks and buses.

(2) Parts to be Covered

There is no clear-cut definition for "metal parts." In this survey, therefore, the following guidelines were employed.

- Parts which use a substantial quantity of metal (e.g., finished seats) will be included in the survey.
- Electrical equipment (e.g., generators) will not be included.

#### 1-1-2. Promotion, Control and Protection of Domestic Production

There are no existing policy on local content program or on automotive parts to be localized. Domestic production of automotive parts, however, is encouraged through: 1) various tax incentives based on the Promotion of Investment Act, 1986; and 2) tariff protection based on customs regulations, customs orders, etc.

(1) Procurement of Raw Materials and Equipment

Importers of raw materials and components not produced domestically, as well as machinery and equipment not produced domestically and used directly for production, will have their import duties largely reduced or be totally exempted. Since dependence on imports for the above-mentioned items is very high with respect to metal parts, it can be concluded that these measures contribute greatly to the promotion of domestic automotive parts production. No opinion questioning these measures was heard at the firms interviewed during the interviews for this survey.

(2) Regulatory Measures

Under the Industrial Co-ordination Act, 1975 (ICA), parts manufacturers are required to obtain manufacturing licenses. The measure aims at the orderly development of the manufacturing industry. Conditions required for the firms to obtain manufacturing licenses have gradually been relaxed as shown below:

| Year | Shareholders' Fund | | Number of Full-time Employees |
|---|---|---|---|
| At inauguration of ICA, 1975 | $250,000 or more | Or | 25 or more |
| 1985 | $1 million or more | | 50 or more |
| 1986 | $2.5 million or more | | 75 or more |

Firms with shareholders' fund and number of full time employees falling below the levels specified above are exempted from the manufacturing license requirement in order to simplify the procedures required for them to begin production.

(3) Control and Protective Measures

Imports of automotive parts are regulated under the Customs Act, 1967 and related regulations and orders such as the Customs (Prohibition of Imports) Order, 1988. Importers must obtain import licenses for CKD parts and pay import duties and other tariffs for specified automotive parts. Automakers import automotive parts not produced in the country as CKD for vehicle assembly. For example the import duty on CKD for passenger vehicles is 40%.

To encourage the development of the automotive parts industry, a system called the "Mandatory Deletion Program" has been in effect since 1980. Under this system, the items deleted through the established procedures are not allowed to be imported as the CKD parts.

### 1-1-3. Approved Items and Actual Production Items

(1) Local Parts Manufacturing Plan

The outline of the time-phased program to develop local manufacture of component parts is shown in the Industrial Master Plan. This program is not the enforcing plan but rather the indicative plan to show the future direction of the automotive parts industry. The schedule for the future is shown in Table V.1-1. Assembly of engines is planned for the 1990s.

(2) Approved Product Items

In conformity with the Promotion of Investment Act, 1986 and the Industrial Co-ordination Act, 1975, incentives and product items are approved to individual firms. The approved items are listed in the "Directory of Approved Auto Component Manufacturers, as at 31/8/87." The list includes parts requiring high technology, such as crankshafts, engines, transmissions and bodies. Crankshaft production was approved in 1986 for firms with foreign capital participation. Engines, transmissions, and bodies were approved in 1987 for the production by firms with 100% local capital. All the items shown in Table V. 1-1 are among the approved items.

(3) Items in Production

Only a few metal parts are currently produced, and none of these require advanced technologies. The parts now in production, and the parts which have been approved but not yet produced, as shown by the survey, are shown in Tables V.1-2 and V.1-3, respectively.

The Mandatory Deletion Program is not applied to all items in production. It is applied only after the requests from parts manufacturers. Currently 30 items, including some non-metal products, have been designated as Mandatory Deleted Components (see Table V.1-4).

Among the items which have not yet actually implemented domestic production, there are some which have only recently been approved and others of which production has been discontinued. The sharp recent drop in motor vehicle production is believed to be chiefly responsible for the failure of practical implementation of domestic parts production.

## Table V.1-1 Indicative Local Parts Manufacturing Programme for PROTON

| Parts | | 1987—1990 | 1990—1995 |
|---|---|---|---|
| Body Parts | : | Body panels; bumper; radiator grill; window regulator; door handle, lock & hinges; other plastic & rubber parts such as rubber damper; plastic plug; dust covers. | Dashboard |
| Engine Parts | : | Beltings; pulley; electric cooling fan; engine mounting. | Assembly of engine incorporating local component such as spark plug, oil filter, fuel filter, piston, cylinder liner, gasket, timing chain, manifold, water pump oil pump, fule pump. |
| Drive, Transmission & Steering Parts | : | Pedals; gear shift lever; sub-assembly of steering system; tie rod end; sub-assembly of propeller shaft. | Clutch assembly incorporating local clutch disc & facing; gear box & rear axle sub-assembly incorporating crown wheel & pinion gear; front, drive shaft sub-assembly incorporating ring pin. |
| Brak & Suspension Parts | : | Disc pad; brake sub-assembly including local sourcing of drum, disc & lining; brake booster; parking brake lever; torsion bar & stabilizer; suspension arms. | Master brake cylinder sub-assembly; brake caliper; vacuum pump. |
| Electrical Parts | : | Sensor; electronic device/ system for control, monitoring and display of operating & functional data; electronic ignition device; sub-assembly of head lamp, signal & indicator lamp; switches; ignition coil; distributor; cigar lighter; clock. | Complete manufacture of lamps; wiper arm & blade. |
| Trim & Internal upholstery and general parts | : | Trims; handrest & grip; mirror; warning triangle; tool set; rubber grommets, plastic plugs & clips. | Specialised bolt & nut, screws, clip & other fasteners. |

**Table V. 1-2 Automotive Metal Parts in Production**

| | | | |
|---|---|---|---|
| Engine Parts | : | Air Filter | Air Filter Housing |
| | | Cylinder Liner | Fuel Filter |
| | | Fuel Tubing | Oil Filter |
| | | Piston | Radiator |
| Transmission & Steering Parts | : | Clutch Tubing | Clutch Disc |
| | | Clutch Cover | Rack & Pinion |
| | | Shackle Assy | Shackle Pin |
| | | Shackle Bolt | Steering Linkage |
| | | Tie Rod | Tie Rod End |
| | | Wheel | Wheel Rim |
| | | Wheel Stud | Wheel Bolt |
| | | Wheel Nut | Wheel Weight Balance |
| | | Wheel Cover | |
| Suspension & Brake Parts | : | Air Receiver Tank | Air Receiver Housing |
| | | Ball Joint | Brake Tubing |
| | | Brake Disc | Brake Shoe |
| | | Coil Spring | Leaf Spring |
| | | Spring Pin | Spring Bush |
| | | Shock Absorber | Suspension Shock Absorber |
| Body Parts | : | Bodies-Truck | Bodies-Pick Up |
| | | Bodies-Bus | Bodies-Van |
| | | Bus Seat | Battery Holder |
| | | Bracket | Body-Side Moulding |
| | | Centre-Bolt | Cross-member |
| | | Door Washer | Exhaust Pipe |
| | | Exhaust-clamp U-bolt | Fuel Tank |
| | | Grease Nipple | High Tensile Bolt |
| | | High Tensile Nut | Muffler |
| | | Muffler Hanger | Metal Bush |
| | | Seat Complete | Spare Wheel Clamp |
| | | Safety Belt Metal-parts | Steel Washer |
| | | Spring Washer | U-bolt |
| | | Sun Visor (Metal) | Bodies Passenger Car (only for proton) |
| Other Parts | : | Electronic Horn | Spark Plug |
| | | Screw Jack | |

Source: Study Team estimate based on the field survey
MIDA

**Table V.1-3 Automotive Metal Parts Whose Production Has Not Yet Been Started or Has Been Ceased after Being Produced Once**

| | | | |
|---|---|---|---|
| Engine Parts | : | Crank Shaft | Constant Velocity Assembly |
| | | Engines for M.V. & Other Use | Engine Valve Spring |
| | | Engine Oil Filler Cap | Engine Cooling Water Jacket Plug |
| | | Piston Pin | |
| | | Piston Ring | |
| | | Radiator Cap | |
| Transmission & Steering Parts | : | Drive Shaft | Crown Wheel and Pinion Gear |
| | | Hub Bolt | Gear Shift Assy |
| | | King Pin | Hub Cap |
| | | Pedal-Accelerator | Pedal-Brake |
| | | Propeller-Shaft | Pedal-Clutch |
| | | Rear Axle | Propeller Tube |
| | | Spindle Knuckle | Spring Shackle |
| | | Steering Lock Assy | Steering Column |
| | | Steering Gear Housing | Steering Gear Syprocket |
| | | Transmission | Transmission Gear Syprocket |
| | | | Wheel Disc |
| Suspension & Brake Parts | : | Brake-Drum | Brake-Hub |
| | | Brake-Booster | Brake-Master Cylinder |
| | | Brake-Caliper | Connecting Arm |
| | | Hand Brake Lever | Hand Brake Bracket |
| | | Parking Brake Assy | Suspension Connecting Rod |
| | | Stabilizer Bar | Suspension-Front |
| | | Suspention-Rear | Torsion Bar |
| Body Parts | : | Body Stamping Parts (except PROTON's) | Bonnet Prop |
| | | | Door-Lock |
| | | Chassis | Lock for Trunk |
| | | Door-Latch | Lock Nut |
| | | Door-Handle | Lock for Hood Lid |
| | | Lock Cylinder Key | Seat Slide |
| | | L-bolt | Window Latch |
| | | Lock for Seat | |
| | | Trunk Hinge | |
| | | Window Regulator | |
| Other Parts | : | Bearing Ring | LPG Conversion Kit |

Source: Field interview survey
MIDA

## Table V.1-4: Items whose Imports as CKD are Prohibited

| Items | Passenger cars | Commercial vehicles |
|---|---|---|
| 1. Air Filter | o | o |
| 2. Brake/clutch/fuel tubing | o | — |
| 3. Coil spring | o | o |
| 4. Electric Horn | o | o |
| 5. Exhaust muffler | o | o |
| 6. External body protective moulding | o | o |
| 7. Fuel tank | o | o |
| 8. Leaf spring | — | o |
| 9. Radiator | o | o |
| 10. Seat Assembly | o | o |
| 11. Shock absorber | o | — |
| 12. Suspension shock absorber | — | o |
| 13. U-bolt, spring pin & shackle pin | — | o |
| 14. Wheel nut & stud | o | o |
| 15. Alternator & regulator | o | o |
| 16. Battery | o | o |
| 17. Carpet and underlay | o | — |
| 18. Flasher relay unit | o | o |
| 19. Melt damping sheet | o | — |
| 20. Paints | o | o |
| 21. Radiator hose | o | o |
| 22. Safety glass | o | o |
| 23. Safety seat belt | o | o |
| 24. Seat padding | o | o |
| 25. Starter motor | o | o |
| 26. Tube valve & tubeless type valve | o | o |
| 27. Types and Tubes | o | o |
| 28. Windshield washer motor | o | o |
| 29. Wiper motor | o | o |
| 30. Wiring harness | o | o |

Note: As of December 31, 1987.
o ; to be prohibited
—; none to be prohibited
Source: MIDA

## 1-2. Production Trends

### 1-2-1. Automobile Production Trends

Automobile production is reviewed here because the production of automotive parts for OEM depends largely on automobile production trends.

(1) Production Volume

Automobile production statistics show that the number of vehicles produced has declined yearly after peaking in 1984 (see Table V.1-5). Production fell by almost 50% in 1986, followed by a further drop below the 50,000-unit mark in 1987.

**Table V. 1-5: Changes in the Number of Automobiles Produced**

| Calendar year | Passenger cars (units) a) | Commercial vehicles (units) a) | Total (units) a) |
|---|---|---|---|
| 1983 | 100,201 (100) | 18,240 (100) | 118,441 (100) |
| 1984 | 96,261 ( 96) | 28,555 (157) | 124,186 (105) |
| 1985 | 69,769 ( 70) | 42,054 (231) | 111,823 ( 94) |
| 1986 | 42,015 ( 42) | 19,821 (109) | 61,836 ( 52) |
| 1987 | 33,685 ( 34) | 15,305 ( 84) | 48,990 ( 41) |

Note: a) indicates an index taking 1983 as 100.
Source: MIDA; reports on monthly production achievement of assemblers.

The Industrial Master Plan had forecasted annual increases in automobile production from 1985. A quick glance, however, indicates a large discrepancy between the forecast and actual results starting in 1986, as shown in Tables V.1-6 and V.1-7.

Approval of component production continues, but actual production is expected to depend on a recovery in automobile production.

**Table V.1-6: Comparison of Forecast with Actual Results in Passenger Car Production**

| *Calendar year* | *Results (units)* | *Forecast (units)* | *Results/Forecast* |
|---|---|---|---|
| 1985 | 69,769 | 107,010 | 65% |
| 1986 | 42,015 | 115,280 | 36% |
| 1987 | 33,685 | 124,260 | 27% |

Source: MIDA

**Table V.1-7: Comparison of Forecast with Actual Results in Commercial Vehicle Production**

| Calendar year | Results (units) | Forecast (units) | Results/Forecast |
|---|---|---|---|
| 1985 | 42,054 | 31,950 | 132% |
| 1986 | 19,812 | 35,630 | 56% |
| 1987 | 15,305 | 39,690 | 39% |

Source: MIDA

(2) Production Status by Firm

Currently, there are 12 automobile assembly plant (including PROTON), of which two have ceased production and 10 continue to operate. Of the 10 firms, two produce commercial vehicles.

The particularly sharp drop in passenger car production after peaking in 1983 is more prominent when broken down by firms, as shown in Table V.1-8. Although production of the PROTON SAGA national car began in 1985, only 33,685 passenger cars were produced in 1987, of which the PROTON SAGA accounted for all but 9,503. Seven firms were responsible for the production of these remaining units, averaging 1,358 vehicles a year per assembly plant.

13 foreign automakers, including Toyota and Ford, supplied the CKD parts for assembly of the 9,503 units. 31 vehicle models, including the Corolla and Telstar, were assembled with the supplied CKD. On average, therefore, each foreign automaker produced 731 units, and 307 units of each vehicle model were assembled.

Specifications of automotive parts normally differ in accordance with vehicle models. Volumes of specific parts for vehicles other than the PROTON were remarkably small.

**Table V.1-8: Number of Passenger Car Production by Firms**

| Firm | 1983 | 1987 | 87/83 |
|---|---|---|---|
| Proton | 0 (units) | 24,182 (units) | — |
| Others | 100,201 | 9,503 | 9.5% |
| Total | 100,201 | 33,685 | 33.6% |

Source: MIDA

### 1-2-2. Trends in Automotive Metal Parts Production

(1) Production

Statistics reveal that the value of automotive parts production has steadily risen from 1981 to 1985, as shown in Table V.1-9. The figures for metal parts alone indicate a similar trend.

Automotive parts production has increased despite the drop in automobile production. The increase is believed to have come from increased demand in the replacement market, including exports and parts installation rate for new vehicles.

**Table V.1-9: Actual Value of Automotive Parts Production a)**

(Unit: M$1,000)

| Calendar year | Total production value b) | Metal parts alone c) |
|---|---|---|
| 1981 | 98,948 | 46,781 |
| 1982 | 106,486 | 52,753 |
| 1983 | 147,092 | 66,315 |
| 1984 | 151,356 | 86,984 |
| 1985 | 178,326 | 92,553 |

Note: a) Peninsular Malaysia alone. In and after 1983, only firms with no less than 30 employees.
b) Including all product codes of MIC code 38439.
c) Including the following product codes out of MIC code 38439.
02-15, 17-19, 24-27, 30, 31, 33, 35, 36 and 43-45.

Source: Bureau of Statistics (Figures after 1985 not published yet.)

(2) Current Production Status

Parts manufacturers are experiencing difficulties. Seen from several viewpoints, the situation is as follows:

1) The parts manufacturers interviewed during this survey uniformly raised the question of declining automobile production. They probably have the capacity to raise operation rates. Some manufacturers said that, given the current situation, investment for automation aimed at improving efficiency seems to be out of the question, let alone new plant and equipment investment for upgrading of production facilities.

2) Production of new parts requires metal dies, moulds and other tools. The tools would be necessary even if existing facilities are fairly complete. Such expenses are extremely high when viewed in light of the limited production volume. Many parts manufacturers complained that the costs involved in commencing production of new parts are prohibitive. A similar problem arises with existing parts when automakers revise their models. Many parts manufacturers pointed out the difficulties caused by an excess of vehicle models and frequent model changes.

3) Metal materials for the parts are mostly imported from Japan. Because of the appreciation of the yen, suppliers of the materials have requested price increases. The requests are said to have been repeated every two or three months, thus exerting pressure upon the management at parts manufacturers.

4) According to the earlier-mentioned "Directory," 156 metal parts licenses have been approved, of which 35 after January 1, 1986. Of the 121 cases approved by the end of 1985, 60 have been implemented. In other words, 50% of the licenses approved more than two years ago have not yet been implemented. Since many items not yet produced include those already under production by other manufacturers, it can be concluded that low demand is mainly responsible for the failure to start production.

5) The 156 licenses were granted to 135 firms. However, only 57 of the firms are operating, due mainly to the reasons stated above. Notable is the fact that licenses for production of each of the earlier-mentioned items requiring high technology (such as engines and transmissions) have been granted exclusively to one manufacturer. It is expected that, in the future, major parts will tend to be produced by a few, large firms.

### 1-3. Import and Export Trends

#### 1-3-1. General Status

Naturally enough, imports exceed exports in the balance of trade for automotive parts, as is shown in Table V.1-10. Exports remain at a level ranging from 0.72% to 2.55% of imports (including CKD parts). Automotive parts accounted for only 0.035% of Malaysia's total exports in 1987. Trade statistics for metal parts alone were not available.

**Table V.1-10: Exports and Imports of Automotive Parts Inclusive of CKD Parts**

(Unit: M$1,000)

| Calendar year | Exports (FOB) | Imports (CIF) | Exports/Imports |
|---|---|---|---|
| 1981 | 8,800 | 1,214,134 | 0.72% |
| 1982 | 12,681 | 928,648 | 1.37% |
| 1983 | 15,741 | 1,159,441 | 1.36% |
| 1984 | 10,238 | 1,191,217 | 0.86% |
| 1985 | 8,968 | 1,064,556 | 0.84% |
| 1986 | 8,447 | 633,187 | 1.33% |
| 1987 | 15,841 | 622,307 | 2.55% |

Note: SITC (Rev.2) code numbers (781-010, 781-031, 782-120, 783-110, 784)
Source: Malaysia Annual Statistics of External Trade, etc.

#### 1-3-2. Imports

A breakdown of the imports in Table V.1-10 for the last three years is shown in Table V.1-11.

The decline in demand for CKD parts is of the same nature as the decrease in automobile production. In 1987, 87% of the CKD imports originated in Japan. There are two types of parts production: 1) processing from original raw materials; and 2) assembly of components (e.g., shock absorbers). In the latter case, many components are imported. The components are included in the "other parts" category of Table V.1-11. About 55% come from Japan, with another 19% originating in West Germany. Currently, automotive parts assembled from imported components are regarded as domestically-produced parts. The expansion of domestic component production has yet to be tackled.

Table V.1-11: Breakdown of Automotive Parts Imports

(Unit: M$1,000)

| Calendar year | CKD parts | Other parts | Total |
|---|---|---|---|
| 1985 | 895,341 | 169,215 | 1,064,556 |
| 1986 | 484,263 | 148,924 | 663,187 |
| 1987 | 445,514 | 176,793 | 622,307 |

Source: Malaysia Annual Statistics of External Trade, etc.

In terms of raw material imports, most metal materials come from Japan. Without domestic production, Malaysian firms must depend on imports for their supply of sheet steel and seamless steel pipes. Steel bars are also imported from Japan. It is said that Japanese steel bars are used because those made in other countries suffer from more defects while being cold forged. Parts manufacturers are importing raw materials of similar quality.

As one of the measures for the development of the domestic automobile industry, imports of CBU passenger cars have been controlled through high import duties and quotas. The import duty is fixed at 140% - 300%, and the vehicle import quota is set at 10% of the demand in the preceding year. As shown in Table V.1-12, while new car imports during the last three years have dropped sharply, used car imports have increased, thus indicating the strength of demand. Of all new car imports, 70% came from Japan and 20% from West Germany. 90% of imported used cars came from Japan and 5% from West Germany. New and used-car import trends have not changed significantly during the last three years.

Table V.1-12: Imports of CBU Passenger Cars

| Calendar year | New cars (units) | Used cars (units) | Total (units) |
|---|---|---|---|
| 1985 | 2,528 | 6,117 | 8,645 |
| 1986 | 303 | 3,714 | 4,017 |
| 1987 | 158 | 6,616 | 6,775 |

Source: Malaysia Annual Statistics of External Trade, etc.

### 1-3-3. Exports

A breakdown of the exports in Table V.1-10 for the last three years is shown in Table V.1-13

CKD parts in 1987 include those shipped to Indonesia (used in the assembly of 96 passenger cars) and to Singapore (used in the assembly of two). The largest portion of the "other parts" category goes to Singapore, followed by Japan and Thailand. In 1987, these three countries accounted for 80% of all exports. Statistics classified according to part are not available, but it is clearY that parts such as mufflers are exported to the replacement market abroad.

**Table V.1-13: Breakdown of Automotive Parts Exports**

(Unit: M$1,000)

| Calendar year | CKD parts | Other parts | Total |
|---|---|---|---|
| 1985 | 23 | 8,945 | 8,968 |
| 1986 | 5 | 8,442 | 8,447 |
| 1987 | 1,620 | 14,221 | 15,841 |

Source: Malaysia Annual Statistics of External Trade, etc.

Taking imports of "other parts" as 100, exports in 1987 were an insignificant 8%. The interviews suggested that, first, products of high quality should be manufactured, and then gradual increases in production and reductions in cost through economies of scale should be made. As for the OEM (original equipment market), however, a parts-supply system has already been established. In these interviews, Japanese parts manufacturers were requested to show more interest in the product market as well as to provide technological assistance.

In order for the automotive parts market to expand, domestic automobile production will have to increase. The PROTON SAGA, of which production began in 1985, is intended not only for the domestic market but also for export. The United States and the United Kingdom are the main destinations. Past exports of passenger cars are shown in Table V.1-14. New CBU car exports have increased dramatically since 1986. Of the new car exports in 1986, 271 units went to Japan and 180 to Singapore. In 1987, 395 units went to Brunei, 216 to Japan, 182 to New Zealand, and 55 to Singapore. On the other hand, used car exports are intended primarily for Australia.

## Table V.1-14: Exports of CBU Passenger Cars

(Unit: A vehicle)

| Calendar year | New cars | Used cars | Total |
|---|---|---|---|
| 1985 | 27 | 144 | 171 |
| 1986 | 491 | 108 | 599 |
| 1987 | 925 | 182 | 1,107 |

Source: Malaysia Annual Statistics of External Trade, etc.

## 1-4. Industry Structure

### 1-4-1. Assembly Plants

As stated earlier, 10 assembly plants are currently operating. The first of them was established in 1965. PROTON was set up under the national car project in May 1983 and commenced operation in July 1985. Classified by location, seven firms are located around Kuala Lumpur, one in the southern part of the country, one along the eastern coast of the peninsula, and still another in East Malaysia. The firm in East Malaysia produces only commercial vehicles. Some changes of vehicle models to be assembled have taken place among the assembly plants from 1986 to 1987. The changes may be due to the decline in automobile production and have some relation to body painting technology. The survey did not reveal any future plan relative to such changes in the production structure. It is recognised, however, that there are too many assemblers for the number of vehicles produced. The Industrial Master Plan sets forth the idea of integrating the industry into three firms. Rationalization and restructuring will be the largest problems facing the automobile industry in the future.

### 1-4-2. Parts Manufacturers

(1) General Company Status

As of August 31, 1987, 135 automotive metal parts manufacturers had obtained approval to operate, and 57 of them were in operation. About 65% of the factories belonging to the operating parts manufacturers are located around Kuala Lumpur, where the automakers are concentrated. Some parts manufacturers are located in the north, where no automakers exist. The whole situation cannot be grasped because data such as the time of establishment of individual firms and their number of employees is still incomplete. It was observed in the survey, however, that the major firms vizited generally employed no more than 100 people and that many had started their operation since 1980. This is believed to be true of most firms.

Seen from the viewpoint of cooperative relations with foreign firms, parts manufacturers having no joint venture or technological tieup with foreign counterparts to produce single-body parts such as fuel tanks, bolts and nuts, and pistons for replacement. Assembled parts are produced using imported components with the cooperation of foreign firms, most of which are Japanese.

(2) Transactions

Parts production licenses are given so as not to allow any one firm to monopolize supply of an item. Due to the small volume of production, however, the number of firms producing the same item is limited, most often ranging from one to three. At present, 10 automobile assemblers, including PROTON, are operating. Parts manufacturers, therefore, deliver their products to two or more assemblers. For example, some component manufacturers supply shock absorbers to all but Toyota vehicle assemblers, while others deliver radiators to all but Nissan vehicle assemblers. Although there are some parts manufacturers such as those given in the examples above that avoid transactions outside their affiliations, transactions in general are carried out multilaterally. Between assemblers and parts manufacturers there are no strong group ties. During the survey one assembler remarked, "We refrain from interfering in the affairs of parts manufacturers, even to suggest the correction of defects in their products, because they deliver these products to many assemblers." Creating a system allowing smooth technological guidance under such an environment may be difficult.

One of the benefits of the subcontracting structure is that any firm processing simple parts can receive orders from companies in different industries and raise its operation rate. During the survey, an automotive parts manufacturer was found to be placing orders for press-moulded and press-punched parts with an electric machinery parts processor. Currently, however, there are few such cases. In the case of press working, lack of skill in metal die technology was pointed out. Improving quality and increasing the number of transactions between subcontractors in different industries are expected to lead to the strengthening of the automotive parts industry.

(3) Industrial Groups

One group of parts manufacturers is the Malaysian Automotive Component Parts Manufacturers Association (MACPMA). As of June 15, 1987, the association had 48 member firms. Except for a few motorcycle parts makers, most are automobile component manufacturers. The member firms can be said to comprise the backbone of the industry. MACPMA has six concrete objectives for its activities, aiming generally at expansion of the market for parts manufacturers.

Major groups of related industries include the Malaysian Motor Vehicles Assemblers Association (MMVAA) and the Malaysian Motor Traders Association (MMTA).

## 2. Actual Production State

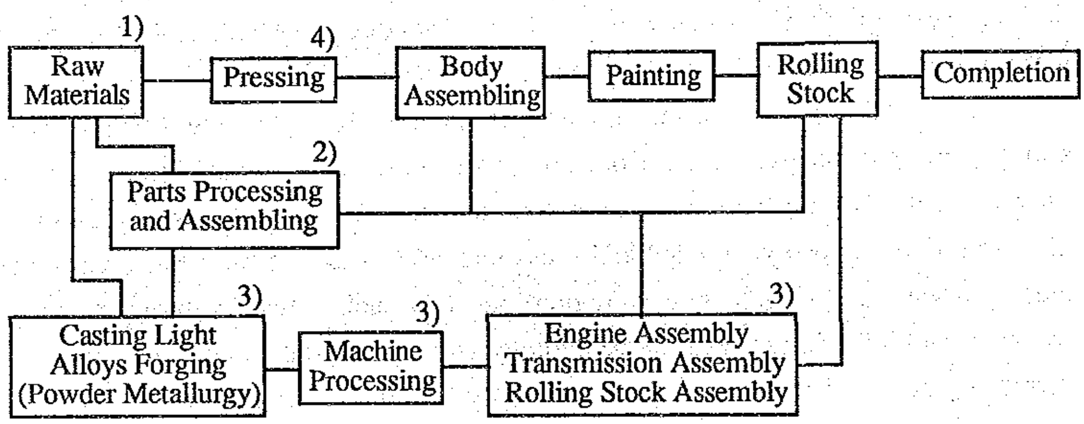
### 2-1. Manufacturing Process and Specifications

#### 2-1-1. Manufacturing Process

(1) Parts Manufacturers

The manufacturing process in general is shown in Fig. V.2-1.

**Fig. V. 2-1 Automobile Manufacturing Process**




The following is a general outline of the metal parts manufacturing process in Malaysia.

The raw materials seen in 1) in Fig. V.2-1 are almost all imported from foreign countries such as Japan. The parts shown in 2) can be manufactured with relatively little technical know-how. The parts indicated in 3) are imported at present, although there are plans to initiate production. The car body pressing in 4) is done by PROTON for the PROTON SAGA only. The parts makers in 2) in Fig. V.2-1 were the main targets of the survey. The companies visited are shown in Table V.2-1.

Table V.2-1 Parts Manufacturers Visited During the Survey

| | Firm name | Relationship with foreign firms | Major items of products | Remarks |
|---|---|---|---|---|
| 1 | United Industries Sdn. Bhd. | | Mufflers, exhaust pipes | Has facilities for welding pipes. |
| 2 | United Filter Sdn. Bhd. | | Oil filters, air filters, air receiver housings | Equipped with small-sized hydraulic presses. |
| 3 | United Vehicles Industries Sdn. Bhd. | | Fuel tanks, screw jacks, cross members | Equipped with 1500T, 1000T and 500T presses. |
| 4 | United Sanoh Industries Sdn. Bhd. | Joint venture | Brake tubes, fuel tubes | |
| 5 | United Tools & Dies Sdn. Bhd. | | | Manufactures jigs and tools for use by the above-stated firms. |
| 6 | Nippondenso Capital Sdn. Bhd. | Joint venture | Receiver hoses, evaporators, condensers, compressors | |
| 7 | Nippondenso (M) Sdn. Bhd. | Joint venture | Starter motors, regulators, alternators, radiators, windshield wipers | |
| 8 | Auto Parts Manufacturers Co. Sdn. Bhd. | Technological tie-up | Leaf springs, shock absorbers | Equipped with hydraulic presses, heat treatment furnaces, load testers. |
| 9 | Auto Coil Spring Sdn. Bhd. | Technological tie-up | Coil springs | |
| 10 | Kilang Alatganti Bangi Sdn. Bhd. | Technological tie-up | Body side mouldings | Equipped with roll moulders. |
| 11 | Sanden International (M) Sdn. Bhd. | Joint venture | Compressors for car air-conditioners, clutches for compressors | QC circles in practice |
| 12 | Car Seats (M) Sdn. Bhd. | Joint venture | Seats complete | Removal of factory planned. |
| 13 | Oriental Metal Industries (M) Sdn. Bhd. | Joint venture | Wheels | Produced for Proton alone. |
| 14 | AAE-ZF Steerings Sdn. Bhd. | Joint venture | Steering gears, lacks and pinions | |
| 15 | AAE-TRW Components Sdn. Bhd. | Joint venture | Tie-rod ends | |
| 16 | GMPE Sdn. Bhd. | | | Design and manufacture of tools for AAE firms. |
| 17 | NGK Spart Plugs (M) Bhd. | Joint venture | Spark plugs | Equipped with plating facilities, QC circles in practice. |
| 18 | Oriental Showa Sdn. Bhd. | Joint venture | Shock absorbers | |
| 19 | ISUMI (M) Sdn. Bhd. | Joint venture | Pistons, cylinder liners | |
| 20 | Belton Sdn. Bhd. | | Wheel studs, wheel nuts, U bolts, shackle ass'y | Equipped with cold forging and heat treatment facilities. |
| 21 | Yodoshi Malleable (M) Sdn. Bhd. | Joint venture | Brackets for compressors | Equipped with continuous production line of cast iron for small-sized products. |

Note: The following five automobile firms were visited.
1. Perusahaan Otomobil Nasional Sdn. Bhd.
2. Associated Motor Industries Malaysia Sdn. Bhd.
3. Asian Automobile Industries Sdn. Bhd.
4. Assembly Services Sdn. Bhd.
5. Oriental Assemblers Sdn. Bhd.

(2) Special Features of the Manufacturing Processes at Parts Manufacturers

1) In the case of manufacturers which are joint ventures or which receive technical assistance, the selection of equipment for parts manufacturing is carried out by the foreign counterpart. In the manufacturing process, investigation processes are carefully incorporated to guarantee quality. During visits for the present survey, measurement and maintenance data were collected and analysed. In the manufacturing process, equipment was installed to confirm the functioning of the parts, and tests were carried out on each individual part. Standards in manufacturing work are posted through all steps in the process, and work is carried out in accordance with those standards. In some cases the name of the cooperating foreign counterpart was left on the drawing. When necessary, diagrams were fully utilized.

In the case of manufacturers with only local capital, manufacturing processes are set up based on technologies obtained by traveling abroad for training or through the use of technological knowledge obtained from equipment makers. For this reason, local capital enterprises do not always have satisfactory quality control systems in the manufacturing process.

2) In the industrialized nations, one of the most important matters when the manufacturing process is organized is how to minimize the number of workers. The enterprises visited in this survey, in contrast, all employed a large number of workers. According to an evaluation made by one Japanese-affiliated component manufacturer, productivity in Japan is three times higher than in Malaysia. This is due to the fact that each piece of equipment is operated by one worker, unlike in Japan, where one worker may operate a number of machines (the multi-machine responsibility method) or handle a number of processes (the multi-process responsibility method). Another cause is the low degree of automation, with manual operation being the general rule. Furthermore, transport is often carried out by hand due to inadequate assembly lines.

3) The handling of raw materials and finished products in the parts production process varies remarkably from company to company. At joint ventures and manufacturers with technology cooperation agreements, technical guidance is being carried out even in such areas as product maintenance. At companies with only local capital, there were often no qualms about mixing half-finished products and scrap during the manufacturing process. Since the handling of products plays an important role in quality control and production efficiency, guidance in this area is considered necessary by cooperating enterprises. When such a control system is developed, it becomes possible to

raise the level of control methodology for materials in process during the manufacturing process. Production methods appropriate to small volume production can also be introduced. Such production control should be oriented as a basic principle to large-variety, small-volume production.

## 2-1-2. Specifications

### (1) Automobile Specifications

There are many restrictions on automobile production. For example, when exporting automobiles each country has different criteria for specifications in areas such as exhaust gas emission control and safety requirements. Exports must comply with these specifications. For this reason, each automobile maker promotes its own research. At the same time, it must make decisions on such matters as the structure, shape, thickness, and material quality of components in order to reduce manufacturing costs. Basically, the same can be said of production for the domestic market. In order to protect the reputation of its own vehicles, an automobile maker cannot lower the quality in specifications for basic functions such as driveability and safety. The necessity of maintaining cost competitiveness in the domestic market is equally important in the case of exports. Naturally, these specifications influence parts specifications as well.

### (2) Parts Specifications

Since each automobile maker has its own set of specifications, parts manufacturers must work in accordance with different specifications, and it is difficult to cope with the many different automobile models and the low volume of production. In the case of the fuel tank, for example, the sheet metal used for the body ranges from 0.80 mm to 0.75 mm thick depending upon the automobile maker. This not only complicates the procedures for purchasing materials and inventory management but also means that it is necessary to keep a supply of each different thickness in stock. This increases the burden on management. A difference in thickness of only 0.05 mm is very significant from the standpoint of automobile specifications, and the fuel tank is an important part for safety maintenance. Thus, thorough consideration is given by the automobile makers to the tank's design in order to improve durability and reduce weight.

From the standpoint of the parts maker, the question of why standardization cannot be carried out has arisen. In the present situation, in which each new model is an attempt at improvement over a predecessor, it is difficult to come up with specifications common to all makers.

On the other hand, there are components for which specifications can be standardized. Standardized specifications are applied to items not normally considered automobile parts, such as nuts and bolts. Also included in this category are those parts having a function of their own, such as batteries and lamps. At the same time, parts test methodologies are also standardized.

However, these items make up only a very small percentage of automobile components, making it difficult to raise production efficiency. The same situation prevails among domestic automobile makers in Japan, and the problem of standardization has been under serious consideration for some time.

## 2-2. Technology Standards

### 2-2-1. Production Engineering

After receipt of design drawings for the products to be made, the production engineering is carried out according to such basic conditions as price, production volume and existing equipment. Production processes are established, equipment selected, and tools designed. Prototypes are then made and mass-production tests are carried out. The term "Production Engineering" encompasses all these activities.

(1) Current Production Engineering Status

The present survey revealed that production engineering perfected by foreign enterprises has been introduced to those parts makers participating in joint ventures or technology provision agreements. Thus, technicians from local work together with foreign technicians to make prototypes. In this manner, local technicians can receive necessary technological training. Among local parts makers, there are some who find it impossible to respond to changes in automobile design without assistance from cooperating enterprises. It can be said that the level of engineering at those parts makers which do not enjoy such relationships are much lower.

(2) Cost Estimates

During visits for the present survey, it was found that it is impossible for parts makers to draw up total cost estimates because cost breakdowns lack detail. This phenomenon can be viewed as resulting from a lack of such basic concepts as efficiency and yield rate in terms of individual parts and individual manufacturing processes. In other words, standards of management control in the manufacturing processes are insufficient.

In the case of Japanese parts makers, it is a common practice to present written estimates with analyzed details such as processing costs, materials costs, equipment preparation costs, and labor costs. Negotiations based upon such detailed estimates are then carried out. This indicates that they have attained sufficient standards of quality and cost control.

(3) The Case of South Korea

In South Korea, local parts makers are generally capable of meeting orders for the production of press-processed parts. Given product design drawings and necessary advice concerning the shape and precision of parts, many local parts makers have sufficient production engineering processing plans and metal die and mould designs, and can produce high-quality products and prototypes.

As explained above, production engineering consists of many types of technology. South Korean enterprises are making efforts to absorb those technologies and increase their abilities. To take a certain South Korean automobile maker as an example, when the company sends its people to Japan for technological training at the Japanese automobile maker with which it has technological cooperation, it requires its employees to take a Japanese language test, and the employees are not allowed to visit Japan until they have achieved a set level of proficiency. Due to such requirements, most of the technicians who come to Japan for training can speak Japanese and are able to master even high-level technologies very quickly.

## 2-2-2. Manufacturing Technology

(1) An Outline of Manufacturing Technology

The following is a list of the types of technology necessary for the production of metal parts: casting technology; forging technology; processing technologies such as cutting and bending; heat treatment technology; and quality inspection. There are other necessary techniques in the selection of raw materials, plating and soldering.

These various technologies are utilized in accordance with the different types of parts. But at present, technologies such as hot forging, precision machine processing, and the various tests have not yet been introduced. Thus, parts that require these technologies are not being made. Also, testing is generally carried out by either the cooperating parts makers or the automobile makers. Only a few companies have equipment for testing the life expectancy of their parts.

(2) Manufacturing Technology Today

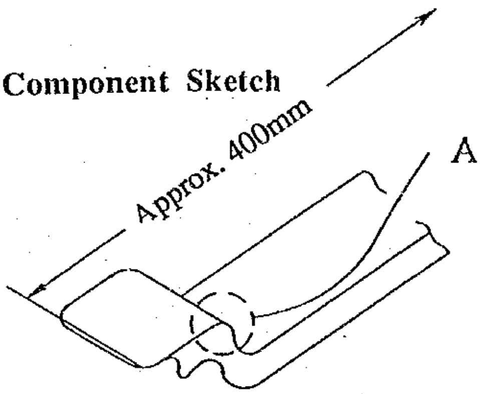
Evaluation of parts manufacturing technology is conducted by automobile makers who decide whether or not to use the parts. Parts makers who make assembly parts evaluate the components of parts in terms of whether or not they can use them. The following standards for individual technologies are viewed from the points of these evaluations and the results of survey visits to the factories of the companies in question.

1) Processing technology

The success or failure of pressing processes depends upon metal mould technology. Considering the fact that PROTON is already producing its own body parts, it can be said that a satisfactory level of domestic production has been reached, but many areas remain in which conditions are unsatisfactory. Some local capital enterprises do not have sufficient design technology to produce the metal dies and moulds necessary for production. In one case a joint venture enterprise ordered the pressed parts seen in Fig. V.2-2 from a local parts maker. The parts maker used metal dies and moulds and produced a prototype, but in the A-part wrinkles and cracks appeared which were impossible to repair satisfactorily even after repeated attempts. Due to scheduling problems, the enterprise which had placed the order was forced to order the moulds from the metal mould department of an electric appliance maker. The parts in question required only folding and bending. Such parts could easily be produced in Japan. In the processing of cup-shaped items, some products were heavily scored. In the case of machine processing, there are very few makers capable of processing brackets, which require processing simultaneous to different portions. In the case of hole-drilling processing, it was found some firms were unable to finish the products in accordance with design tolerances, and there were often significant variations in the finished product.

Thus, it can be seen that basic technical problems being solved by joint ventures and firms with technology provision agreements remain unsolved among those enterprises operating solely on local capital.

**Fig. V.2-2 Rough Component Sketch**




Radiator Bracket (thickness=0.8mm)

2) Casting Technology

There is a long history of iron casting technology. However, there was no development of large casting technology or precision casting technology until it became necessary for the promotion of the automobile industry. The metal dies and moulds used by PROTON to form body parts are large, and success has been achieved in the production of large mould prototypes weighing about three tons. In the casting of nonferrous metals, pistons were produced with aluminum alloys. However, gravity die casting remains the norm, and no injection molding is conducted. Due to a lack of gas extrusion technology, compressor covers that require an airtight seal are not produced domestically. Also, while there are plans to initiate production of aluminum wheels, these have yet to become a reality. However, hubs for bicycles are already being produced by injection, and it appears that the avoidance of this technology is due more to cost considerations than to technological problems.

3) Forging Technology

As mentioned earlier, hot forging cannot be observed In forging, the most important technical point is the way in which the metal mould is made. At present, these metal dies are all imported, and complicated shapes are not being made. They have not yet reached the standard of shapes requiring no processing, which should be the aim of cold forging. Since the former is also used in mass production, actual production by moulds with complicated shapes should be backed up by an increase in production volume.