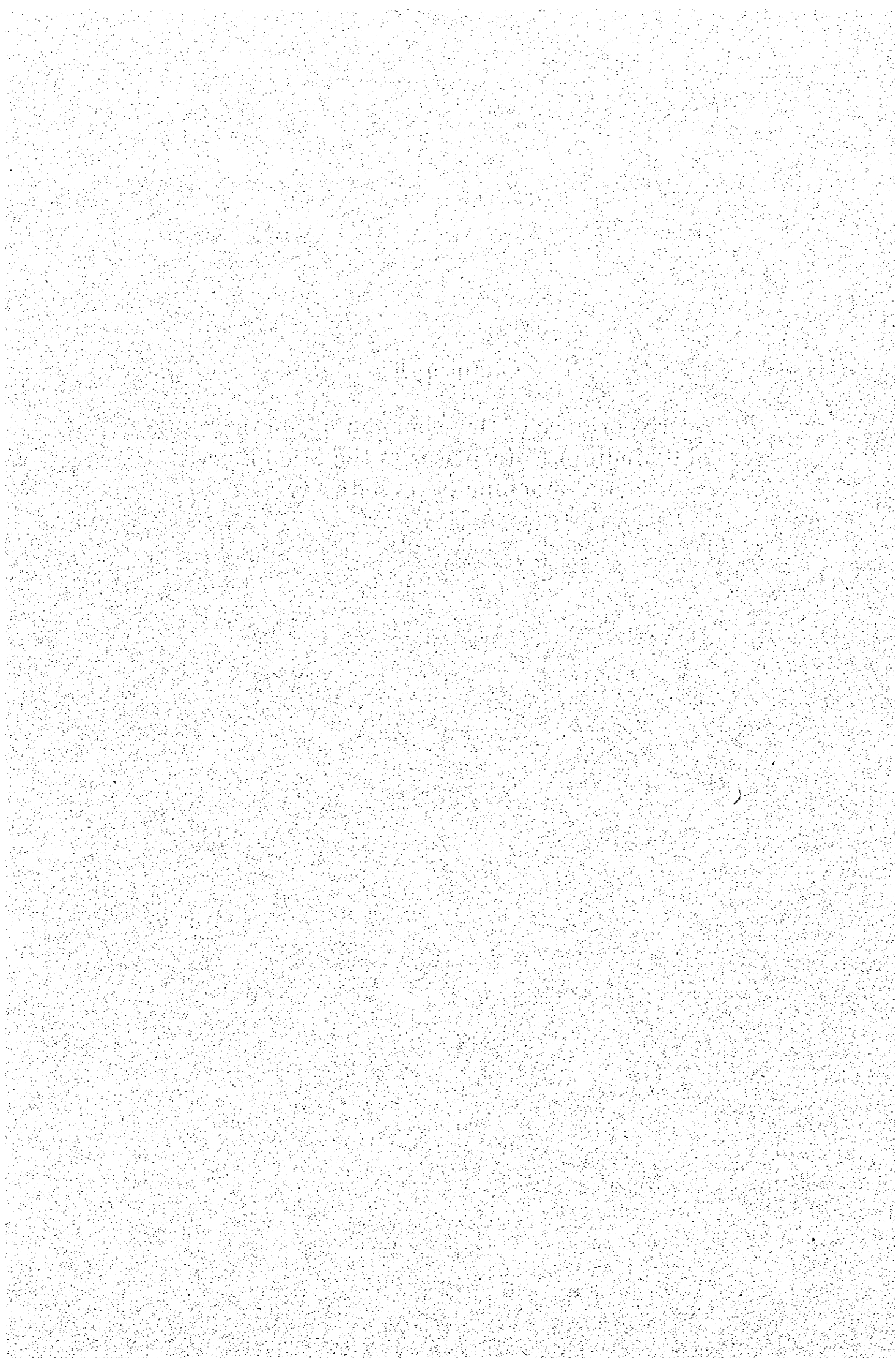


Chapter III

Experience of Development of Small and Medium Enterprises in the Machinery and machine parts industry



Chapter III

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1. Features of the machinery and machine parts industry in Japan

In the machinery and machine parts industry, which is the subject of this study, products are generally manufactured through the production process "material→working→assembling". As the following five middle categories (28-32) of Japan Standard Industrial Classification cover the above features of the industry, these five categories have been selected in this study.

(1) Metal products manufacturing industry (hereinafter called "metal products industry")

Categories of business of high SME nature such as knives, hardware, working tools, bolts/nuts/springs, heat treatment and plating are included in this field.

(2) General machinery and equipment manufacturing industry (hereinafter called "general machinery industry")

Machinery of assembling type and working type form the mainstream in this field. Bearings and piston rings (which are products of large-size enterprises) are also included in this field.

(3) Electrical machinery and equipment manufacturing industry (hereinafter called "electrical machinery industry")

Heavy electrical machinery, internal combustion engine electrical components, telecommunication machinery and equipment and electronic components are also included.

(4) Transport machinery and equipment manufacturing industry (hereinafter called "transport machinery industry")

Automotive vehicles, rolling stock, and their parts, ships, aircrafts ...

(5) Precision machinery and equipment manufacturing industry (hereinafter called "precision machinery industry")

Weighing machines, measuring instruments, medical care equipment, time pieces, cameras, etc.

The five categories of business indicated above are what are included in the machinery and machine parts industry.

The five categories of business indicated above are classified as capital goods business (such as industrial machinery and metal working machinery) or as consumer durable goods business such as TV sets and refrigerators. There are cases where terms heavy machinery and light machinery are used for expressing categories of business. But no quantitative definition has been made for these terms.

1.1 Transition of development in the Machinery and machine parts industry

a. Objective

Table 1-1 shows industrial statistics calculated to learn the trends of production in the period of 1960 to 1996 for each one of the five middle categories covered in this study. The volume of shipments of the whole industry (indicated as whole industry) and the volume of shipments of SMEs (with not more than 299 employees) were separately calculated to observe the contribution by middle category of the whole industry and the contribution by middle classification of SMEs (indicated in the table as ratio of SMEs). Since the figures extracted out of industrial statistics are of a long period of time, adjustment was made using the wholesale price index released by the Bank of Japan.

b. Trends of production of the five middle categories

Table 1-1 shows the yearly volume of shipments by middle category. It is said that the Japanese industry has experienced a recovery period (1945-1954) after World War II, a high-growth period (1955-1972), a stable period (1973-1984) and a transition period (1985-present). It can be said that the Japanese industry has maintained its prosperous growth as long as these processes are observed. The field of electrical machinery in particular indicates a rapid growth because of computers and the introduction of electronics in machine control, image equipment and others. This prosperous growth is supposedly led by policy supports by the government (to be described later) and efforts made by enterprises themselves.

Table 1-1 Progress of manufacturing and shipping amount by category of business

| | | (Unit: million yen) | | | | | | | | | |
|---|----------------|---------------------|-----------|------------|------------|------------|------------|------------|------------|--|--|
| | | 1960 | 1965 | 1970 | 1975 | 1980 | 1985 | 1990 | 1996 | | |
| Metal products industry | Whole industry | 1,428,979 | 3,171,162 | 7,638,680 | 8,660,271 | 11,472,553 | 13,541,249 | 18,299,076 | 18,095,802 | | |
| | SMEs | 1,172,141 | 2,507,778 | 6,100,266 | 7,049,215 | 9,605,330 | 10,818,281 | 14,796,364 | 14,189,291 | | |
| | Ratio of SMEs | 82.0% | 79.1% | 79.9% | 81.4% | 83.7% | 79.9% | 80.1% | 78.4% | | |
| General machinery manufacturing industry | Whole industry | 2,295,471 | 4,389,944 | 11,708,845 | 12,099,393 | 18,162,869 | 24,459,458 | 33,560,462 | 31,645,340 | | |
| | SMEs | 1,168,631 | 2,193,682 | 5,601,862 | 6,140,945 | 9,747,762 | 12,751,419 | 18,456,524 | 16,900,000 | | |
| | Ratio of SMEs | 50.9% | 50.0% | 47.8% | 50.8% | 53.7% | 52.1% | 55.0% | 53.4% | | |
| Electrical machinery manufacturing industry | Whole industry | 937,117 | 1,849,637 | 5,974,357 | 7,401,683 | 14,952,660 | 28,904,583 | 47,623,193 | 62,497,603 | | |
| | SMEs | 239,329 | 544,248 | 1,756,617 | 2,538,179 | 5,068,929 | 8,794,093 | 13,923,963 | 17,229,399 | | |
| | Ratio of SMEs | 25.5% | 29.4% | 29.4% | 34.3% | 33.9% | 30.4% | 29.2% | 27.6% | | |
| Transport machinery manufacturing industry | Whole industry | 1,483,596 | 3,306,905 | 8,872,096 | 14,052,160 | 28,083,793 | 33,161,632 | 45,984,483 | 45,832,109 | | |
| | SMEs | 283,391 | 570,498 | 1,479,041 | 2,734,822 | 4,495,878 | 5,844,745 | 8,363,226 | 8,562,663 | | |
| | Ratio of SMEs | 19.1% | 17.3% | 16.7% | 19.5% | 19.5% | 17.6% | 18.2% | 18.7% | | |
| Precision machinery manufacturing industry | Whole industry | 214,535 | 481,442 | 1,111,862 | 1,646,771 | 3,321,503 | 4,308,026 | 5,066,341 | 4,138,574 | | |
| | SMEs | 109,422 | 238,956 | 551,123 | 771,181 | 1,525,638 | 1,951,413 | 2,391,168 | 2,284,738 | | |
| | Ratio of SMEs | 51.0% | 49.6% | 49.6% | 46.8% | 45.9% | 45.3% | 47.2% | 55.2% | | |

Source: Industrial Statistics Chart (Industries Volume)

Note: Values were adjusted using the wholesale commodity price index.

1.2 Machinery and machine parts industry and subcontracting structure

Presence of the subcontracting structure between large-size enterprises and SMEs is a big reason for the growth of the machinery and machine parts industry. The roles and functions of the subcontracting structure, inter-enterprise linkage and flows of technologies and information are described below.

(1) Subcontracting structure

a. Definition of subcontracting enterprises

According to the definition in "Subcontracting SMEs Promotion Act", "subcontracting" is defined as to execute production and/or working to products, parts, accessories or the like or to produce and/or repair equipment used for production of products, with orders received from enterprises whose paid-in capital or number of employees is larger than the subject enterprise. The enterprise that places orders in such transactions is called parent enterprise (ordering enterprise) and the enterprise that receives such orders is called subcontracting enterprise (order receiving enterprise).

b. Progress of establishment of subcontracting structure

It is said that the subcontracting structure was established by large-size enterprises to save capital and to take advantage of the wage difference by business scale during the recovery period and the high growth period since 1945. Even large-size enterprises (parent enterprises) did not have sufficient capital strength in the post-war Japan, and in addition, the domestic market was small. Therefore, large-size enterprises left important portions in the company and placed orders for the rest with external SMEs. Since SMEs did not have funds, technology or human resources for execution of product development, market development and others in those days, they accepted the deals offered by parent enterprises.

Furthermore, large-size enterprises also had rough passages up to the present time, and they provided technological guidance to subcontracting enterprises, for improving the quality of their products. Many of automotive vehicle parts subcontracting enterprises introduced mass-production type production processes for exhaustive rationalization.

c. Production in the company and ordering to outside manufacturers

Machinery is produced through assembling and working in diversified parts composition. Furthermore, since many enterprises are of multi-model small batch production, many of these parts are procured through purchase from specialized enterprises (standard articles which conform to industrial standards), through ordering to and working at outside manufacturers (of articles designed by the company) and through production in the company. P-parts requiring high working

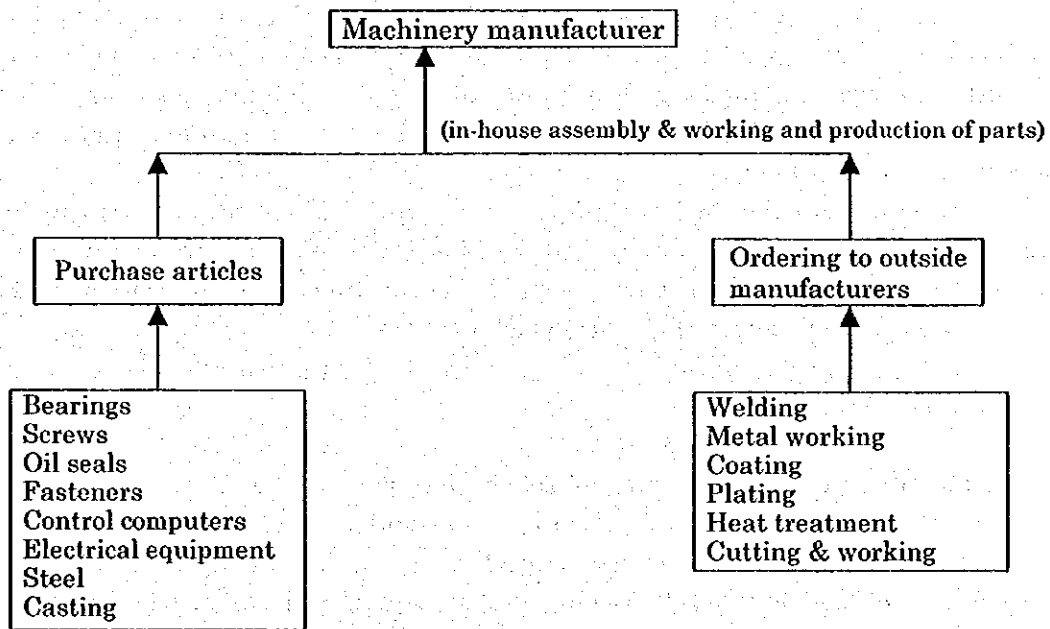
accuracy (of severe control structure) and large-size parts are worked in the company and heat treatment, plating, coating, sheet metal and coating requiring professional technology are made at outside manufacturers.

Fig.1-2 indicates the dependency of a machinery manufacturer on external manufacturers.

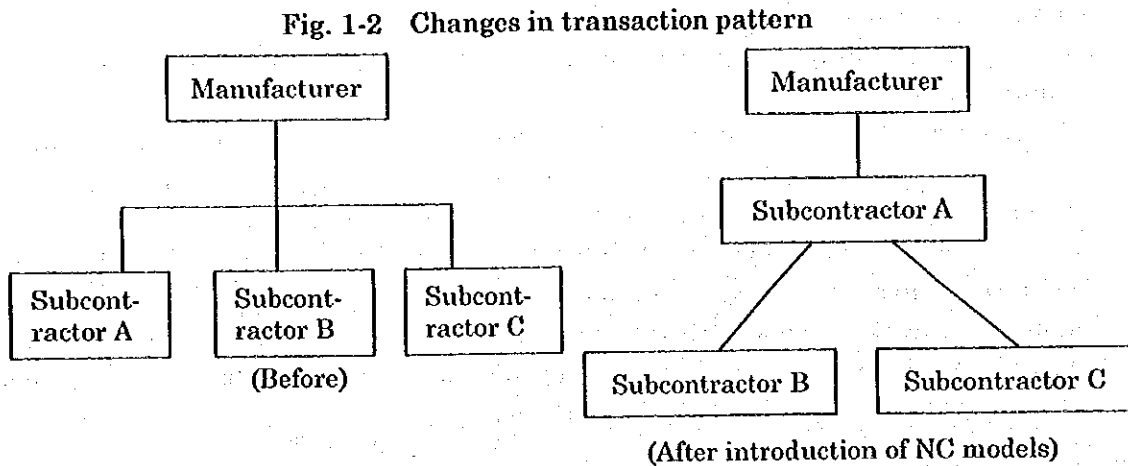
In case of automotive vehicle parts, synchronization with the production line of the company itself is requested to subcontracting enterprises. In case of the machinery industry, on the other hand, the transaction relation is rather loose.

When these relations are explained in further detail, the former can be said to be a mass-production type subcontracting enterprise and the latter a job manufacturing type subcontracting enterprises. Both belong to the category of machinery industry, but features of production processes and production management structure are entirely different between them.

Fig. 1-1 Machinery and machine parts industry and subcontracting structure



d. Changes in subcontracting structure



Since orders were placed in parallel before, manufacturers were required to conduct management operations such as acceptance inspection even for single articles. Recently, however, manufacturers began to place orders for functional units. This method made a substantial reduction of the burden of parent enterprises in subcontract management.

After introduction of NC models, an enterprise (Subcontractor A) capable of providing the function of assembly and working serves as the core, and enterprises (Subcontractors B & C) which are not capable of providing other than cutting function work only as subcontractors of a subcontractor.

1.3 Independent type SMEs

Jonan Area having Ohta Ward of Tokyo Metropolis as nucleus is an urban type industry integrated area. Ohta Ward in particular is characterized by precise working of small- and medium-sized articles, and it is said that the majority of technologies needed for metal working are present in this area. The features of industry integration in this area can be summarized as follows.

- a. While other local industry integrated areas are integrated with kernel industries as nuclei, no kernel industry exists in Jonan Area.
- b. Being of small-lot production configuration, which is contrary to automotive vehicle parts subcontracting SMEs, the SMEs in this area are capable of receiving orders from all the fields.
- c. The technological levels of enterprises were improved because of advancement of division of labor as specialized by field of working technology.
- d. Inter-enterprise transactions in the area are positively executed, and these transactions perform the function of enterprise processes.
- e. Specializing in small-lot production and being strong in the production of spare parts and prototypes, the SMEs in this area have high added value productivity.

- f. With an abundance of technological information in the area, many product development type enterprises are also appearing.

Ohta Ward industry integrated area, as an urban type industry integrated area, has features which are different from those of local industry integrated areas (towns formed around enterprises). However, Jonan Area is under severe conditions that hinder its development, including mixture of houses and factories, deterioration of operation infrastructure and restriction of factory building area by an ordinance of Tokyo Metropolitan Government, because of increase of the population in the area. Some of enterprises have already relocated to reclaimed lands (Central Plating Cooperative which was indicated as a case, is a typical one) or out of Tokyo. At any rate, the Ohta Ward industry integrated area is characterized by its richly accumulated technologies. For this reason, it is considered that side-supports such as backup of new operations and upbringing of successors are needed in the future to keep its richly accumulated technologies.

2. Principal measures for the machinery and machine parts industry

2.1 Machinery Industry Promotion Extraordinary Action Act

a. Background

It is said to be "Machinery Industry Promotion Extraordinary Action Act" that renovated the industrial structure of Japan in the 1955-1965 period. The industrial structure of the machinery and machine parts industry of Japan in those days was extremely characteristic in such a way that it consisted of the completed machinery production sector that was mainly organized by large-size enterprises on one hand and the machine parts manufacture sector which supplied materials and parts to said sector on the other hand. The majority in the machine parts manufacture sector were SMEs, and their productivity was extremely inferior because of their limited production of diversified products and obsolete equipment. Although the machinery and machine parts industry was anticipated to grow as a leading industry among others in the secondary industry, the growth of this industry was stagnant.

b. System

This Act was intended to update the least rationalized sector, to promote accumulation of capital and technologies, to eliminate the conspicuous difference between SMEs and large-size enterprises and to promote modernization of the machinery and machine parts industry as a leading industry. This act had the following characteristics:

- i. The rationalization basic plan and the implementation plan are created individually for the machinery industry specified by the Minister of International Trade and Industry. (The plan was determined with and to support for whole

structure of large-size enterprises /SMEs.)

- ii. Treasury funds are provided to support implementation of such plans.
- iii. The Minister of International Trade and Industry can give directives for joint activities, if necessary for achieving the target of rationalization.
- iv. This Act was established as a law effective for a limited period of five years.

It was determined to support the fields indicated below, which, dominated by SMEs, lagged behind among others in the machinery industry at that time.

- Basic machinery (machine tools, casting machines, forging presses, etc.)
- Common parts (bearings, gears, etc.)
- Parts for completed machines for export (parts for sewing machines, automotive vehicles, etc.)

c. Fruits

Initially, seventeen categories of business were specified in the governmental ordinance, selected from those whose main forces were SMEs and whose products were considered suitable to be produced by small and medium-sized specialized manufacturers also in the future. Later, one category was additionally specified in 1957 and another four in 1958. (However, one category of business was transferred in 1957 because of establishment of Electric Industry Promotion Extraordinary Action Act.) Specific categories of business are shown in Table 2-1.

Table 2-1 Transition of categories of business specified as specific categories of business of machinery industry (fiscal 1956 - 1970)

| | Specified fiscal year | | | | | | |
|--|-----------------------|-----|-----|-----|-----|-----|-----|
| | '56 | '59 | '61 | '64 | '66 | '68 | '70 |
| Grinding wheels | | | ○ | — | — | — | ○ |
| Cast and forged steel | | | ○ | — | — | — | ○ |
| Forged products | | | ○ | — | — | — | ○ |
| Pig iron castings | ○ | — | — | — | — | — | ○ |
| Die cast | ○ | — | — | — | — | — | ○ |
| Powder metallurgy | ○ | — | — | — | — | — | ○ |
| Screws | ○ | — | — | — | — | — | ○ |
| Internal combustion engines | | | ○ | — | — | — | ○ |
| Gears | ○ | — | — | — | — | — | ○ |
| Machine tools | ○ | — | — | — | — | — | ○ |
| Forging machines | | ○ | — | — | — | — | ○ |
| Electrical welding machines | ○ | — | — | ○ | — | — | ○ |
| Electric tools | ○ | — | ○ | — | — | — | ○ |
| Cutting tools | ○ | — | — | — | — | — | ○ |
| Molds | ○ | — | — | — | — | — | ○ |
| Bearings | ○ | — | — | — | — | — | ○ |
| Transport machinery | | | ○ | — | — | ○ | ○ |
| Hydraulic and pneumatic machinery | | | ○ | — | — | — | ○ |
| Chemical machinery | | | ○ | — | — | — | ○ |
| Plastic resin machinery | | | ○ | — | ○ | ○ | ○ |
| Industrial sewing machine | | | | | ○ | — | ○ |
| Sewing machine parts | ○ | — | ○ | — | — | — | ○ |
| Textile machinery | | | ○ | — | — | — | ○ |
| Mining and civil engineering work construction machinery | | | ○ | — | — | — | ○ |
| Industrial vehicles | | | ○ | — | ○ | — | ○ |

| | Specified fiscal year | | | | | | |
|---|-----------------------|-----|-----|-----|-----|-----|-----|
| | '56 | '59 | '61 | '64 | '66 | '68 | '70 |
| Food processing machinery | | | | | ○ | | ○ |
| Woodworking machinery | | | ○ | | | | ○ |
| Industrial kilns and furnaces | | | ○ | | ○ | | |
| Casting equipment | | | ○ | | ○ | | |
| Packaging machinery | | | ○ | | | | ○ |
| Precise measuring instruments | ○ | | | | | ○ | |
| Testing equipment | ○ | | | | | | ○ |
| Analytical equipment | | | ○ | | ○ | | |
| Industrial measuring instruments | | | ○ | | | | ○ |
| Industrial weighing machines | | | ○ | | ○ | | |
| Clock parts | ○ | | | ○ | | | |
| Printing presses | | | | ○ | | | ○ |
| Office equipment | | | ○ | | | | ○ |
| Railroad signal and safety equipment | | | ○ | | | ○ | |
| Valves | | ○ | | | | | ○ |
| Heat treatment | | | ○ | | ○ | | |
| Gas cutters | | ○ | ○ | | | | |
| Telecommunication equipment | | | | ○ | | ○ | |
| Railway cars | | | | | ○ | | ○ |
| Railway car parts | | ○ | | ○ | | | |
| Automotive vehicle parts | ○ | | | | | | ○ |
| Machinery and tools for automotive vehicles | | | ○ | | | | ○ |
| Farming machinery | | | ○ | | | | ○ |
| Wind-force and water hydraulic machinery | | ○ | | | | | ○ |
| Number of categories of business | 17 | 21 | 40 | 39 | 36 | 33 | 33 |

Note: The object categories of business in 1956 were 17 categories of business including batteries (transferred to Electric Industry Promotion Extraordinary Action Act in 1957).

Source: The Japan Development Bank 25-year Company History

“Specific Electronics Industry and Specific Machinery Industry Promotion Extraordinary Action Act” was enforced in 1971 as a law effective for a limited period of seven years.

What constituted the basis for enforcement of this law was such a report from the Industrial Structure Council as described below.

Large changes such as (1) progress of internationalization, (2) intensification of shortage of labor, (3) increase in social needs for safety measures against public environmental hazard, (4) individualization and diversification of personal consumption pattern, (5) progress in information technology and others were anticipated to occur in the environment that surrounds the machinery and machine parts industry in 1970's, and it was necessary to execute policies and measures that deal with these changes.

The interdependence was being strengthened between the electronics industry and the machinery industry in recent years as represented by computerized control of machine tools. Therefore, the new law unitized former Machinery Industry Promotion Extraordinary Action Act with Electric Industry Promotion Extraordinary Action Act, and incorporated new features. Prevention of danger, preservation of living environment, industrialization of new technologies, electric power saving, etc. were indicated as the direction of treasury support to the machinery industry.

Table 2-2 Machinery industry

| | | |
|---|--|---|
| <input type="radio"/> Metal machine tools | <input type="radio"/> Plastic resin machinery | <input checked="" type="radio"/> Artificial grinding wheels |
| <input checked="" type="radio"/> Forge rolling machinery | <input type="radio"/> Woodworking machinery | <input checked="" type="radio"/> Bearings |
| <input type="radio"/> Transport equipment | <input type="radio"/> Combustion furnaces | <input type="radio"/> Precise molds |
| <input checked="" type="radio"/> Chemical machinery | <input type="radio"/> Automatic casting machinery | <input type="radio"/> Hydraulic and pneumatic equipment |
| <input type="radio"/> Public environmental hazard preventing equipment | <input type="radio"/> Automatic packaging machinery | <input type="radio"/> Automatic regulator valves |
| <input type="radio"/> Freezing units | <input type="radio"/> Industrial robots | <input type="radio"/> Automotive vehicle parts |
| <input type="radio"/> Central heating and air-conditioning equipment | <input type="radio"/> Industrial measuring instruments | <input type="radio"/> Forgings |
| <input type="radio"/> Textile machinery | <input type="radio"/> Measuring instruments related to public environmental hazard | <input type="radio"/> Castings |
| <input checked="" type="radio"/> Civil engineering and construction machinery | <input type="radio"/> Railway cars (up to fiscal 1973) | |
| <input type="radio"/> Farming machinery | <input type="radio"/> Nuclear reactor parts | |

Note: mark indicates simple continuation, and mark indicates what accompanied changes as if continuation was not made, although continuation was made in practice. Others were newly specified in fiscal 1971.

Source: The Japan Development Bank 25-year Company History

Table 2-2 includes those categories of business which were newly added in the field of machinery and machine parts industry following the enforcement of the new law in 1971.

This scheme was taken over by "Electronics and Machinery Industries Business Upgrading Promoting Funding", which was based on "Specific Machinery and Information Industries Promotion Extraordinary Action Act" (July 1978 - July 1985), in 1978.

2.2 Smaller Enterprise Modernization Promotion Law

a. Background

Smaller Enterprise Modernization Promotion Law was officially announced in 1963. But SMEs were under such environmental conditions as described below because of aftereffect of the business prosperity in those days (1959- 1961).

- i) Increase in salaries and tightness of labor market
- ii) Transition to open economy structure and competition with emerging nations
- iii) Automotive vehicles and home electric appliances industries and others commenced mass-production structure to strengthen international competitiveness. (Reorganization of subcontractors)
- iv) Changes in consumption and physical distribution accompanying high growth of the Japanese economy

b. Scheme of Smaller Enterprise Modernization Promotion Law

The purport of this law was to specify categories of business which needed so that the Minister in charge will formulate a (5-year) plan for modernization of the

categories of based on the investigation of the realities and to subsidize those SMEs intending to make the improvement. The contents of the plan were as follows:

i) Target of modernization in the target year

(Performance, quality, cost, suitable production scale, production method, production amount or outlook of export of products)

ii) Methods for achieving the target

Matters related to upgrading the SME structure such as modernization of equipment, rationalization of management, technologies and skills, joint operation of business and grouping of factories, etc.; normalization of competition; improvement in business relations; development of demand

When SMEs in the specified categories of business want to update their equipment in accordance with the plan, they can receive favorable loans from governmental financial institutions. In addition, they can receive business upgrading funds (Japan Small & Medium Enterprise Cooperation Act), precedent loans of SME equipment modernization loans and extra depreciation of machinery and equipment, factory construction, etc.

c. Fruits

The categories of business indicated below were specified among those related to machinery and machine parts, and efforts are being made for improvement in management and technology. Many categories of business which lost international competitiveness are also included in these categories of business.

1963: Screws, western style tableware, pig iron casting, gears, working tools, parts for automotive vehicles, electrical plating

1964: Heat treatment

1971: Farm machinery, food machinery, packaging machinery, valves, molds, scales, pressure gauges, small-size springs

1966: Small and medium-sized steel ships, box making machinery, meat and fisheries machinery, small-size boilers

1967: Parts for textile machinery, metal pressing

1969: Transport vehicles for industrial use and their parts

1970: Printed circuit boards

1971: Flat knitting machines, Christmas lamp bulbs

2.3 Small and Medium Enterprises Management Upgrading Loans System (Japan Small & Medium Enterprise Corporation Act)

a. Background

The Small and Medium Enterprises Basic Law and Smaller Enterprise Modernization Promotion Law also clearly state that modernization of SMEs upgrades the industrial structure or strengthens international competitiveness of industries and makes contribution to the national economy. Japan has been promoting modernization of SMEs by establishing their organization since 1961 as the method for modernization of SMEs.

b. System

i) The SME Management Upgrading Loans assists cooperatives, which were organized under The Cooperative Societies of Minor Enterprises Law, in the execution of factory grouping projects, joint facilities projects, etc. for modernization. The feature of this system is that diagnosis, guidance and financing are provided in a unit from the project planning stage through the administration stage. The funds are covered by budgets of The Japan Small & Medium Enterprise Corporation (hereinafter called "JSMC") and of prefectures.

ii) The objective of the upgrading project is policy financing to promote modernization of SMEs by collaboration and joint operation. Therefore, it is necessary to create a plan that incorporates policy requirements in the design stage.

iii) This project focuses on grouping of factories. As discussed below, each industrial complex is developed in its own manner.

*Grouping in the same category of business (foundry, metal pressing, etc.)

In this case, even if the technologies used may be the same, each of the members (participating enterprises) continues sales activities as before with its own strong sales channel. With respect to technological development and production activities, on the other hand, the feasibility of joint operation (joint production facilities project) is high because there is a high similarity in technologies used among them. The possibility of cost reduction can also be expected due to it.

"Chuo Plating Industrial Cooperative", which was used as a case example in this study, targeted improvement of the operation infrastructure with joint facilities (waste water treatment plant) through grouping of enterprises of the same category of business.

*Grouping of different categories of metal business (automotive vehicle parts, machinery parts, etc.)

In this case, diverse categories of business such as machining, heat treatment, forging and casting assemble together, and each participating member (enterprise) is capable of completing one product through inter-enterprise supplementation. This

method also permits improvement in the technological level and optimization of the management scale through achievement of one process per enterprise (technological specialization) in such a state that many enterprises assemble at one place and inter-enterprise information is acquired.

Mitaka High-Tec Center Cooperative, which was introduced as Case (1), is a factory grouping type project which accompanied redevelopment of the town. But enterprises (members) that assembled there are of different categories of business as viewed from their technologies and products. Therefore, no joint facilities project has been attempted in this industrial complex. Since enterprises of different categories are assembled here, products which are handled by members can be worked through inter-enterprise supplementation among members.

Utilizing this function enabled each member to adjust the amount of initial equipment investment it had to make and thus proceed to optimize its management scale with such grouping as the opportunity.

c. Fruits

We have seen 11,463 joint facilities established at 458 industrial complexes during the 1961-1998 period. There have been a number of SMEs which merged together or which converted the line of business as upgrading projects as opportunities, in these facilities.

2.4 Machinery Credit Insurance Law

a. Background

When SME managers newly procure machinery and equipment to update their facilities, one of the three methods described below is taken.

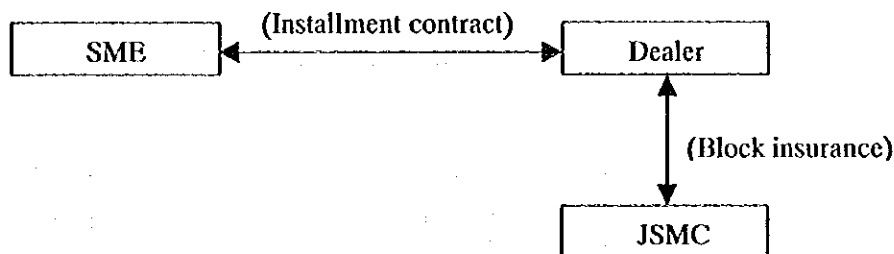
- i) Installment sales: Equipment is purchased from a dealer on an installment basis.
- ii) Loan guarantee: The dealer becomes the guarantor for the SME for borrowing funds for purchase of equipment from a financial institution.
- iii) Leasing contract: Equipment is leased to the SME from a leasing agent.

However, there have been cases where accidents such as default of payment occur in the process of these contracts and prices cannot be recovered by dealers or the like. For SMEs, on the other hand, there have been cases where contracts were not established from the aspect of credit such as performance figures, at the time of contracting with dealers.

b. Scheme

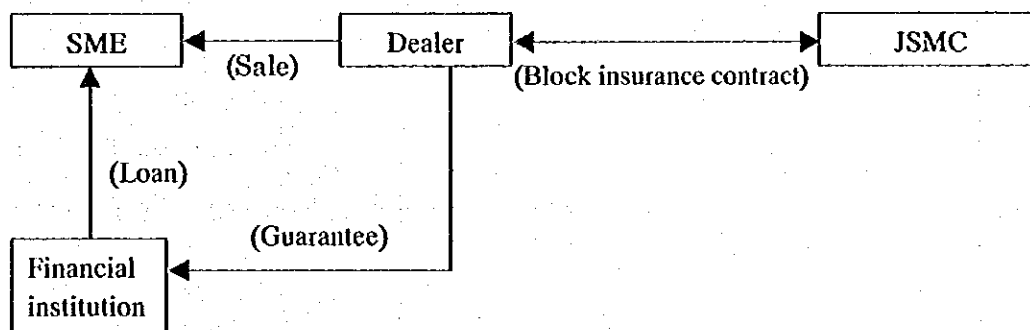
This law intends to accelerate promotion of this industry, by supporting SMEs to upgrade their facilities. The following supporting measures are taken depending on configuration of transaction for this purpose.

i) Installment contract



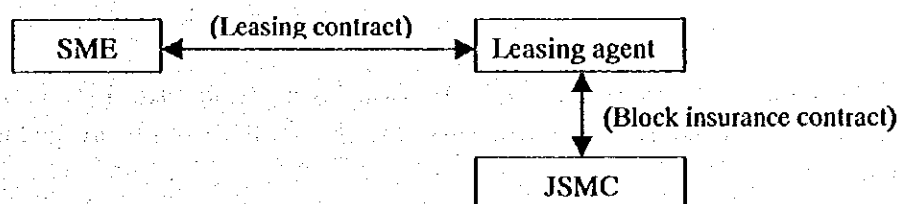
The Corporation has block insurance contracts with machinery and equipment dealers. If any default occurs with an SME regarding payment for the purchase, one half of the balance of the receivable price after delivery of equipment to the user is covered by this insurance.

ii) Loan contract



When an SME receives a loan from a financial institution for purchase of equipment, there are cases where the dealer becomes the guarantor to the financial institution. If any default occurs in the payment in such a case, one half of the receivable price is compensated.

iii) Lease credit insurance



When an SME uses machinery and equipment leased from a leasing agent, if any default occurs in the payment during the leasing period, one half of the balance of the receivable leasing charge is compensated.

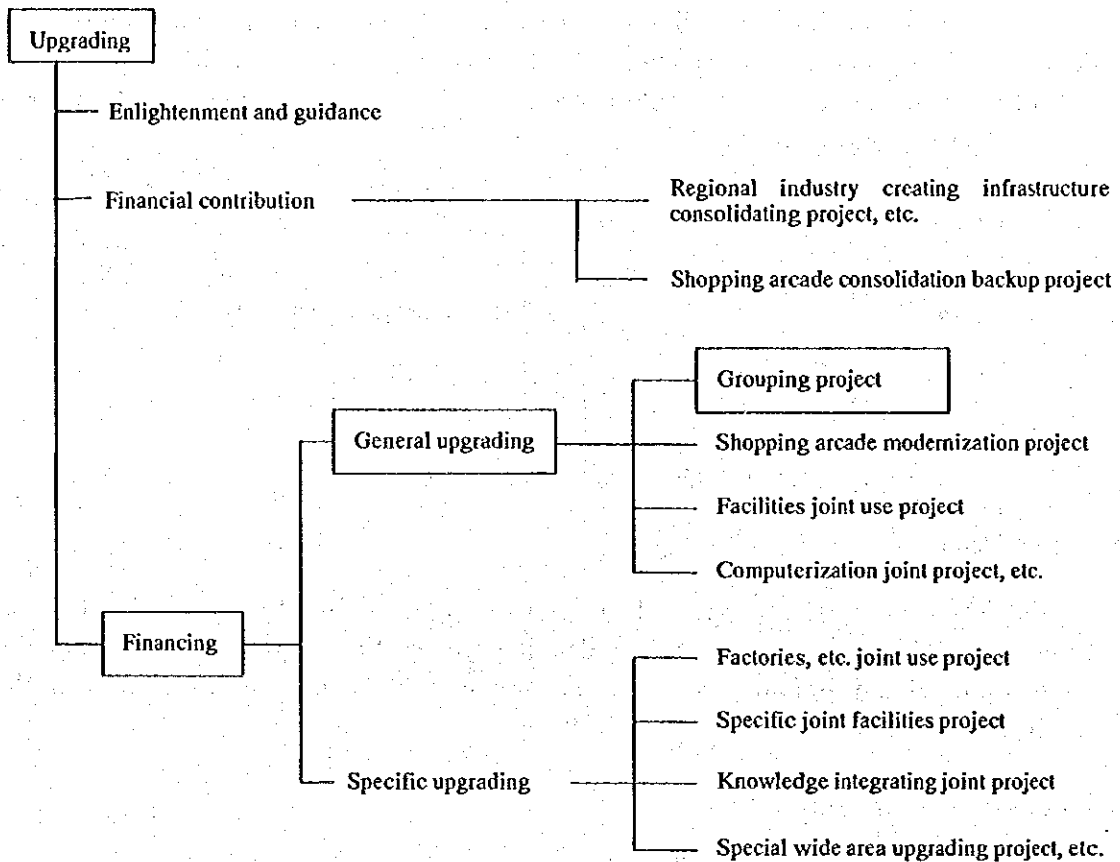
c. Fruits

Physical distribution of the machinery and machine parts industry is activated by guarantee by public institutions when the equipment is to be updated or when new machinery and equipment are to be introduced by SMEs. In this connection, leasing insurance contracts in which JSMC was involved during fiscal 1998 amounted to

1,193.7 billion yen.

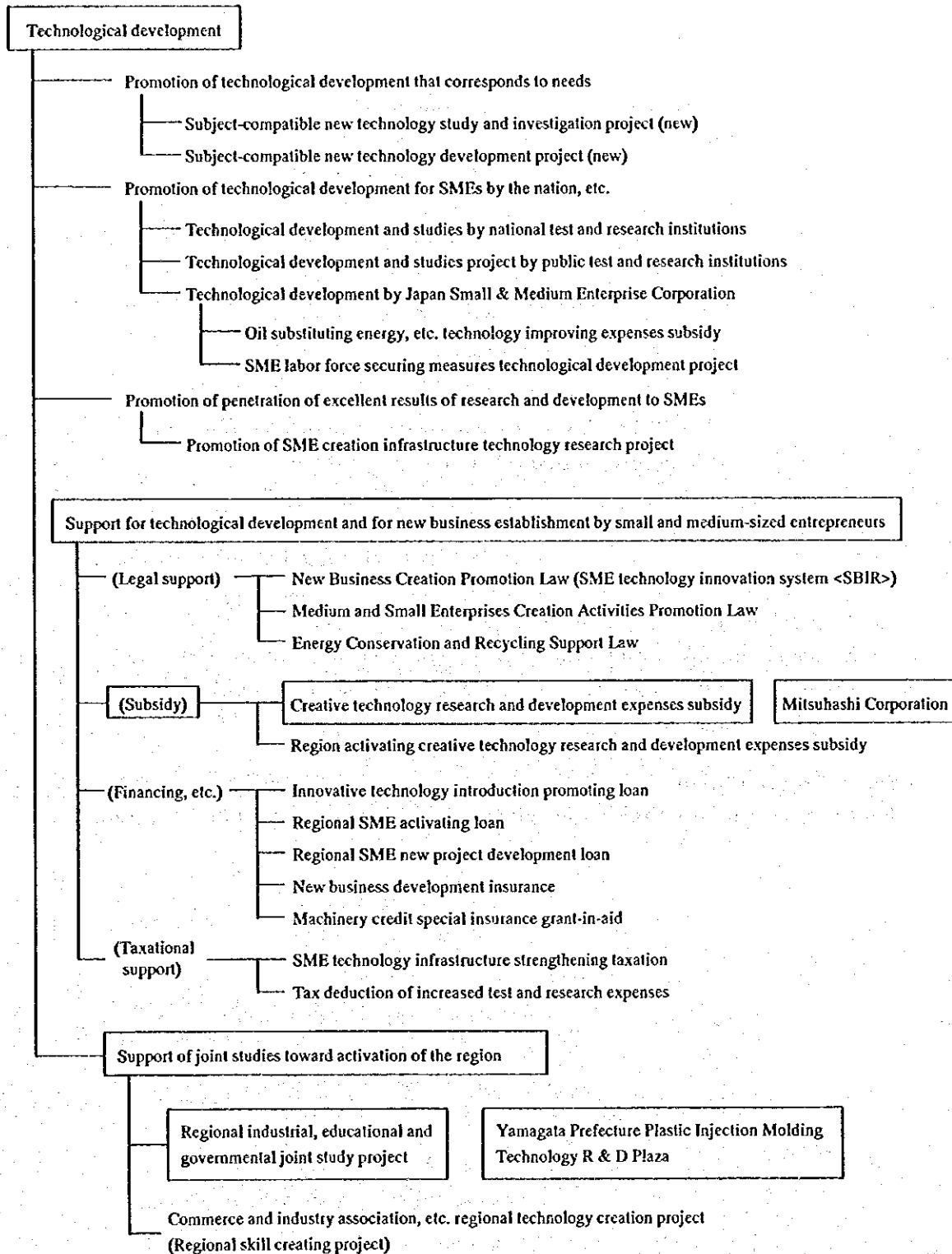
3. Examples of successful development in the Machinery and machine parts industry

Four examples are introduced in this chapter. (1) Mitaka High-Tech Center and (2) Central Plating Cooperative are used as examples of grouping projects.



(3) Mitsuhashi Corporation and (4) Yamagata Prefecture Plastic Injection Molding Technology R & D Plaza are introduced as an example of technological development.

Structure of measures related to technologies of SMEs



3.1 Management upgrading project - Factory grouping project (Mitaka High-Tech Center Cooperative)

a. Overview of the project

- Number of cooperative members: 17 companies
 - Configuration of relocation: Full relocation
 - Amount invested: 38,060 thousand yen
 - Investment plan
 - + Factory ground area: 3,143m² (1,085,976 thousand yen)
 - + Factory building area: 6,285m² (1,238,143 thousand yen)
 - + Equipment: Cargo elevator (max. load 1,500 kg) x1 (119,508 thousand yen)
Passenger elevator (for 9 persons) x 2
Parking lot for 62 cars
Parking lot for 100 bicycles
Facilities: Large meeting room, small meeting room, secretariat,
Japanese matted room, recreation room
 - + Structure: (23,349 thousand yen)
 - + Others: (25,985 thousand yen)
- Total 2,492,961 thousand yen
- Fund raising plan
 - + Management upgrading fund: 2,145,550 thousand yen (86.1%)
 - + Funds on hand: 347,411 thousand yen (13.9%)

Total 2,492,961 thousand yen (100%)
 - Repayment conditions: Term 20 years (grace period: 2 years), no interest
 - Joint project: Finance project, machinery and equipment joint purchase project

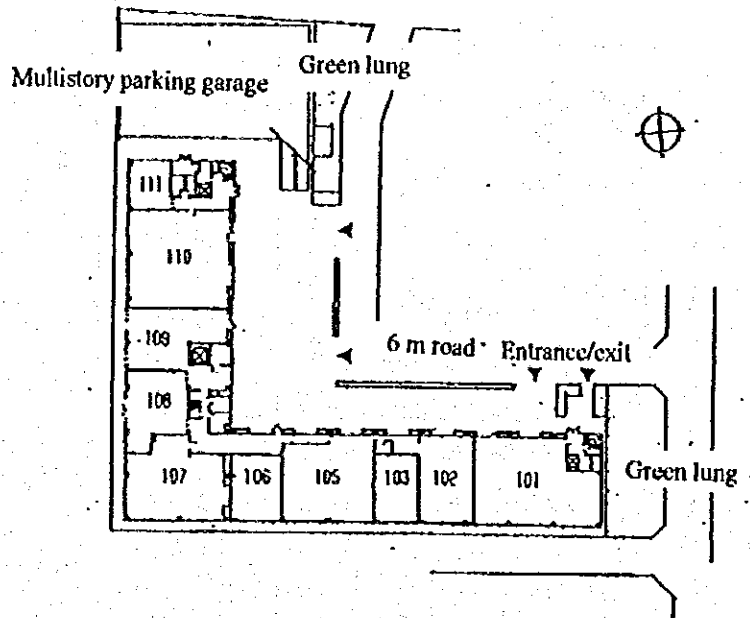
| No. | Enterprise name | Main products | Capital (million yen) | No of employees | Equipment |
|-----|--|--|--------------------------|--------------------|--|
| 1 | OKUAWKI Co., LTD. | Cutting, Assembly | 10 | 10 | Turning machine, drill press |
| 2 | TOHGANE PACKING Co., LTD. | Packing | 10 | 7 | Press |
| 3 | DENKYO SEISAKUSHO Co., LTD | Medical equipment Sheeting | 10 | 4 | NC turret press |
| 4 | HOSINO SEISAKUSHO Co., LTD | Parts for Power Board | 10 | 8 | NC press |
| 5 | KYORITU KAROY SEIKOH Co., LTD | Electronics Parts | 3 | 3 | NC turret press |
| 6 | KABAYA KOGYO Co., LTD | Engine driven mowing machines | 10 | 12 | Electrical discharge machine Milling machine |
| 7 | OHTUKA SEISAKUSHO Co., LTD | Measuring apparatus | 30 | 8 | NC press |
| 8 | MURE KIKAKU Co., LTD | Teaching materials, posters | 30 | 16 | NC editing machine |
| 9 | TOHSHIN KAKOH Co., LTD | Plastic boards | 11 | 4 | Milling machine Lace machine |
| 10 | SEIWA SEISAKUSHO Co., LTD | Development of welding systems for micro- electronics Industry | 10.5 | 19 | CAD/CAM |
| 11 | NAKAMURA KIGATA SEISAKUSHO Co., LTD | Fine wooden patterns | 3 | 2 | NC milling |
| 12 | TANAKA DENSHI CORP. | Micro computer systems | 140 | 27 | CAD/CAM |
| 13 | SHIN-EI DENSHI Co., LTD | Electronics devices | 16 | 14 | CAD |
| 14 | THERMO RIKO Co., LTD | Development and sales of thermal & analysis instruments for research & experiment | 10 | 8 | CAD/CAM |
| 15 | ALL GIKEN Co., LTD | Development of CAD/CAM | 10 | 10 | CAD/CAM |
| 16 | SOHMA GIKEN Co., LTD | Photo-type process for printed circuit boards | 15 | 44 | CAD |
| 17 | MICRONICS JAPAN Co., LTD | Testing system for liquid crystal | 1,846 | 69 | LCD inspection apparatus |

b. Features of the factory building

The factory building is a joint factory of row, multi-storied type as shown in Fig. 3-1.

The plan below shows only the first floor plan.

Fig. 3-1 Plan view of MHC (first floor)



c. History and background of the project

Situated about 30 minutes' train ride away from the heart of Tokyo, Mitaka City is conveniently located for commuting and provides an easy access to the metropolitan area. Accordingly, inflow of population to Mitaka City has continued to cause overpopulation to occur. Elimination of presence of factories and residences in mixture has become a subject for the city government under such a background. To solve this problem, the city government planned group relocation of small and medium enterprises to sites suitable for factories by utilizing management upgrading funds, which are provided under a long-term and low-interest policy financing scheme. The city government started this project with recruiting participating enterprises. It then provided full support in various ways including establishment of a business cooperative of enterprises hoping to participate in it and creation of a management upgrading project plan. The city government acquired a factory lot in advance to quickly promote this factory-grouping project.

History

May 1983: Mitaka Society of Commerce and Industry created "Mitaka Industrial Park Model Plan", and requested the city government to secure lots suitable for factories at the same time.

December 1984: Mitaka Society of Commerce and Industry created "Mitaka Industrial Park Forming Basic Plan".

December 1984: The city government of Mitaka was requested to implement factory joint use (factory apartment) project. The city government decided to promote factory grouping project as one of ten large-scale construction projects, which are incorporated in Mitaka City Basic Plan (revised). The city government recruited enterprises to enter the factory apartment based on the factory apartment plan. 34 corporations applied.

August 1985: The city government acquired a lot in advance, for a site to be reserved for construction of a factory apartment.

September 1986: Mitaka Society of Commerce and Industry entrusted the operations of building basic design and execution design, which accompany Mitaka High-Tech Center (provisionally named) Plan to the city government.

Preliminary diagnosis was conducted by Tokyo Metropolitan Government.

February 1987: Final diagnosis of small and medium enterprises management upgrading project implementation plan was conducted by Tokyo Metropolitan Government.

June 1987: Establishment of Mitaka High-Tec Center Cooperative (MHC) was registered.

October 1987: Discussions were made with "Association against construction of factory apartment" and a memorandum was exchanged with them.

November 1987: A written application for borrowing small and medium enterprises management upgrading funds (factory joint use project funds) was submitted to Tokyo Metropolitan Government.

December 1987: A permit for construction of MHC Building was granted.

The bill to sign a MHC Building construction work contracting agreement passed the city council.

Mitaka City signed a contracting agreement with Shimizu Construction Company.

March 1988: MHC acquired the lot, which is the site reserved for construction of a factory apartment, from the city government.

The loan of management upgrading funds was executed.

March 1988: The work of construction of MHC Building was commenced.

December 1988: The bill to sell MHC Building to MHC passed the city council.

January 1989: A written application for borrowing small and medium enterprises management upgrading funds (for buildings) was submitted to Tokyo Metropolitan Government.

February 1989: The work of construction of MHC Building was completed.

March 1989: MHC acquired MHC Building from the city government. Following the handover of the building, the secretariat moved to MHC Building. Member enterprises relocated to this building and their operation in this building was commenced.

d. Features of member enterprises

Many of the member enterprises are engaged in the individual production configuration of non-mass-production type, non-subcontracting type mainly executing machining, assembly and processing. Like factories located in Ohta Ward of Tokyo, these enterprises are of high research and development functions, and therefore, are capable of processing products of almost all types. The factory grouping project, originally a factory joint use project until the revision to the scheme, drew out the advantage of urban type enterprises to the maximum, locating them around the area suitable for industrial activities. Their technologies were further specialized and their technological level was also elevated. Among member enterprises is one which was successful in research and development and offered their stocks to the public in 1999.

e. Effect of the factory-grouping project

This plan was group relocation of factories for solving the problem of presence of residences and factories in mixture, as part of an urban redevelopment project promoted by the city government. The grouping was not only for gathering factories at one location but for promoting the upgrade of management by making a joint project. At present, with specialized technologies of member enterprises effectively utilized, inter-enterprise supplementation such as order placing and order acceptance is actively performed inside of the joint factory.

The member enterprises positively devoted themselves to inter-enterprise supplementation, since the lot acquisition price was as high as 1.2 million yen per *tsubo* (unit of ground and building areas used in Japan; equivalent to about 3.3 m²) in those days. It was necessary for member enterprises to compress the investment amount to the minimum, and a "scrap and build" of equipment was attempted at the occasion of their relocation to the joint factory. That is, overlapping equipment was adjusted among member enterprises and unnecessary equipment was scrapped. In addition, each member enterprise specialized in its own field of expertise. It made large contribution to enhancement of engineering capabilities, and as a result, member enterprises as a whole acquired engineering capabilities in broad ranges. Such features allowed member enterprises to advantageously evolve their order-accepting activities and their development of market became easy. They recently began to tackle with joint development of new products.

f. Features of grouping project (management upgrading project)

The prime objective of this project was to re-develop the urban area (to eliminate the presence of factories and residences in mixture). Therefore, positive support such as advance acquisition of a lot to secure the site by the city government was provided by the administration. On the other hand, since management upgrading funds are loaned to the cooperative, member enterprises are obliged to have joint liability on guarantee for the loan granted to the cooperative. In other words, if

management and/or solidarity of the cooperative collapses, a contingency such as default of repayment of the loan may arise. In a small and medium enterprises upgrading project in general, a sense of unity in which all the member enterprises provide full cooperation to good leaders including the chairman of the cooperative who exhibits leadership is required for management of the cooperative. In this respect, this cooperative is managed in an ideal way. Business transactions among member enterprises became active as a result of progress of exchange of information among member enterprises.

3.2 Upgrading project - Factory grouping project (Central Plating Industry Cooperative)

a. Background and history of the project

Since member enterprises were located in overcrowded areas, where residences and factories were present in mixture, before they were grouped together, their operation was restricted because of generation of noise, and they were obliged to shorten their working hours. Furthermore, since noxious wastes were produced due to the special nature of the plating business, they had many problems including storage of such dangerous articles in small factories, transportation of such dangerous substances to processing facilities and finding of professional agents capable of treating them. They established a business cooperative in 1961 to solve these problems which are common to the plating business. They received guidance from Small Business Association of Tokyo Metropolitan Government prior to establishment of the business cooperative, and discussions were made on various subjects including mutual exchange among member enterprises and coordination of problem consciousness. Some enterprises gave up participating in the cooperative during the course because of differences in opinions from other member enterprises, but the grouping plan was finally started by 13 corporations.

History

- 1961: Central Plating Cooperative was established.
- 1969: Factory grouping project plan for construction of an industrial park in Keihin Island of Tokyo was created.
- 1976: Construction of Central Plating Industrial Park was commenced.
- 1977: Construction work was completed and relocation was commenced.
- 1998: Central Plating Cooperative acquired ISO 14001.

b. Overview of member enterprises

- Number of member enterprises:

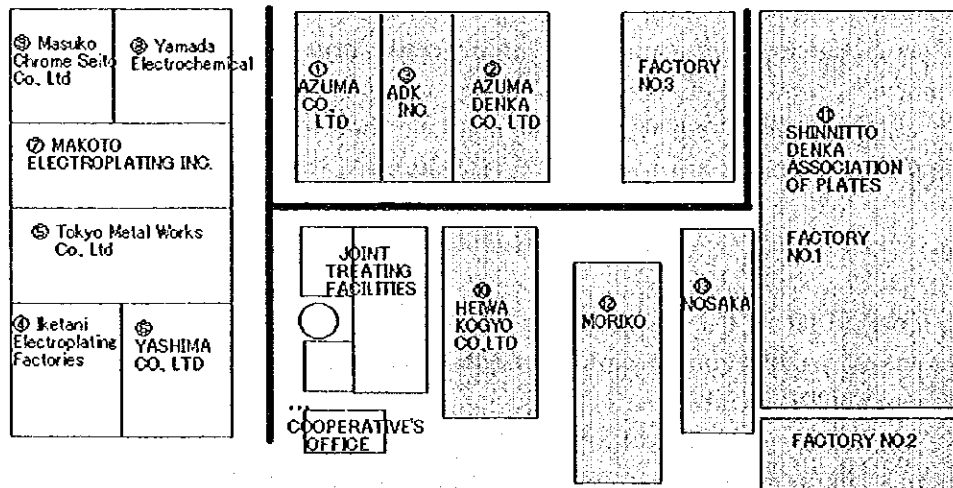
| | |
|----------------------|---|
| Electrical plating | 11 companies (including one cooperative workshop) |
| Relevant enterprises | 2 companies |

Table4-1 Outline of member enterprises

| Ref. No | Enterprise name | Business Activities | Capital (million yen) | No. of employees |
|---------|---|---|-----------------------|------------------|
| 1 | AZUMA CO., LTD. | Through hole plating of PWB | 99.5 | 43 |
| 2 | AZUMA DENKA CO., LTD. | Precious metal plating for semiconductors | 50.0 | 35 |
| 3 | ADK CO., LTD. | Electroplating on Plastic | 40.0 | 9 |
| 4 | Iketani Electroplating Factories | Barrel plating of copper nickel and gold | 9.0 | 11 |
| 5 | Tokyo Metal Works Co., Ltd. | Copper, Nickel, Chrome and Zinc Plating | 40.0 | 32 |
| 6 | YASHIMA CO., LTD. | Barrel plating of tin, solder and precious metals | 10.0 | 8 |
| 7 | MAKOTO ELECTROPLATING INC. | Plating of copper, nickel and precious metal for lighting equipment | 16.0 | 9 |
| 8 | Yamada Electrochemical Coating Inc. | Anodized aluminum and electroless nickel plating | 16.5 | 21 |
| 9 | Masuko Chrome Seito Co., Ltd. | Copper, nickel, chrome, gold and hard chrome plating | 16.0 | 39 |
| 10 | HEIWA KOGYO CO., LTD. | Plastic molding, plating | 10.0 | 53 |
| 11 | Shin Nitto Denka Association of Platers | Copper, nickel, chrome, zinc, electroless Ni, ED coating | 269.0 | 83 |
| 12 | Moriko Electroplating Material Inc. | Manufacture and sale of plating materials | 45.0 | 11 |
| 13 | NOSAKA ELECTRIC CO., LTD | Design and manufacture of plating equipment | 10.0 | 16 |

Typical services provided by member enterprises are shown.

Figure 3-2 Layout of the Central Plating Industrial Park



c. Effect of grouping

This grouping plan was diagnosed by Commerce and Industry Guidance Office of Tokyo Metropolitan Government and construction of the industrial park was also diagnosed by this Agency, before construction work was commenced in 1976. The Industrial Park was completed in 1977 and relocation of member enterprises was commenced in the same year. Fig. 3-2 shows the layout of this Industrial Park. The plating waste water lines of all the member enterprises except the two relevant enterprises are connected to the joint processing facilities of the cooperative. The plating solution is under the overall control system of the cooperative through the discharge treatment. The capacity utilization was largely improved by such complete compliance with the environment conditions and relocation to a place that is suitable for factories. In addition, the following effects were obtained from the relocation to the Industrial Park.

- i. The Central Cooperative Bank for Commerce and Industry fully supported joint financing project of the cooperative to facilitate fund management of member enterprises.
- ii. The engineering capabilities were improved due to exchange of information among member enterprises.
- iii. It has become possible to perform broad-range activities in the aspect of order acceptance.

As a result of such cooperative activities, the Cooperative obtained ISO 14001 in 1998. Such achievement of a masterstroke was the first among many industrial parks in Japan.

d. Environment complying facilities

Presence of environment complying facilities largely leads to high capacity utilization of factories of member enterprises of this Industrial Park. A completely closed system was introduced for the first time in Japan, as joint facilities of the cooperative.

3.3 Technological development with subsidy (Mitsubishi Co., Ltd.)

a. Overview of the enterprise

- Founded in: August 1975
- Category of business: Development and marketing of office machines
- Paid-in capital: 15 million yen
- Number of employees: 4

b. Features of the enterprise

Yokohama City, where Mitsuhashi Co., Ltd. is located, is growing as an industrial city with its world-famous trading port and is known for accumulation of supporting industries engaged in production of parts.

Although Mitsuhashi belongs to the category of small-size enterprises, this company (or its president) possesses as many as 176 industrial property rights, and it is a typical enterprise of research and development type. Many of patents of this enterprise have been merchandized and are sold through distribution channels of leading trade houses of Japan.

Production of products developed by Mitsuhashi Corporation is outsourced to specialized factories item by item. Products are completed at these specialized factories with technological complement executed by them, and finished products are delivered to Mitsuhashi. The feature of this transaction relation is that a kind of grouping has taken place while technological information required for production was exchanged frequently among about 30 enterprises to which production is outsourced from Mitsuhashi. This management method is typical "fab-less" configuration of the enterprise in which the subject entity only executes design of products and does not fabricate products by themselves. The operations of Mitsuhashi related to production are limited to coordination of production plans among enterprises and stock management at Mitsuhashi.

Fig. 3.3 Complementing relations among enterprises

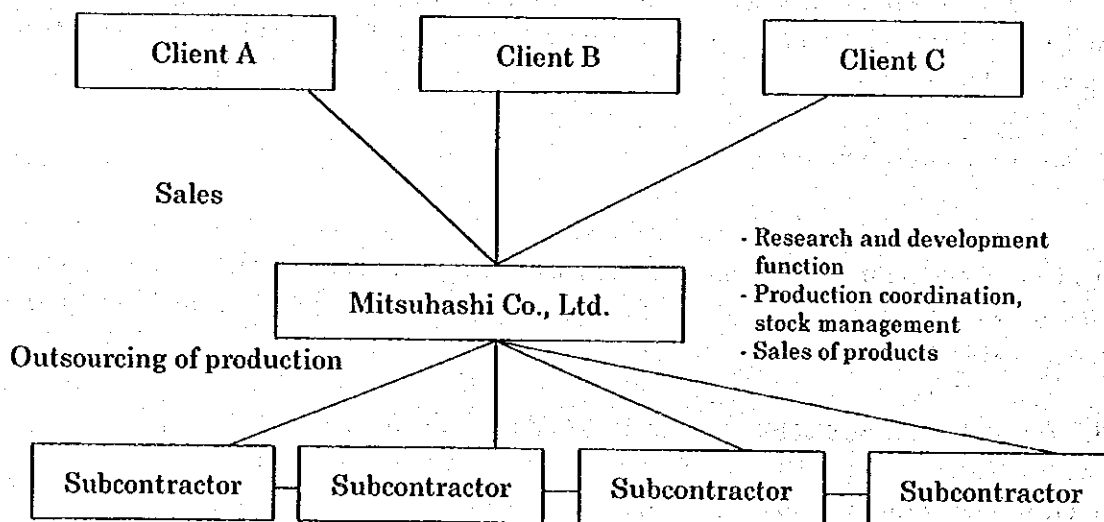
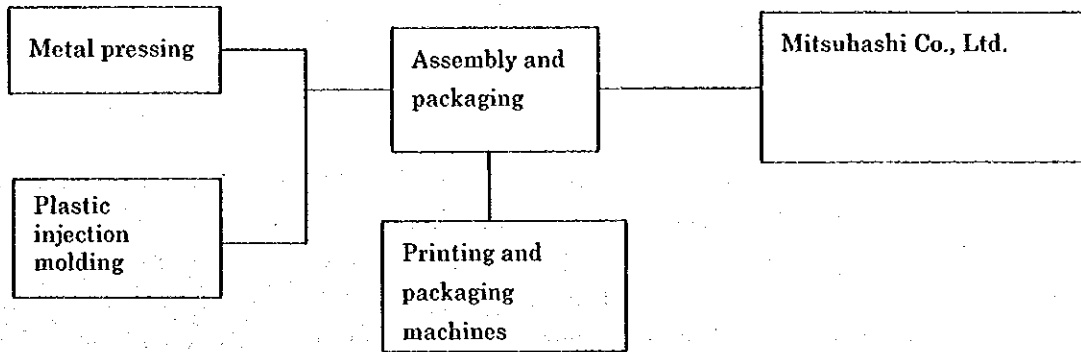


Fig. 3.4 Flow of production processes

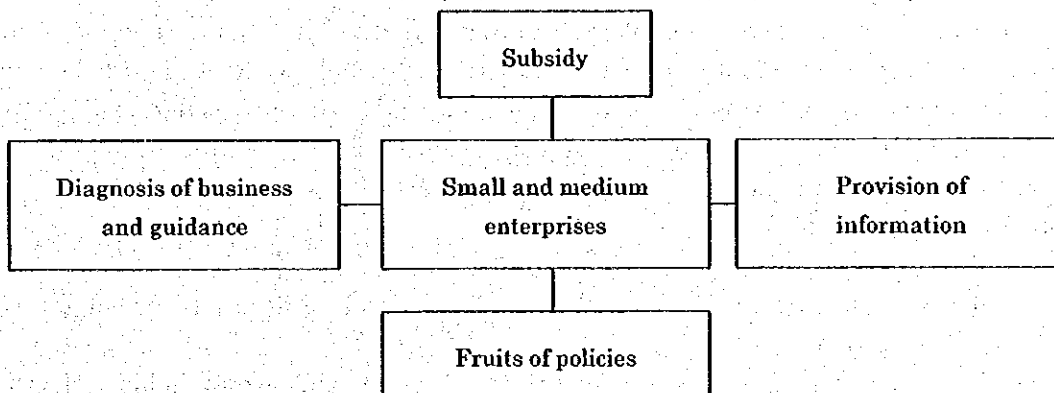


The principal products of Mitsuhashi are office goods such as staplers and punches. It is characteristic of production of these goods that the accuracy of their working is low, as industrial products, compared to products of other machinery and machine parts industries, the life time of molds in use is long and the number of components is small.

c. Policy effect

Mitsuhashi acquired durability test equipment with subsidy of five million yen for development of new products in 1997. In this way, Mitsuhashi executes research and development using subsidy and at the same time, created molds for producing prototypes and fabricated machines for conducting durability tests of new products, they were able to largely shorten the originally anticipated development period. In addition, after completion of development of new products, inter-enterprise complementation was brought about through a series of working processes such as metal pressing, plastic injection molding, coating, springs, bolts and nuts, plating, etc., thus to combine research and development with production as one system as intended by this policy.

Fig. 3.5 Construction of supporting system



3.4 Supporting of research and development through tie-up among industrial, governmental and academic sectors (Yamagata Prefecture Plastic Injection Molding Technology R & D Plaza)

a. Background of the activities

Yamagata Prefecture, whose capital is Yamagata City, is located about 360 km to the northeast of Tokyo. The ratio of shipping amount of the processing and assembling type industry to the shipping amount of the entire manufacturing industries was 15.3% in 1965, but it grew to 57.7% in 1997. Particularly due to the fact that global large-size enterprises such as NEC and Fujitsu, recently branched out in Yamagata Prefecture, existing industries were influenced by them and the necessity for their modernization increased. Administrative organs, therefore, positively provided cooperation to small and medium enterprises and guided them so that inter-enterprise complementation can be achieved among these large-size enterprises and existing industries.

b. Overview of business activities

Plastic injection molded products and press-worked products have become core products in the market in the prefecture, while cut type products used to be core products. For this reason, the demand for molds has sharply increased and requirement for higher working accuracy has also increased as a natural consequence. To cope with such requirements, it has become necessary for mold producing enterprises and plastic injection molding enterprises (which are small and medium enterprises) to collect technological information quickly and introduce production know-how and management technology.

However, it was a large burden for small and medium enterprises to acquire and introduce required information and technology individually by themselves from the aspects of cost and time, as they are far apart from Tokyo, which is the base of information. Accordingly, about 30 enterprises out of 130 mold relevant enterprises in Yamagata Prefecture requested national universities in the prefecture and Industrial Technology Center of the prefecture to join their group as information transmitting sources and technology guiding organs, and joint study groups "Yamagata Prefecture Plastic Injection Molding Technology R & D Plaza" and "Frontiers" was organized as a result. Such group activities are called "supporting through tie-up among industrial, governmental and academic sectors" in Japan, and the Japanese Government is attaching importance to it as a policy for upbringing small and medium enterprises.

This group was established around 1985, and the use of Industrial Technology Center of the prefecture is guaranteed for facilities and equipment needed for the activities of the group.

To acquire the latest technological information, the group holds a lecture meeting about once every two months to listen to lectures of experienced college professors, engineers of advanced enterprises, engineers of processing machine

manufacturers and others. Graduate students of Yamagata University also participate in this group and provide cooperation in material testing. In addition, joint studies by pick-up through Internet of information provided by national research organs, Smaller Enterprise Comprehensive Agency and others are also conducted. The budget for activities conducted by this time has been maintained with the annual membership fee of 70,000 yen per member. Supporting from Yamagata Prefecture is currently limited to provision of research facilities and payment of honorarium to lecturers who give lectures at lecture meetings. But Yamagata Prefecture is thinking of providing replete supporting measures when the number of members increases in the future.

c. Policy-achievement by group activities

These activities were successful in providing member enterprises with the following fruits:

- 1) Frequent exchange of information among enterprises has enabled inter-enterprise complementation to be achieved easily.
- 2) Decision making in management has become expedited owing to acquisition of ample information.
- 3) The know-how for use of simple molds has been accumulated and the area of service provided to clients has been expanded.
- 4) The geographical area of clients has been expanded because of technological development achieved this time.

4. Application in developing nations and points to consider

(1) Upgrading project- Factory grouping project - Mitaka High-Tech Center Cooperative

Rented and leased apartments and joint factories exist also in developing nations such as Malaysia but they are largely different in the method for administration from those of upgrading project in Japan. In Japan, instead of mere acquisition, renting and leasing of land and buildings, a cooperative association is organized by participating enterprises and this cooperative association attempts strengthening of economical foundation of participating enterprises mainly through joint projects such as joint purchase project (in this particular case, however, the co-op is administered mainly with cooperative inter-enterprise cross-fertilization of information and supplementing relations because co-op members possess broad-range technologies) and partial cooperation of production.

Also, it is a significant feature that JASMEC, Commerce and Industry Guidance Agency of Tokyo Metropolitan Government and Governmental Financial Institution for SMEs are continuously providing support and guidance. In application in developing nations, it would also be necessary to first establish a system for providing support and guidance to SMEs, and then a financing scheme as well.

(2) Upgrading project - Environmentally friendly type factory grouping project -
(Central Plating Industry Cooperative)

For developing nations, it is an essential condition as well as a big issue in the 21st century to promote industrial development and to take environmental measures at the same time.

The method to execute group transfer of enterprises of noxious substances generating type enterprises including plating business and to solve the problem of waste water processing with collaborating facilities of the cooperative is considered to be an effective means for developing nations. Furthermore, it is supposedly applicable to industries requiring environmental measures against air, exhaust heat, offensive odor, vibration, dust and others in addition to waste water processing of plating business. The important points are exhibition of strong leadership by the top executives of the cooperative and others, use of long-term low-interest financing schemes, and diagnosis and guidance of public organizations.

(3) Creative and technological research and development subsidy - Mitsubishi Co.,
Ltd.

To implement policies for improving engineering capabilities in developing nations, it is important that a supporting structure that provides diagnosis of business, guidance and information is constructed, instead of mere supply of subsidy for research and development. This is a point that is necessary for increasing the effectiveness of the policies.

In this case, fab-less formation of production activities was accomplished with focus on the patents possessed by the company and research and development capabilities of the president himself. Small-scale enterprises tied together and successfully completed products based on this formation. This is a good example of supporting an SME by an administrative organization in the development of new products brought effect to many SMEs.

(4) Supporting of research and development through tie-up among SMEs, universities
and public laboratories - Yamagata Prefecture Plastic Injection Molding Technology
R & D Plaza

In a developing nation or region where industrialization is to be promoted, provision of public test and research institutions would be an effective means as promoters of industrialization. In Japan, public laboratories and testing institutions played important roles in 1960's when industrialization was promoted and efforts were made to improve engineering capabilities, and the foundation for evolution of Japan to a technological nation of today was formed. Today, however, engineering capabilities of SMEs are high, and the roles of public laboratories and testing institutions are relatively less important.

In this case, collection of technological information and technological development through tip-up among SMEs, universities and public laboratories are

explained. Today, the technologies and the market are changing at an unprecedented speed. It can be said that grouping in the exchange among SMEs, universities and public laboratories is an effective means to cope with such changes or with local conditions.

In developing countries without supporting system, there are various options for grouping, including tie-up among SMEs and universities and joint research supported by advanced enterprises. The significance will lie in collaboration in gathering technological information and in development.