6. Machine Element Sector

6.1 Dies

6.1.1. Supply and demand trend

(1) Outline

The domestic production of dies in 2006 was ¥487.96 billion or an increase of 11.1% over the previous year. This is due to an expanded production of large-sized, precise and complex dies such as dies for die-casting and for pressing purposes. The output of small-sized and simple dies, such as dies for glasswork, was lower as compared with that in 2005. In addition to the growth in larger dies, such other tendencies as “increased prices” and “falling production” were continued in 2006.

The export of dies was ¥381.6 billion or down 9.4% from 2005. The ratio of export to China/Hong Kong rose in 2006. The import of dies grew by 10.4% y/y to ¥86.15 billion; behind this is increased import from China/Hong Kong.

(2) Production

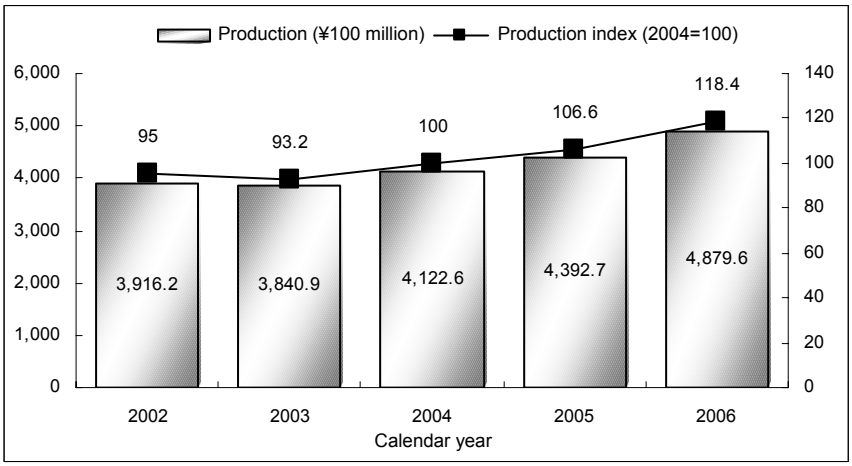
The production of dies (at the manufacturers with 20 workers or more) in 2006 was ¥487.96 billion or an increase of ¥48.7 billion over the previous year. Since 2003, the domestic die output has grown for three consecutive years and approached the ¥500.0 billion mark (See Fig. 6-1). The domestic production in 2006 rose by 18.4% as compared with that in 2003. As shown in Figure 6-3, all types of dies, excluding those for rubber molding/glasswork, recorded considerable increase over the previous year.

The production of dies for die casting showed especially high growth of 37.0% over 2005. That of dies for casting, forging, pressing and plastic molding also tended to increase at a steady rate of 10% or so.

The production figures in 2006 show that dies for pressing and plastic molding combined accounted for about 80% of the total output (dies for pressing, 39.1%; dies for plastic molding, 37.3%). Therefore, description below about the trend of the die industry is centered on dies for pressing and plastic molding.

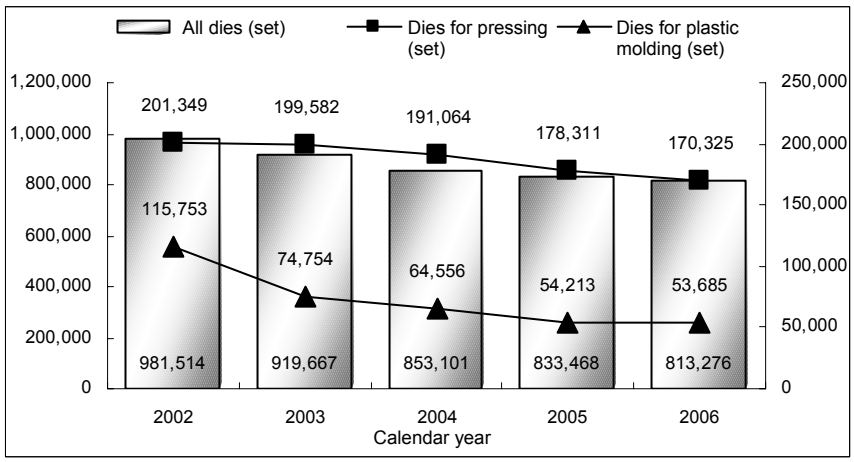
Figure 6-2 indicates that the quantity of all types of dies produced in 2006 fell as in the past several years. Moreover, this downward trend is observed for dies for pressing and those for plastic molding, too. The quantity of output of all dies dropped from 833,468 sets in 2005 to 813,276 sets in 2006. That of dies for pressing fell from 178,311 sets in 2005 to 170,325 sets in 2006. In addition, that of dies for plastic molding decreased from 54,213 sets in 2005 to 53,685 sets in 2006. The production quantity of dies for plastic molding in 2006 was less than a half that in 2002. These figures show that the quantity of all dies, dies for pressing and dies for plastic molding has long been in a falling trend. If this tendency continues, the production quantity of dies in 2007 will be less than 800,000 pieces.

Fig. 6-1 Production of dies (at the manufacturers with 20 or more workers)



Source: Based on the Ministry of Economy, Trade and Industry, “Annual Report of Machinery Statistics.”

Fig. 6-2 Trend of production quantity (in set) of dies



Source: Same as that for Fig. 6-1.

Fig. 6-3 Production of dies by product category

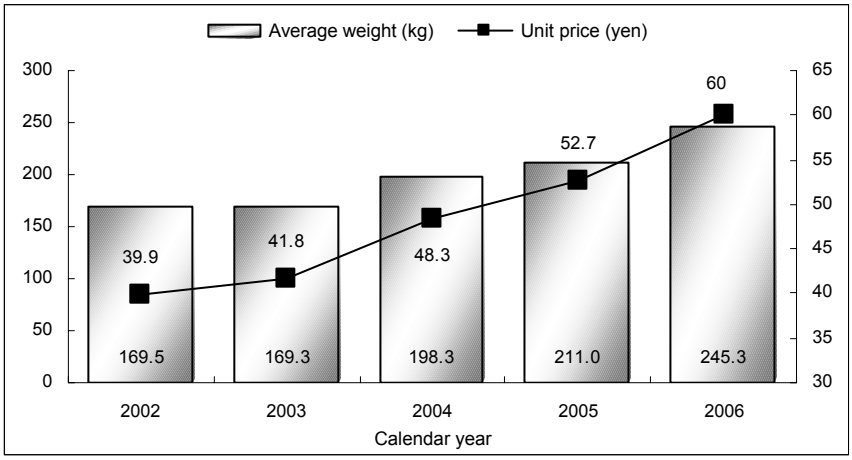
(Calendar year, ¥100 million)

	2002	2003	2004	2005	2006	Growth rate (2006)	Component ratio (2006)
All dies	3,916.2	3,840.9	4,122.6	4,392.7	4,879.6	11.1%	100%
For pressing	1,638.9	1,534.1	1,710.5	1,748.4	1,909.5	9.2%	39.1%
For plastic molding	1,494.5	1,504.6	1,594.7	1,680.9	1,821.0	8.3%	37.3%
For die casting	275.3	280.7	297.2	384.7	527.2	37.0%	10.8%
For forging	142.0	151.8	157.8	176.7	211.1	19.5%	4.3%
For rubber molding	103.9	109.4	113.1	127.3	125.8	-1.2%	2.6%
For casting	118.1	119.8	108.6	135.8	151.0	11.2%	3.1%
For powder metallurgy	63.5	68.4	73.8	78.7	79.2	0.7%	1.6%
For glasswork	80.0	72.1	66.9	60.4	56.5	-6.5%	1.2%

Source: Same as that for Fig. 6-1.

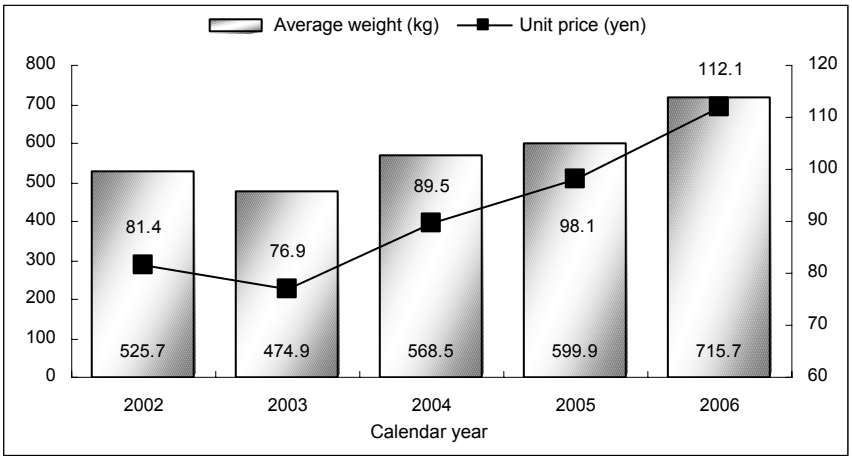
Then the trend of the unit price (¥10,000) and average weight (kg) of dies is described below. Figures 6-4, 6-5 and 6-6 show that the weight and price of all dies, dies for pressing and dies for plastic molding continued to increase in 2006. The unit price of all types of dies went up from ¥527,000 in 2005 to ¥600,000 in 2006 (See Fig. 6-4). The average weight of all dies rose from 211kg in 2005 to 245.3kg in 2006. From dies for pressing, too, the unit price increased from ¥981,000 in 2005 to ¥1,121,000 in 2006, while the average weight became heavier from 599.9kg in 2005 to 715.7kg in 2006. Finally for dies for plastic molding, the unit price rose from ¥3,101,000 in 2005 to ¥3,392,000 in 2006 and the average weight, from 699.7kg in 2005 to 739.3kg in 2006. These figures indicate that the unit price and average weight of all dies, dies for pressing and dies for plastic molding have long kept an upward trend and recorded the highest value in the past five years in 2006. It can generally be said that higher technology is required to make larger dies. For example, in the case of dies for pressing, sequential feeding dies are larger and require higher-level technology than single feeding dies; thus the former is more expensive than the latter.

Fig. 6-4 Average weight and unit price of all types of dies



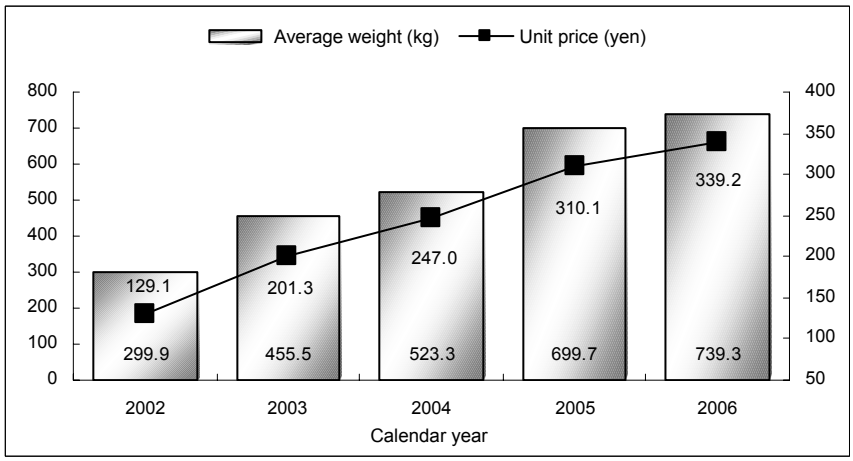
Source: Same as that for Fig. 6-1.

Fig. 6-5 Unit price and average weight of dies for pressing



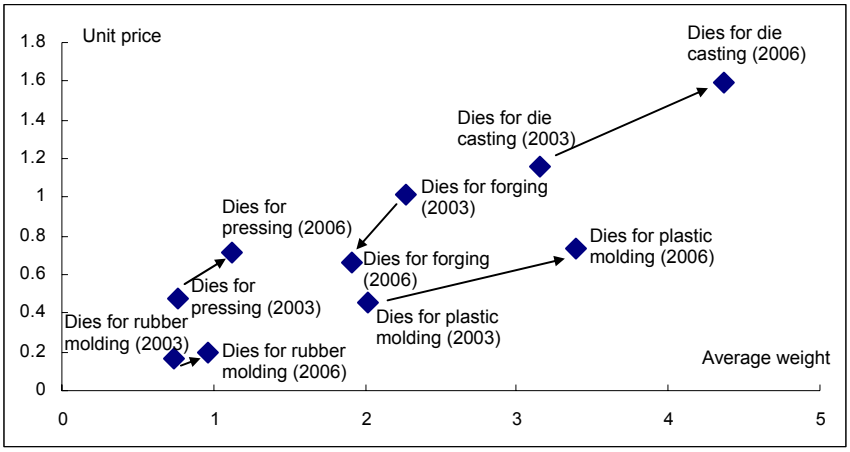
Source: Same as that for Fig. 6-1.

Fig. 6-6 Unit price and average weight of dies for plastic molding



Source: Same as that for Fig. 6-1.

Fig. 6-7 Changes in the average weight and unit price of various types of dies (comparison between 2003 and 2006)



Source: Same as that for Fig. 6-1.

Therefore, the declining production quantity of dies and their increasing unit price and average weight can be regarded as the indicators that point to a transfer of the Japanese die industry to the low-volume output of larger dies, which requires higher technology. Figure 6-7 shows this transfer of the domestic die industry.

Figure 6-7 compares the average weight and unit price of dies for die casting, plastic molding, forging, pressing and rubber molding in 2003 and those in 2006. From this figure it can be seen that the unit price and average weight of all of these dies, excluding dies for forging, increased.

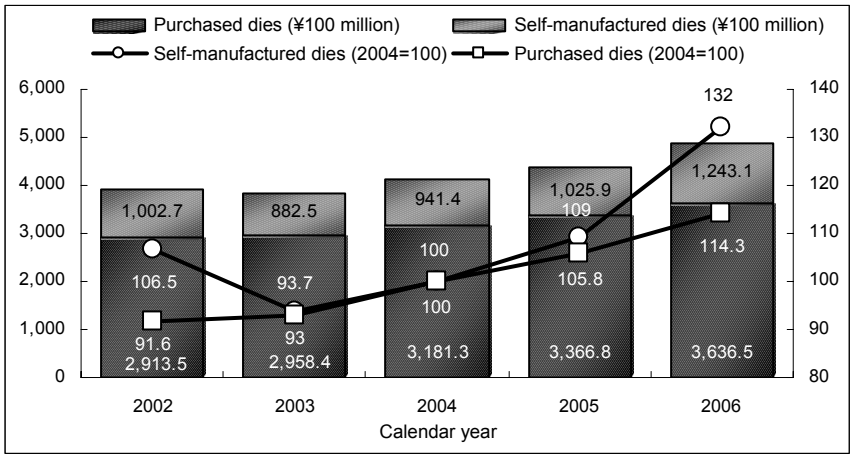
Another change in the domestic die market is the advance of self-manufacture as shown in Figure 6-8. As represented in the case of Canon Inc. that made Igari Mold Co. its wholly-owned subsidiary in 2004, major manufacturers have promoted the self-manufacture of important dies in recent several years.

To sum up, the situation of production of all dies, dies for pressing and dies for plastic molding may be expressed as “continued upward trend of amount of production and downward trend of production quantity.” Behind this tendency is probably the progress of production of “larger and more expensive” dies in Japan.

Considering the recent production trend of dies in China and Southeast Asia, mainly Thailand, the die manufacture in Japan will have an increasing trend of “super-large,” “super-precise” and “super-complex” products. In fact, Honda Engineering Co. says that it will raise the level of die technology of its subsidiary in Thailand to that equal to the level in Japan.[1]

[1] See, for example, the lecture of the company at the 2007 Conference on Die and Mould Technology held by the Japanese Society of Die and Mould Technology.

Fig. 6-8 Advance of self-manufacture of dies



Source: Same as that for Fig. 6-1.

(3) Export and import[2]

The export of all types of dies in 2006 amounted to ¥381.6 billion (See Fig. 6-9). This means that the export in 2006 increased by 9.4% over the previous year. The export of dies for pressing in 2006 was ¥148.44 billion or an increase of 13.3% y/y (See Fig. 6-10). That of dies for plastic molding in 2006 grew by 7.2% y/y to ¥145.14 billion (See Fig. 6-11). As noted, the die export in 2006 can be said to have been favorable.

The export of dies to China/Hong Kong continued to increase, too. Figure 6-12 shows the die export to the three largest trade partners (U.S., China/Hong Kong and Thailand) in the 2002-2006 period. According to this figure, the ratio of Japan's die export to China/Hong Kong in 2002 was 19.8% of the total export. But in 2006, the export to China/Hong Kong rose to 26.8% of the total. In addition, the U.S. had had the largest share of the die export from Japan until 2004, but in 2005 and after, China/Hong Kong was the top importer of Japanese-made dies, surpassing the U.S.

The import of dies in 2006 was ¥86.15 billion, up 10.4% over the previous year (See Fig. 6-13). Die import has rapidly increased in the recent several years (in 2006, up 90.4% over 2002). Figure 6-14 shows the trend of shares of the top three importers of Japanese-made dies. In 2006, 51.6% of Japan's die import was from South Korea, a decline of 7.8% from the previous year. By contrast, import from China/Hong Kong increased, accounting for 22.6% of the total import in 2006 (12.1% in 2002). China/Hong Kong has made its presence felt more as the die exporting country to Japan, too. Attention should also be paid to the movements of Thailand in the future.

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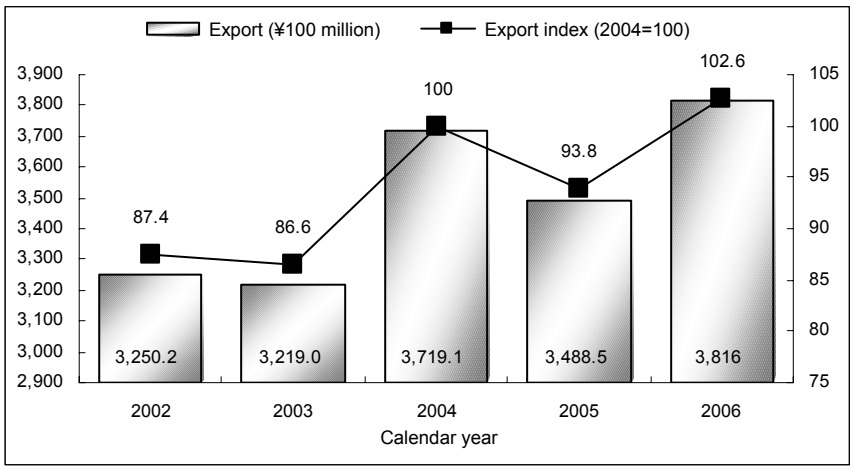
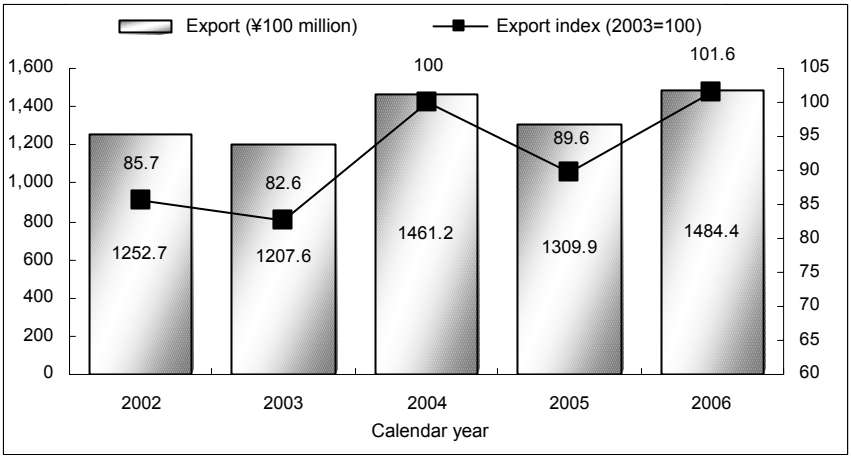
[2] The item numbers of the foreign trade statistics used are as follows: all types of dies: 8207.20-200, 8207.20-900, 8207.30-100, 8207.30-900, 8480.10-000, 8480.20-000, 8480.30-000, 8480.30-000, 8480.41-000, 8480.49-000, 8480.50-000, 8480.60-000, 8480.71-000, 8480.79-000; dies for pressing: 8207.30-100. 8207.30-900; dies for plastic molding: 8480.71-000, 8480.79-000. The foreign trade statistics adopt the division "dies for rubber or plastic molding;" thus the export-import statistics for dies for plastic molding include those for dies for rubber molding, too.

Fig. 6-9 Situation of export of dies



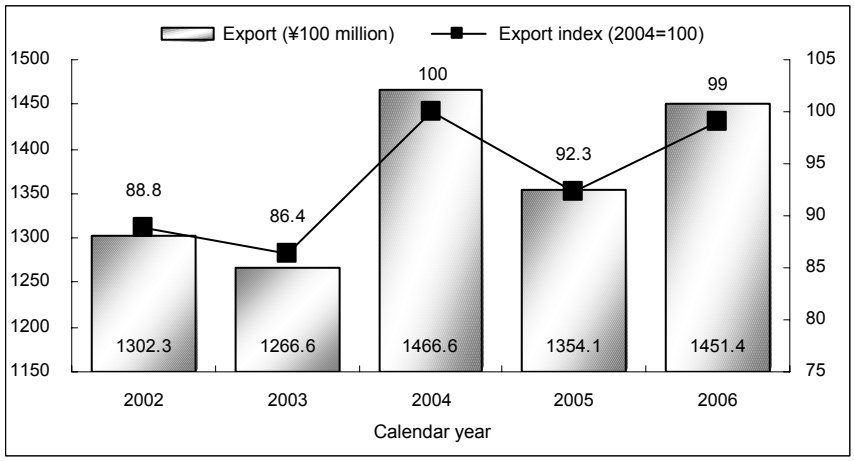
Source: Based on the Ministry of Finance, “International Trade Statistics.”

Fig. 6-10 Situation of export of dies for pressing



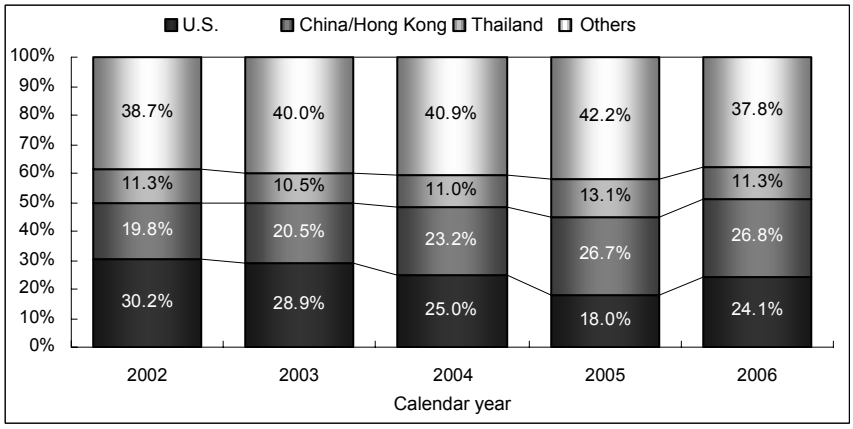
Source: Same as that for Fig. 6-6.

Fig. 6-11 Situation of export of dies for plastic molding



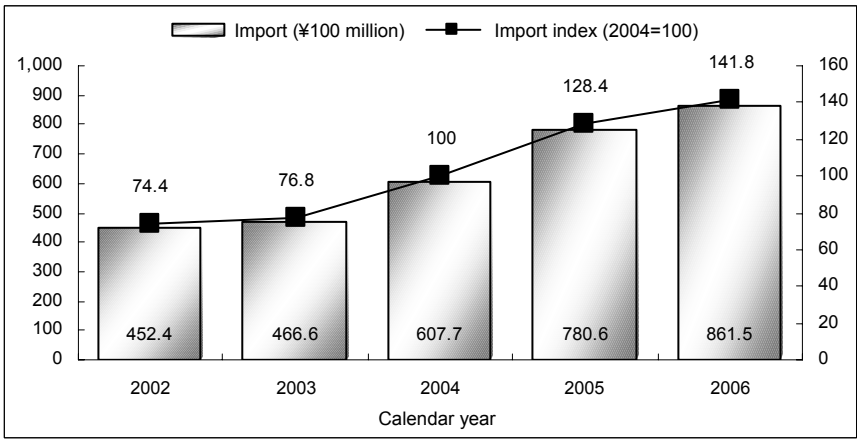
Source: Same as that for Fig. 6-6.

Fig. 6-12 Situation of export of dies by main importing country



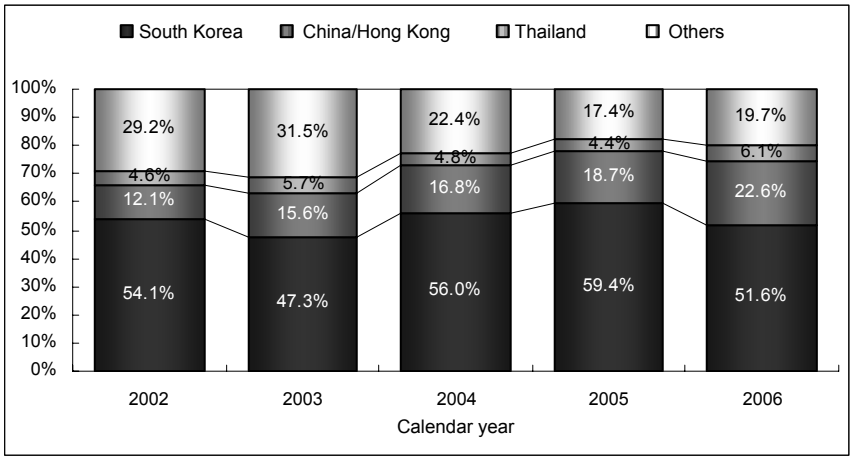
Source: Same as that for Fig. 6-6.

Fig. 6-13 Situation if import of dies



Source: Same as that for Fig. 6-6.

Fig. 6-14 Situation of import of dies by main exporting country



Source: Same as that for Fig. 6-6.

6.1.2. Results of operations and the trend of the die industry

(1) Trend of management

Figure 6-15 shows the trend of management in FY2006 of main seven die manufacturers.

Futaba Corp. registered sales of ¥39,696 million or an increase of 3.3% over the previous year in 2006 (the operating profit declined by 4.0%). The company says that the growth in sales was due to the business recovery of mainly consumer electronic appliance businesses, such as the manufacturers of cellular phones and flat-screen TVs, and greater demand for dies.

Fuji Technica Inc. suffered a decline of 19.1% y/y in sales to ¥13,190.0 million in 2006, but its operating profit was ¥872.0 million or a growth of 57.5% y/y. According to the company, the main factor behind this was successful projects for China and Russia.

Kuroda Precision Industries Ltd. recorded sales of ¥3,794.0 million, up 25.2% y/y, in 2006. The company says that while orders for dies for motors for air-conditioner and other household electric appliances and those for printers and other office equipment tended to level off, orders for core dies for motors mounted on hybrid vehicles picked up well as a result of increased production of these vehicles. Orders for dies for small-sized vibrating motor cores used for cellular phones increased, too, and the company states that they filled these orders by reinforcing the production capacity and cost competitiveness of its Malaysian subsidiary, thereby attaining greater sales.

Hoden Seimitsu Kako Kenkyusho Co. had sales of ¥4,122.72 million in 2006, down 7.2% from the previous year, and its operating profit, ¥751.44 million, down 22.8% y/y. The company points out as a reason for this that orders for dies for extrusion dies for automobile parts and other industrial aluminum parts picked up but those for extrusion dies for ceramics honeycombs for purifying automobile exhaust gas declined.

Marujun Co. recorded an increase of 1.8% in sales to ¥3,410.0 million but its operating profit fell to 516.0 million, down 1.0%. According to the company, the delivery period was shortened and

the quality was improved for domestic dies, resulting in smaller sales and operating profit. On the other hand, it says that then sales of its Thai subsidiary increased.

Nichidai Corp.'s sales in 2006 were ¥6,029.0 million or a decline of 3.3% from the previous year. The company's operating profit lowered by 25.2% y/y to ¥510.69 million, too. The factors behind this given by the company include the fact that mainly due to increasing investment in overseas manufacturing bases by Japanese automobile manufacturers, new domestic projects for parts decreased, mostly in the Chubu (Central Japan) district, leading to inactive demand for dies.

The sales of Arrk Corp. in 2006 were ¥318,504.0 million or an increase of 1.6% over the previous year. This amount was the largest in history to the company. Behind this is an increase in the company's business and capital tie-up partners as shown in Figure 6-15. But its operating profit dropped by 39.1% y/y to ¥11,149.0 million. Sekisui Machinery Co., with which Arrk cooperates in business and capital, also had a growth in sales of 1.6% y/y but a smaller operating profit (down 4.0%) in 2006. The company says that the reasons for the lower operating profit include rising prices of steel and other materials for dies and higher labor costs in Asia.

Fig. 6-15 Consolidated settlement of accounts of main die manufacturers (as of the most recent announcement)

(Consolidated; ¥10,000; amounts less than ¥10,000 rounded off)

	FY2005		FY2006		Y/y growth rate	
	Sales	Operating profit	Sales	Operating profit	Sales	Operating profit
Arrk Corp.	26,493,100	1,830,500	31,850,400	1,114,900	20.2%	-39.1%
Dies for plastic molding						
Sekisui Machinery Co. Dies	689,217	53,334	699,900	51,200	1.6%	-4.0%
Dies for pressing						
Futaba Corp. Manufacturing equipment segment	3,842,700	258,800	3,969,600	243,100	3.3%	-6.1%
Fuji Technica Inc. Dies for pressing for automobiles	1,629,539	55,366	1,319,000	87,200	-19.1%	57.5%
Kuroda Precision Industries Ltd. Precision equipment/systems equipment segment	587,300	161,451	695,700	98,400	18.5%	-39.1%
Press dies	302,971	—	379,400	—	25.2%	—
Hoden Seimitsu Kako Kenkyusho Co. Dies	446,339	97,283	412,272	75,144	-7.6%	-22.8%
Marujun Co. Dies segment	334,900	51,600	341,000	51,100	1.8%	-1.0%
Dies for forging						
Nichidai Corp. Dies	623,534	68,286	602,900	51,069	-3.3%	-25.2%

Notes: 1. The description following the company name is the name of the segment to which the die business belongs.
2. Sales figures include sales between different segments.
3. The sales and operating profit figures for Arrk are those of the whole company (Sekisui Machinery is Arrk's subsidiary).

Source: Prepared based on the financial statements, quick reports on the settlement of accounts, etc. of the companies.

Fig. 6-16 Arrk's business and capital tie-up partners

2006			
	April	Shanghai Longchuang Qiche Designing, Ltd.	China
	April	Soode Nagano Co.	Japan
	June	Graphic Products Inc.	Japan
	August	Sagamihara-Buhin Co.	Japan
	August	New System Holding Company Limited	Thailand
	October	Shokowsha Co.	Japan
2007			
	January	Xianghu Gufen, Ltd.	Taiwan
	February	Ecoplastic Co.	South Korea

Source: Prepared based on the published data of Arrk Corp.

(2) Technological innovation and the business environment

This section discusses the situation of technological innovation and R&D activities of die manufacturers. The R&D expenditure of these manufacturers is as shown in Fig. 6-17. Arrk Corp. spent ¥1,165.0 million for R&D in FY2006, an increase of 60.2% over the previous year. Sekisui Machinery Co. also increased its R&D expenses by 100% y/y to ¥38.0 million in FY2006. Futaba Corp. invested ¥388.0 million in R&D, up 83.9% y/y and Fuji Technica Inc., ¥12.0 million, up 9.1% y/y. The R&D expenditure of Nichidai Corp. in FY2006 was ¥86.13 million or a 34.0% y/y growth.

On the other hand, Kuroda Precision Industries Ltd. cut its R&D expenses by 42.8% y/y to ¥107.0 million, Hoden Seimitsu Kako Kenkyusho Co., by 7.8% y/y to ¥226.0 million, and Marujun Co., by 34.0% y/y to ¥86.13 million.

Figure 6-18 shows the R&D expenditure to sales ratio of the major manufacturers. As seen in the figure, the R&D intensity of the domestic die manufacturers are not very high. Since it have been requested to raise the value added of dies as stated earlier, die businesses will need to be more positive to R&D activities in the future.

Fig. 6-17 R&D expenditure of main die manufacturers

(Consolidated; ¥10,000; amounts less than ¥10,000 rounded off)

	FY2005	FY2006	Y/y growth rate
Arrk Corp.	72,700	116,500	60.2%
Sekisui Machinery	1,900	3,800	100%
Dies for pressing			
Futaba Corp.	21,100	38,800	83.9%
Fuji Technica	1,100	1,200	9.1%
Kuroda Precision Industries Ltd.	18,700	10,700	-42.8%
Hoden Seimitsu Kako Kenkyusho	24,500	22,600	-7.8%
Marujun Co.	105,500	57,500	-45.5%
Dies for forging			
Nichidai	6,430	8,613	34.0%

Source: Financial statements of the companies.

Fig. 6-18 R&D expenditure to sales ratio of main die manufacturers

(Consolidated; ¥10,000; amounts less than ¥10,000 rounded off)

	FY2005	FY2006	Y/y ratio
Arrk Corp.	0.27%	0.37%	0.09%
Sekisui Machinery	0.28%	0.54%	0.27%
Dies for pressing			
Futaba Corp.	0.55%	0.98%	0.43%
Fuji Technica	0.04%	0.06%	0.02%
Kuroda Precision Industries Ltd.	1.39%	1.54%	-
Hoden Seimitsu Kako Kenkyusho	2.58%	2.32%	-0.26%
Marujun Co.	3.04%	1.43%	-1.61%
Dies for forging			
Nichidai	0.60%	0.71%	0.11%

Source: Financial statements of the companies.

The details of main R&D activities of the main die manufacturers are as shown in Figure 6-19. Arrk and Sekisui Machinery are doing R&D on 3-D CAD, such as the system of "CAD/CAM/CAE for unifying 3-D CAD data." Nichidai is continuing the development of "plastic joining method." One of the purposes of these R&D activities is to "shorten the delivery time" in an attempt to meet the growing needs of dies-using industries.

Fig. 6-19 Main R&D projects of main die manufacturers

Manufacturer	Main R&D activities
Arrk Corp.	CAD/CAM/CAE system for unifying 3-D data; in-mold dies/three-color molding dies
Sekisui Machinery	CAD/CAM/CAE system for unifying 3-D data
Futaba Corp.	Development of a mechanism for reducing the time for transferring CAD data to processing data
Fuji Technica	Application of thermal spraying technology to die surface treatment/use of non-contact 3-D measured data for die modifying work
Kuroda Precision Industries Ltd.	Structural analysis of dies for pressing/study of molding mechanism of dies for pressing
Marujun Co.	Development of die structure for weight reduction of automobile body parts
Nichidai	Development of implanting forge welding

Source: Prepared based on the quick report on the settlement of accounts of the companies.

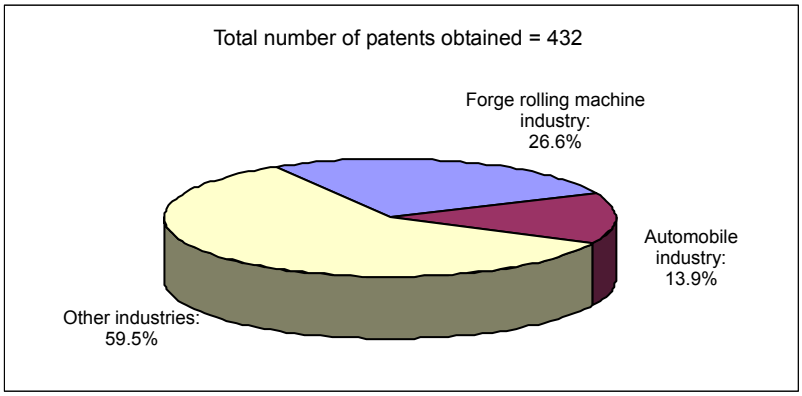
(3) Future prospects and problems

Domestically made dies have had higher value added (They have become "super-large," "super-precise" and "super-complex"). This section examines the need of die industries to cooperate with other businesses and organizations in such a changing domestic market as well as their present

situation and future directions.

Figure 6-20 is a pie chart showing the ratio of patents related to dies for pressing obtained by industry. The figure indicates that the forge rolling machine industry and the automobile industry combined have got 40.5% of these patents.

Fig. 6-20 Trend of patents for dies for pressing obtained by industry

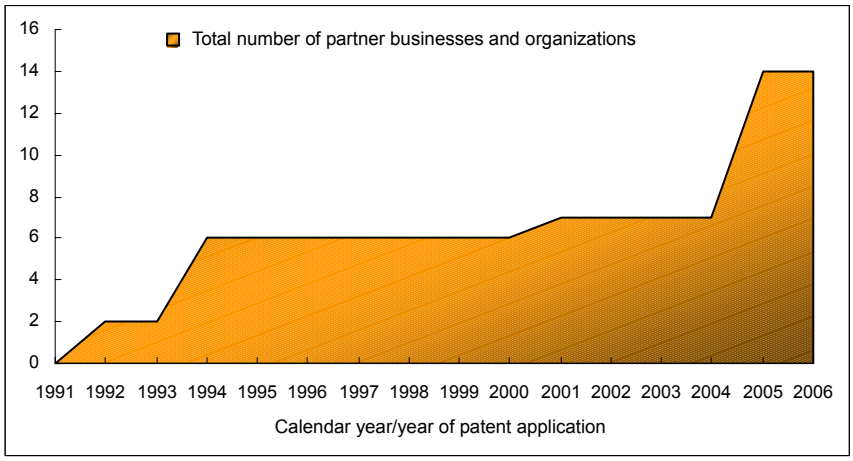


Source: Prepared based on the data of the Industrial Property Digital Library.

In other words, machine tool manufacturers and the die and die self-manufacture segments of the automobile industry are working as the “sites” of cooperation between the manufacturers of dies for pressing and the machine tool and automobile industries. Thus it is supposed that a variety of knowledge and findings that would urge the development of technology related to dies for pressing are exchanged at these sites.

As noted above, if die manufacturers are to do technical development work and make dies of higher value added, it is important for them to positively work together with other businesses in and out of the die industry and with universities and public organizations. In fact, Company A, one of the leaders in dies for automobiles having high-level technology (engaged in the designing and making dies for pressing and pressing), has positively been cooperating with these parties. In addition, diverse attempts to encourage technical development with cooperation between die manufacturers and other industries universities and public organizations have been made across Japan, such as the group for die study in Shimane Prefecture and the workshop for dies for pressing in Gunma Prefecture.

Fig. 6-21 Trend of the number of Company A's partner businesses (1991-2006)



Note: Figures are all of the patents applied by Company A. The figures for the "Total number of partner businesses and organizations" are the number of applicants excluding Company A for each patent.

Source: Prepared based on the data of the Industrial Property Digital Library.

One of the results of the cooperation is the foundation of a die business as a university-led venture. The Kyushu Institute of Technology has the Advanced Die Center, which also serves as a center of the "Project for Core Human Resource Development for Advanced Dies in the Northern Kyushu District." On the basis of this fact, a student at the university's doctor's course conducted a joint study with a die manufacturer and founded a company named 3D Engineering as a consequence.

As stated thus far, it will become more important for the die industry to positively cooperate with other industries and the academic world and to support this cooperation.

Fig. 6-22 Outline of 3D Engineering Co.

Company name	3D Engineering Co., Ltd.
Business	R&E and manufacture of dies for metal photofabrication, the designing, manufacturing, and forming of dies for plastic molding, and the holding of events and seminars
Date of foundation	September 26, 2006
Capital	¥10.65 million
Address	Room No. 105, Incubation Building, Kyushu Institute of Technology, 680-4, Kawatsu, Iizuka-shi, Fukuoka Prefecture 820-8502

Source: The website of 3D Engineering Co.